2015-2023

RIIO-ED1 **BUSINESS PLAN**

June 2013 (Updated April 2014)

WESTERN POWER DISTRIBUTION

Serving the Midlands, South West and Wales

Navigation

This document is a compendium of all the WPD Business Plan documents.

There are two ways to navigate to individual documents:

- There is a hyperlinked contents list below
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This version of the WPD RIIO-ED1 Business Plan (updated April 2014) contains a small number of revisions that provide additional explanation, update innovation and losses strategies, update financing values following Ofgem decisions and correct typographical errors. For avoidance of doubt these revisions do not change the original Business Plan expenditure proposals and output commitments.

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Overview document

June 2013 (Updated April 2014)

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Overview
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Foreword

Our business is a simple one. Our purpose is to make sure the electricity network of poles, pylons, cables, wires and substations in our four distribution areas safely delivers power to homes and businesses around the clock.

Outstanding customer service combined with technical excellence, innovation and a clear business structure have made WPD the best electricity distribution business in the UK.


Robert Symons, CEO, Western Power Distribution (WPD)

The WPD South West and WPD South Wales businesses have been industry leaders in the UK for many years. In April 2011 we purchased the former 'Central Networks' distribution businesses based in the West and East Midlands. These two businesses were known to be significantly less efficient than WPD with both poor levels of customer service and work delivery (the businesses are now known as WPD West Midlands and WPD East Midlands).

As part of the acquisition of the Midlands businesses we promised Ofgem (the regulator for electricity distribution companies) that we would significantly improve customer service whilst lowering costs. By applying our simple operational philosophy, where continuous change and innovation is part of what we do every day, to the Midlands businesses, we have been able to effect dramatic improvements in the region within 12 months of the acquisition:

- 20% reduction in operating costs;
- 40% reduction in the average amount of time a customer is without electricity;
- 96% reduction in the number of customers who have a power cut in excess of 18 hours;
- 70% reduction in the number of customer complaints to the industry ombudsman.

Put simply - we deliver on our promises. We are proud of our record but we are not complacent.

The next regulatory period will be eight years from April 2015 to March 2023 - a time in which many new challenges are predicted. These include safeguarding network security and providing reliability at an affordable cost, and continuing to push forward the boundaries of customer service excellence. In addition it is becoming increasingly important to deliver on a range of environmental commitments, including the facilitation of new 'low carbon technologies' – specifically heat pumps for domestic heating, solar photovoltaic for electricity generation and electric vehicle charging.

Our Business Plan sets out our view of this future and has been influenced by engagement with our stakeholders. It explains what we intend to deliver, the amount we propose to invest and how this will impact customers.

Our aim is to keep our business simple, to deliver on our promises and to continue to innovate. Our customers will receive the highest levels of customer service at an efficient cost and WPD will continue to be the industry leader in electricity distribution.

1 Introduction

1.1 This document provides an overview of Western Power Distribution (WPD) Business Plan for the eight year period from April 2015 to the end of March 2023. It includes what we intend to deliver, how much it will cost and the benefits provided to customers and stakeholders.

1.2 The eight year period aligns with the next Ofgem regulatory price control review period, known as RIIO-ED1; the first for electricity distribution to be determined using the Revenue = Incentives, Innovation and Outputs framework.

1.3 The current price control is called Distribution Price Control Review 5 (DPCR5) and it spans a five year period from April 2010 to March 2015.

1.4 This Business Plan overview document, supplementary annexes, Business Plan Data Templates, Price Control Financial Model, cost benefit analysis spreadsheets and supporting data, together form the submission under RIIO-ED1 to Ofgem, who will use the information to determine allowed revenues.

Structure of this document

1.5 We appreciate that the readers of this document will range from regulatory experts and well informed stakeholders through to new customers who may have had little previous knowledge of WPD. We have therefore set out to provide a simple overview of our plans and wherever possible have sought to avoid using acronyms or 'industry jargon'. We include a glossary at the end of the document to help explain specific terms used.

1.6 More technical and detailed information is presented in supplementary annexes that are aimed at readers who have a specialist interest.

1.7 The document is subdivided into the following sections:

Chapter	Title	Content
2	**Executive summary**	An overview of the Business Plan, its aims and its conclusions
3	**Who we are and what we do**	A simple description of our business
4	**Our track record**	What we have achieved
5	**Developing the plan for our business**	The key business objectives and long term strategy that drive our business
6	**Developing the plan for our stakeholders**	An overview of our stakeholder engagement process and the preferences of stakeholders
7	**Incentives**	The incentives that we believe should be active in RIIO-ED1
8	**Innovation**	An overview of our Innovation Strategy
9	**Outputs**	The key services and results we are going to deliver
10	**Expenditure**	The amount we will be spending and on what
11	**Uncertainty**	Details of where there is uncertainty that could affect the overall programme planned for RIIO-ED1
12	**Financing the plan**	How we will finance the network investment through debt and equity
13	**Impact on customers' bills**	An illustration of how the costs for customers will change as a consequence of the expenditure in the plan
14	**Glossary**	An explanation of specific terms and acronyms

Structure of this document

1.8 This Overview document is supported by nine supplementary annexes. These annexes expand upon the details contained within this document. They are available from the WPD website using the following hyperlinks:

SA-01 Stakeholder engagement

http://www.westernpower.co.uk/docs/About-us/Stakeholder-information/Our-future-business-plan/Seperate-documents/Stakeholder-Engagement.aspx

SA-02 Incentives

http://www.westernpower.co.uk/docs/About-us/Stakeholder-information/Our-future-business-plan/Seperate-documents/Incentives.aspx

SA-03 Innovation, smart grids, smart meters, losses and climate change adaptation

http://www.westernpower.co.uk/docs/About-us/Stakeholder-information/Our-future-business-plan/Seperate-documents/Innovation.aspx

SA-04 Outputs

http://www.westernpower.co.uk/docs/About-us/Stakeholder-information/Our-future-business-plan/Seperate-documents/Outputs.aspx

SA-05 Expenditure

http://www.westernpower.co.uk/docs/About-us/Stakeholder-information/Our-future-business-plan/Seperate-documents/Expenditure.aspx

SA-06 Uncertainty

http://www.westernpower.co.uk/docs/About-us/Stakeholder-information/Our-future-business-plan/Seperate-documents/Uncertainty.aspx

SA-07 Financing the plan

http://www.westernpower.co.uk/docs/About-us/Stakeholder-information/Our-future-business-plan/Seperate-documents/Financing-the-Plan.aspx

SA-08 Business performance, efficiency and benchmarking

http://www.westernpower.co.uk/docs/About-us/Stakeholder-information/Our-future-business-plan/Seperate-documents/Business-Efficiency.aspx

SA-09 Data assurance

http://www.westernpower.co.uk/docs/About-us/Stakeholder-information/Our-future-business-plan/Seperate-documents/Data-Assurance.aspx

2 Executive summary

Who we are and what we do

2.1 WPD is a Distribution Network Operator (DNO) and distributes electricity to 7.8 million customers across the Midlands, South Wales and the South West. Our role is simple:

- we operate our network assets effectively to 'keep the lights on' for our customers;
- we maintain our assets so that they are in a condition to remain reliable;
- we fix our assets if they get damaged or if they are faulty;
- we upgrade the existing networks or build new ones to provide additional electricity supplies or capacity to our customers.

2.2 Our costs make up around 16% of a domestic customer's bill.

Our track record

2.3 We keep the business simple and operate an efficient business model, with a flat structure that only has three layers between our field staff and the Board.

2.4 Our staff put customers first, treating customers the way they would like to be treated themselves.

2.5 Our track record is second to none:

- we deliver the best network performance, restoring customers' supplies after power cuts faster than any other network operator;
- we provide the best customer service in the UK, consistently appearing at the top of Ofgem's customer satisfaction surveys;
- we carry out the greatest number of innovation projects across the industry;
- we deliver our work programmes, adjusting them as circumstances change, but never losing sight of getting them completed;
- we operate a local, team based organisational structure that is predominantly made up of our own staff and delivers work in a low cost and efficient way.

2.6 In April 2011 we took over the West Midlands and East Midlands licences. Within a year, we had fully reorganised the businesses, reduced overhead costs, implemented WPD systems and operating procedures and most importantly improved customer service and network performance whilst at the same time significantly reducing costs.

2.7 In addition to achieving annual savings of £119m, since the 2011 acquisition, we will continue to seek out further efficiencies across the whole of WPD. We have allowed for an efficiency gain of 1% per annum of our controllable costs, which is reflected in reduced costs to customers.

Business environment

2.8 The greatest challenge facing our business is to adapt our networks and business processes to the demand for a low carbon environment. There is great uncertainty about the scale of low carbon technology (LCT) that will be adopted by customers to support the Government's objective of reducing greenhouse gases.

2.9 The Department for Energy and Climate Change (DECC) is forecasting high volumes of electric vehicles, solar panels and heat pumps, that could have a significant impact on how much additional capacity the network will require. Within the plan we have used our 'best view' of the scale of this LCT and its impact on the network as informed by independent analysis. We have also modelled alternative scenarios to provide us with a range of potential outcomes.

2.10 Our plans ensure that we can cater for the adoption of LCT irrespective of the amount or the mix of technologies that is adopted.

Our stakeholders' views are important

2.11 In the preparation of this Business Plan we have embarked on a comprehensive and extensive stakeholder engagement process. We have published consultation documents, carried out surveys and engaged directly with hundreds of stakeholders at workshops.

2.12 Due consideration has been taken of the wide range of views that were expressed throughout the engagement process.

Our programme of innovation

2.13 We will complete innovation projects that can be deployed on the network that will either further improve the service we deliver, reduce our costs or both.

2.14 We will share what we learn with others, irrespective of the results, so that the wider industry can benefit.

The outputs we will deliver in RIIO-ED1

2.15 We will continue to provide excellent levels of network performance and industry leading customer service whilst maintaining efficient costs. The main outputs that we will deliver are summarised below:

Category	Output
Safety	• Reduce the staff accident frequency rate by 10%. • Enhance security measures at higher risk electricity distribution sites. • Distribute 500,000 safety advice documents. • Educate 400,000 children about electrical safety through classroom discussions. • Ensure compliance with legislation with a target of zero improvement or enforcement notices being served by the Health and Safety Executive (HSE). • Work in partnership with the HSE.
Reliability	• Reduce the average number of times our customers lose their power supply by 16%. • Reduce the length of time our customers are without power by 23%. • Ensure that a minimum of 85% of customers are restored within an hour on HV faults. • Reduce by 20% the number of customers who suffer a power cut lasting more than 12 hours. • Reduce the number of customers who are classified as worst served by 20%. • Increase our resilience tree cutting programme by 40% to reduce storm related power loss. • Protect 75 electricity substation sites from the risks of flood damage.
Environment	• Facilitate the connection of increased volumes of LCTs. • Reduce the carbon footprint of the business by 5%. • Reduce leaks from electricity equipment - 75% less oil leaks and 17% less SF_6 gas leaks. • Improve visual amenity in National Parks and Areas of Outstanding Natural Beauty (AONBs) by replacing 55 km of overhead lines with underground cable.
Connections	• Reduce the overall 'average time to connect' by 20%. • Provide improved communication with customers including internet based quotations and job tracking facilities. • Deliver zero failures against the connections 'Guaranteed Standards of Performance'. • Facilitate a competitive market.
Customer Satisfaction	• Continue to be the best DNO group in the Ofgem Broad Measure of Customer Satisfaction. • Maintain stakeholder engagement to refine business objectives and demonstrate progress against outputs throughout RIIO-ED1 and beyond. • Enhance communication with customers by use of call backs, text messages or other social media formats to suit the needs of our customers. • Have the fastest answering response time to inbound customer telephone calls in the industry. • Have the fastest customer complaints resolution service in the industry.
Social Obligations	• Ensure we have accurate data on the Priority Services Register by contacting our vulnerable customers every two years. • Enhance services provided to vulnerable customers who lose their power supply. • Maintain our work with charities and support organisations to understand and react to current social issues with respect to power supply. • Help to address fuel poverty by making it easier for customers to access key information.

Safety

2.16 Safety is at the heart of everything we do. We will continue to target improvements in our safety performance. Whilst our safety performance is already very good, we will reduce the accident frequency rate involving our own staff by 10%.

2.17 Substations that are being targeted by vandals or thieves can present serious risks to members of the public, contractors or our own staff. The removal or destruction of electrical equipment by copper thieves also leads to the loss of power to our customers. Sites that are identified as high risk will have enhanced security measures implemented to reduce this risk.

2.18 We will continue our practice of targeted mailshots of our safety literature and will send out over 500,000 copies to specific landowners, businesses or leisure operators whose clients could be exposed to higher risks should those activities be conducted near to our equipment.

2.19 School children are not always aware of the potential danger of electricity or the potential danger of the electricity network. During RIIO-ED1 we will educate 400,000 school children about the potential dangers of electricity via our on-going programme of school visits.

2.20 We will work cooperatively with the Health and Safety Executive to not only ensure our practices and policies continue to be compliant with health and safety legislation but also to seek out and apply best practice in the management of safety.

Reliability

2.21 We will replace poor condition assets and provide additional network capacity where necessary to prevent power cuts and the length of time customers are without power.

2.22 Where power cuts occur we will respond quickly, restoring supplies as a priority. We will ensure that a minimum of 85% of our customers are restored within one hour when affected by a high voltage fault.

2.23 We currently have excellent performance against the requirement to restore power within 18 hours. We will reduce this target to a maximum of 12 hours. We will further improve the performance against the new 12 hour target by 20% over RIIO-ED1.

2.24 We will reduce the number of customers who are classified by Ofgem as “Worst Served” by 20% (4,000 customers). This will ensure 99.9% of our customers are not worst served.

2.25 Severe weather can lead to loss of power due to our overhead network being hit by windborne debris or trees. To increase the network resilience we have a programme to clear trees that are in the immediate vicinity of the network. We will increase the volume of resilience tree works by 40%.

2.26 Substations that become flooded can lead to the loss of power to many of our customers for extended periods. We will continue our programme of flood defence works at sites that are identified as prone to flooding to reduce this risk by protecting an additional 75 substation sites.

Environment

2.27 We will monitor the uptake of LCTs to identify 'LCT hotspots' and facilitate their connection, reinforcing the network where necessary.

2.28 We will take the results of our Low Carbon Network Fund (LCNF) projects and apply the learning within our business planning and design tools to add load without the need for reinforcement.

2.29 We will continue to reduce the impact of our activities on the environment by reducing our own carbon footprint by 5% through actions to reduce:

- our energy consumption by 5%;
- the amount of oil that leaks from underground cables by 75%;
- the volume of SF6 gas lost by 17%;
- the volume of waste sent to landfill by 20% over the first two years and 5% per annum thereafter.

2.30 We will improve visual amenity in National Parks or Areas of Outstanding Natural Beauty (AONBs) by replacing 55km of overhead lines with underground cable.

Connections

2.31 We already provide an excellent connections service. However, we propose to further reduce the overall time to connect by 20% by reducing both the time to provide a quotation and the time to complete the physical works.

2.32 We will continue to work with relevant customers and stakeholders to improve our communication with them including the provision of online based quotations and tracking of their jobs.

2.33 The Guaranteed Standards of Performance (GSOPs) set out the minimum service standards that DNOs must meet under the regulatory framework. Where a standard is not met then a payment is made to that customer. WPD will continue to have the lowest number of failure payments made to customers under these connections GSOPs.

2.34 Over recent years we have been working with third party connection providers to facilitate competition within the connections market. We will continue to work with them, improving processes and data availability, so that the scope for competition is expanded to provide greater choice for customers.

Customer satisfaction

2.35 We will continue to be the best DNO for customer satisfaction as measured by Ofgem's Broad Measure of Customer Satisfaction.

2.36 We will maintain our stakeholder engagement process to understand and refine our service delivery to ensure our customers continue to get the service that they want now and to inform our future plans.

2.37 We will keep customers updated during power outages by the use of call backs or text messages or other social media methods in accordance with customers' preferences.

2.38 We will have the fastest response times for answering telephone calls in the industry.

2.39 We will have the fastest complaints resolution service in the industry.

2.40 We will continue to make improvements for the majority of customers that prefer to use the telephone, but we will also develop a range of communication methods during the current price control to include online information exchange and the use of social media. We propose to continue to introduce new methods of communication as technology evolves during RIIO-ED1.

Social obligations

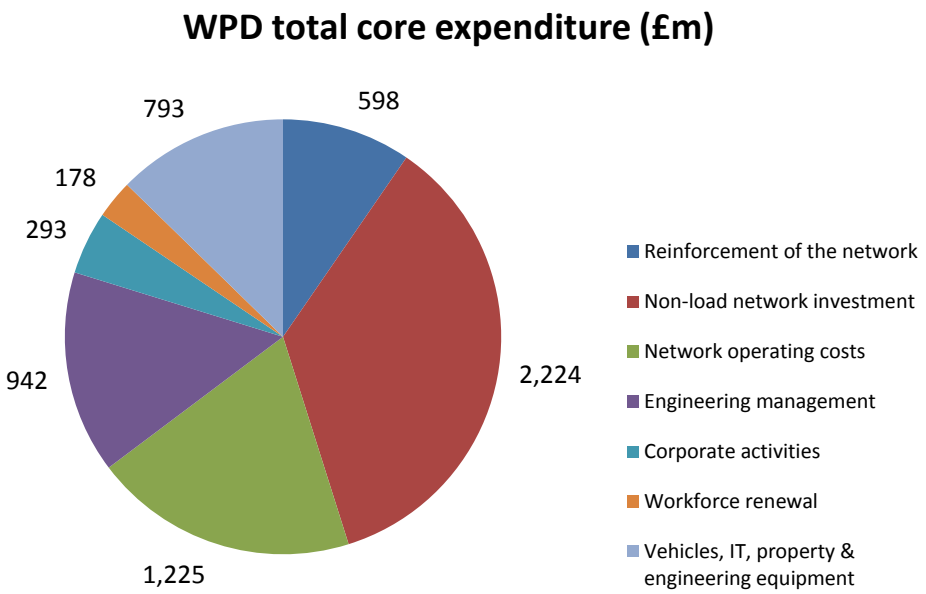
2.41 We will ensure that we know who and where our vulnerable customers are so that we can give them extra help during power cuts. As a minimum we will contact every customer on the Priority Services Register every two years to validate the information we hold.

2.42 We will play a role in addressing fuel poverty by training staff to recognise the indicators of fuel poverty, enhancing the provision of relevant information and building a network of regional referral partners.

2.43 Where customers would benefit from information and periodic support we will work with partner organisations that have the relevant experience and expertise to help.

Expenditure

2.44 Over the RIIO-ED1 period we will be investing £6.25bn in core distribution business activities, funded through Distribution Use of System Charges (DUoS).



2.45 Of this total:

- £598m will be spent on reinforcing the network to accommodate load growth and the impact of low carbon technology on the network;
- £2,224m will be for maintaining the existing network through replacement and refurbishment of assets and improving the resilience and performance of the network;
- £1,225m will be for maintenance of assets, repairing faults and other associated activities;
- £942m will be used for engineering management including the costs of contact centres, stores and the people managing the delivery of the work programme;
- £293m will be for corporate activities such as human resources, finance and regulation;
- £178m will be for renewing and training of our workforce;
- £793m will be for the renewal and maintenance of vehicles, IT systems, non-operational property and tools and equipment.

2.46 In addition to the core expenditure of £6.25bn, a further £2.93bn is required to cover the costs of non-core activities such as smart metering, transmission charges, pensions and business rates. This makes the total expenditure funded through DUoS to be £9.18bn.

2.47 The table below re-states the values into the Ofgem cost classifications of totex, non-controllable opex and deficit pension contributions. The values tie up to the amounts in the Price Control Financial Model issued by Ofgem alongside the Decision to Fast Track WPD document (28th February 2014).

WPD Business Plan – Ofgem costs classifications (£m)					
	West Midlands	**East Midlands**	**South Wales**	**South West**	**WPD Total**
Core expenditure	1,877.70	1,880.20	990.7	1,503.80	6,252.40
Smart metering	8.7	9.3	4.1	5.7	27.8
Real price effects	142	140.8	71.4	112	466.2
Normal pension contributions	84.7	84.5	62.3	98.8	330.3
Miscellaneous	-2.2	-0.4	-2.3	-0.3	-5.2
Totex	**2,110.90**	**2,114.40**	**1,126.20**	**1,720.00**	**7,071.50**
Rates	276	362.7	144.8	146.4	929.9
Licence Fees	9.6	10.4	4	6.4	30.4
Transmission exit charges	107.9	92.7	68.7	71.6	340.9
Smart Metering - pass through	7.4	7.6	3.6	5.7	24.3
Carbon reduction commitments	0.8	0.8	0.8	0.8	3.2
Miscellaneous	0.4	0.3	0	-0.2	0.5
Non controllable opex	**402.1**	**474.5**	**221.9**	**230.7**	**1,329.20**
Deficit pension contributions	**165.7**	**163.3**	**172.9**	**281.3**	**783.1**
Total expenditure	**2,678.7**	**2,752.2**	**1,521.0**	**2,232.0**	**9,183.8**

Note that the expenditure represents WPD's best view which includes expenditure for worst served customers and undergrounding in AONBs and National Parks. These two costs categories are not included in the opening 'base' Price Control Financial Model (PCFM) because they are costs that are logged up and funded retrospectively. There is therefore a small difference between WPD's best case and the PCFM base case.

Uncertainties

2.48 The Business Plan covers the period April 2015 to the end of March 2023. In drafting the plan there are a number of uncertainties that could present a financial risk to the business. The principle uncertainties are detailed in the uncertainty section of this document.

2.49 Although we are best placed to manage the risk of delivery of our plan, there are some areas of uncertainty which need additional mechanisms due to the external nature of the uncertainty and its potential impact.

2.50 During DPCR5 Ofgem introduced a reopener mechanism that limited financial risk providing a safety net for companies where actual costs are materially higher than forecast. We propose that Ofgem continue to use reopener mechanisms. The full details of the uncertainties are discussed in Supplementary Annex (SA-06) Uncertainty.

Financing the plan

2.51 The expenditure proposals will require WPD to raise around £1.74bn of new debt and shareholders will re-invest £1,082m. In addition £850m of long term debt matures and will need to be re-financed. To calculate our allowed revenues and cash flows we have assumed:

Parameter	Value	Details
Cost of Debt	2.6%	Per Ofgem Decision to fast-track Western Power Distribution document 28th February 2014.
Cost of Equity	6.4%	Per Ofgem Decision to fast-track Western Power Distribution document 28th February 2014.
Gearing	65%	The same as DPCR5.
Vanilla WACC	3.9%	Derived from cost of debt and cost of equity.
Capitalisation	80%	The same as DPCR5 after taking into account changes in definition.
RAV Depreciation	35 years	For RIIO-ED1 we will transition from the DPCR5 20 year life to a 45 year life using the transition methodology included in NGET's final proposals.

Impact on customers' bills

2.52 Over RIIO-ED1 our charges will reduce by an average of 13.2% (before inflation).

2.53 For our four DNOs the detailed impact on both domestic and business customers' bills is shown below:

How this will impact domestic customer bills

In 2012/13 prices

WPD West Midlands	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
Percentage change in distribution costs	n/a	-10.2%	0.9%	-5.4%	1.0%	1.0%	1.0%	1.0%	1.0%
Annual change in £'s	n/a	-£10.29	£0.81	-£4.97	£0.88	£0.87	£0.88	£0.89	£0.89
Total distribution charge	£101.17	£90.88	£91.69	£86.72	£87.60	£88.47	£89.35	£90.24	£91.13

WPD East Midlands	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
Percentage change in distribution costs	n/a	-8.2%	0.9%	-4.1%	1.0%	1.0%	1.0%	1.0%	1.0%
Annual change in £'s	n/a	-£7.26	£0.74	-£3.34	£0.78	£0.78	£0.80	£0.81	£0.81
Total distribution charge	£88.11	£80.85	£81.59	£78.25	£79.03	£79.81	£80.61	£81.42	£82.23

WPD South Wales	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
Percentage change in distribution costs	n/a	-22.7%	0.9%	-1.2%	1.0%	1.0%	1.0%	1.0%	1.0%
Annual change in £'s	n/a	-£28.73	£0.89	-£1.19	£1.01	£0.97	£0.99	£0.98	£1.02
Total distribution charge	£126.28	£97.55	£98.44	£97.25	£98.26	£99.23	£100.22	£101.20	£102.22

WPD South West	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
Percentage change in distribution costs	n/a	-17.0%	0.9%	-0.5%	1.0%	1.0%	1.0%	1.0%	1.0%
Annual change in £'s	n/a	-£23.35	£1.06	-£0.58	£1.17	£1.15	£1.16	£1.17	£1.18
Total distribution charge	£137.52	£114.17	£115.23	£114.65	£115.82	£116.97	£118.13	£119.30	£120.48

WPD Total (weighted average)	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
Percentage change in distribution costs	n/a	-13.4%	0.9%	-3.3%	1.0%	1.0%	1.0%	1.0%	1.0%
Annual change in £'s	n/a	-£14.69	£0.87	-£3.14	£0.94	£0.94	£0.94	£0.95	£0.96
Total distribution charge	£109.85	£95.16	£96.03	£92.89	£93.83	£94.77	£95.71	£96.66	£97.62

Notes

1 Revenues are profiled on a "Po/x basis"; revenues fall in 2015/16 and thereafter increase by 1.0% in real terms other than for DPCR5 IIS
2 DPCR4 losses excluded because of uncertainty
3 Smart metering included
4 K factor included in 2014/15
5 DPCR5 tax trigger impact included in 2014/15 and thereafter zero
6 DPCR5 IIS included in 2014/15, 2015/16 and 2016/17 and thereafter zero
7 IFI and LCNF included for DPCR5; NIA and NIC excluded for RIIO-ED1
8 Domestic bill represents Profile 1

How this will impact business customer bills

In 2012/13 prices

WPD West Midlands	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
Percentage change in distribution costs	n/a	-10.2%	0.9%	-5.4%	1.0%	1.0%	1.0%	1.0%	1.0%
Annual change in £'s	n/a	-£24.79	£1.95	-£11.97	£2.11	£2.11	£2.10	£2.14	£2.16
Total distribution charge	£243.71	£218.91	£220.86	£208.89	£211.01	£213.12	£215.22	£217.36	£219.52

WPD East Midlands	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
Percentage change in distribution costs	n/a	-8.2%	0.9%	-4.1%	1.0%	1.0%	1.0%	1.0%	1.0%
Annual change in £'s	n/a	-£18.30	£1.87	-£8.44	£1.97	£1.98	£2.00	£2.03	£2.04
Total distribution charge	£222.01	£203.71	£205.58	£197.14	£199.11	£201.09	£203.10	£205.13	£207.17

WPD South Wales	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
Percentage change in distribution costs	n/a	-22.7%	0.9%	-1.2%	1.0%	1.0%	1.0%	1.0%	1.0%
Annual change in £'s	n/a	-£85.85	£2.66	-£3.58	£3.04	£2.91	£2.94	£2.94	£3.04
Total distribution charge	£377.44	£291.59	£294.25	£290.67	£293.70	£296.61	£299.55	£302.49	£305.54

WPD South West	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
Percentage change in distribution costs	n/a	-17.0%	0.9%	-0.5%	1.0%	1.0%	1.0%	1.0%	1.0%
Annual change in £'s	n/a	-£51.77	£2.34	-£1.29	£2.60	£2.54	£2.57	£2.60	£2.63
Total distribution charge	£304.88	£253.11	£255.45	£254.16	£256.76	£259.31	£261.88	£264.48	£267.10

WPD Total (weighted average)	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
Percentage change in distribution costs	n/a	-13.4%	0.9%	-3.3%	1.0%	1.0%	1.0%	1.0%	1.0%
Annual change in £'s	n/a	-£36.94	£2.18	-£7.91	£2.37	£2.35	£2.36	£2.39	£2.42
Total distribution charge	£276.37	£239.44	£241.62	£233.71	£236.09	£238.43	£240.80	£243.19	£245.61

Notes

1 Revenues are profiled on a "Po/x basis"; revenues fall in 2015/16 and thereafter increase by 1.0% in real terms other than for DPCR5 IIS
2 DPCR4 losses excluded because of uncertainty
3 Smart metering included
4 K factor included in 2014/15
5 DPCR5 tax trigger impact included in 2014/15 and thereafter zero
6 DPCR5 IIS included in 2014/15, 2015/16 and 2016/17 and thereafter zero
7 IFI and LCNF included for DPCR5; NIA and NIC excluded for RIIO-ED1
8 Business bill represents Profile 3

In conclusion

2.54 We have developed a plan that improves network performance, provides excellent customer service and facilitates a move to a low carbon future. This plan balances the needs of investors, customers, stakeholders and the environment.

3 Who we are and what we do

3.1 Western Power Distribution (WPD) is an electricity Distribution Network Operator (DNO). We are responsible for the network of engineering assets that allows the distribution of electricity to customers' premises from the National Grid.

3.2 WPD does not buy or sell electricity, or send any bills to electricity customers.

3.3 What we do is simple and comprises four key tasks:

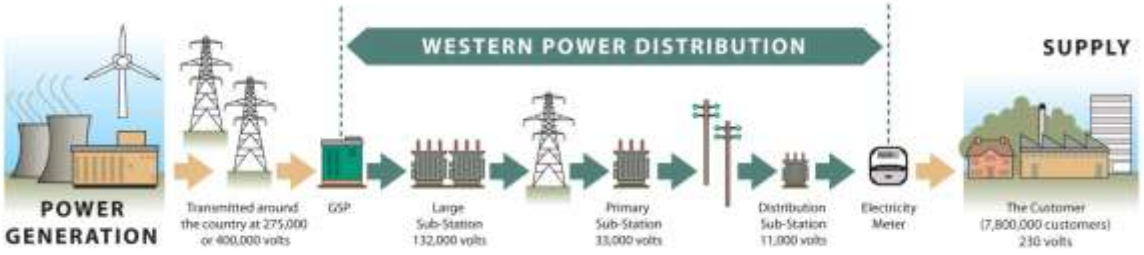
- we operate our network assets effectively to 'keep the lights on' for our customers;
- we maintain our assets so that they are in a condition to remain reliable;
- we fix our assets if they get damaged or if they are faulty;
- we upgrade the existing networks or build new ones to provide additional electricity supplies or capacity to our customers.

3.4 All of these tasks are carried out having the highest regard to levels of safety, whether that is to members of the public, contractors or our own operational staff.

3.5 Our distribution network consists of transformers (which convert electricity from one voltage to another), underground cables and overhead lines (which carry electricity across long distances), switches (to turn on, off or to alter the routing of electricity) and service connections (which take the electricity into customers' premises).

3.6 This network sits between what was traditionally known as the National Grid transmission network and customers.

3.7 The network we operate covers a geographic area of some 55,500 km^2 serving 7.8 million customers.



3.8 The WPD network currently comprises:

Network Assets							
Asset Type	**Units**	**West Midlands**	**East Midlands**	**South Wales**	**South West**	**WPD Total**	**WPD total as a percentage of all DNOs**
Overhead Lines	km	24,000	22,000	18,000	28,000	92,000	33%
Underground Cable	km	40,000	50,000	17,000	22,000	129,000	24%
Transformers	each	50,000	43,000	40,000	52,000	185,000	31%
Switchgear	each	87,000	98,000	35,000	76,000	296,000	25%
Poles	each	372,000	291,000	283,000	442,000	1,388,000	34%
Towers (Pylons)	each	4,000	6,000	3,000	4,000	17,000	34%
Customer Numbers	each	2,470,000	2,619,000	1,108,000	1,561,000	7,758,000	28%
Licenced Area	km^2	13,300	16,000	11,800	14,400	55,500	24%

3.9 Our network is the largest in the UK, covering every kind of geography and demography from densely populated residential areas to widely dispersed rural communities. We operate from the Lincolnshire coast in the East Midlands, through to Gloucestershire in the West Midlands, to Monmouthshire and Pembrokeshire in South Wales, and down into the South West to the counties of Somerset, Devon and Cornwall.

3.10 Our teams are based in local offices where they take responsibility for local issues, deliver local work programmes and respond quickly to local power cuts.

3.11 At WPD we try to get whatever we are delivering right first time. To encourage this we stress that all employees should:

- take personal responsibility;
- follow the problem through until the end;
- work with others to find a solution;
- keep the customer informed;
- follow our Golden Rule – treat customers the way you would like to be treated.

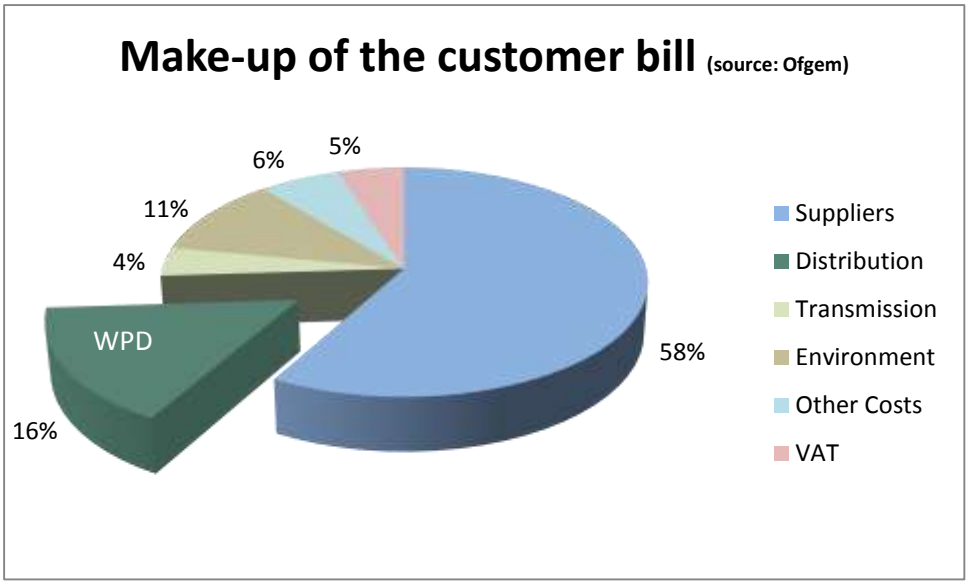
3.12 We continue to look for and make use of innovative techniques and encourage creativity so that we carry out all of our work in an effective and efficient manner. This helps to ensure value for money for our customers, stakeholders and the right return for our shareholders.

3.13 Although we are facilitating competition in some of the services we provide (such as new connections) we are a natural monopoly within the geographic area we serve. We are, therefore, regulated by the Office of Gas and Electricity Markets (Ofgem).

3.14 Ofgem issues licences to DNOs that set out the obligations and responsibilities of the companies and also determines the revenues they are allowed to earn each year. WPD has four licences covering the four geographic areas of the West Midlands, East Midlands, South Wales and the South West.

3.15 Periodically, Ofgem scrutinises the Business Plans of DNOs through a process known as a Distribution Price Control Review. This determines how much DNOs are allowed to charge in total per year for network investment, operating costs and allowed returns.

3.16 This charge, known as DUoS, is payable by the electricity suppliers who, in turn, incorporate it into electricity charges to customers. Our costs account for around 16% of the make-up of an average domestic customer's bill.



4 Our track record

Delivering our promises

4.1 The Business Plan sets out our forward thinking to deliver outputs at efficient cost but it is important to recognise that this is the continuation of an excellent historic performance within WPD.

4.2 We have a demonstrable track record of setting out high quality, accurate plans and then consistently delivering on our commitments. Our record supports our confidence in this Business Plan and our ability to deliver it.

4.3 Our track record has informed our plans and is discussed in more detail in Supplementary Annex (SA-08) Business performance, efficiency and benchmarking.

Reducing our costs following acquisition of the Midlands businesses

4.4 Financial analysis around the time of the acquisition of West Midlands and East Midlands (formerly Central Networks) indicated that we would make cost savings in the order of £108m per annum once the Midlands businesses were fully integrated into WPD.

4.5 We acquired the Midlands businesses on 1st April 2011 and within eight months had changed the Midlands organisation to the WPD team structure. In addition we had exited from expensive 'Alliance' and 'Turnkey' contracts and reduced overall staff numbers by over 800 despite increasing the number of direct field staff employed by over 200. We also harmonised terms and conditions of employment and implemented WPD IT and telecoms systems.

4.6 In the twelve months following the implementation of these changes we delivered savings, outperforming the original estimate:

Annual cost savings following acquisition of the Midlands businesses	
Cost Activity	**Savings Per Year**
Engineering management	£42m
Corporate activities	£20m
Network operating costs	£7m
Network investment	£50m
Total cost saving	£119m

4.7 Engineering management savings: this activity relates to the day to day management of network operations. Efficiencies have been delivered from the implementation of the flat geographic based WPD team structure and the discontinuation of the previous 'Alliance' and 'Turnkey' contracts that duplicated engineering management activity.

4.8 Corporate activity savings: these include head office functions such as finance, human resources and IT. Cost savings come from the scale efficiencies of having one set of head office functions.

4.9 Network operating savings: these costs are associated with network faults, inspection, maintenance and tree cutting activities. WPD has more efficient unit costs.

4.10 Network Investment savings: these costs are for the replacement of existing assets (equipment) or the reinforcing of an existing asset on the network. 'Alliance' and 'Turnkey' contracts were prevalent in both West and East Midlands resulting in the network investment

programme being delivered by third parties. WPD employs direct staff to own the delivery of this activity and the savings are as a result of being both more efficient and not paying a profit margin to a third party.

Proven management of work delivery

4.11 WPD takes a long term view of network reliability and the related investment decisions required. Work programmes are completed to avoid creating a backlog for future customers.

4.12 The price control process requires each DNO to state the proposed volumes and costs of work. Ofgem analyses these submissions, benchmarks them across the industry, adjusts the volumes and determines an efficient amount of capital allowance. DNOs are then required to deliver those volumes in line with the level of expenditure that is allowed.

4.13 WPD has a very good track record of delivery in line with the volumes and financial settlement agreed with Ofgem. We have demonstrated over successive price controls the establishment of robust work programmes, the setting of clear targets and the delivery of those activities.

4.14 However WPD also has an excellent track record of being able to adapt to changed circumstances where it becomes necessary. Should this occur we make quick decisions, establish revised work programmes, set new targets and ensure we deliver against these adjusted work programmes.

4.15 An example of this would be in how we deal with a specific type of switchgear failure that is subsequently identified as having a defect specific to all of that type of equipment. This can occur at any time in a regulatory period and can involve significant volumes of equipment being affected. We can demonstrate our ability to adapt our programmes as necessary and alter budgets, without asking customers for more money, to ensure the delivery of the revised programme.

4.16 Our proven ability to adapt and reprioritise allows us to better deal with the uncertainty surrounding the take up of the LCTs through RIIO-ED1.

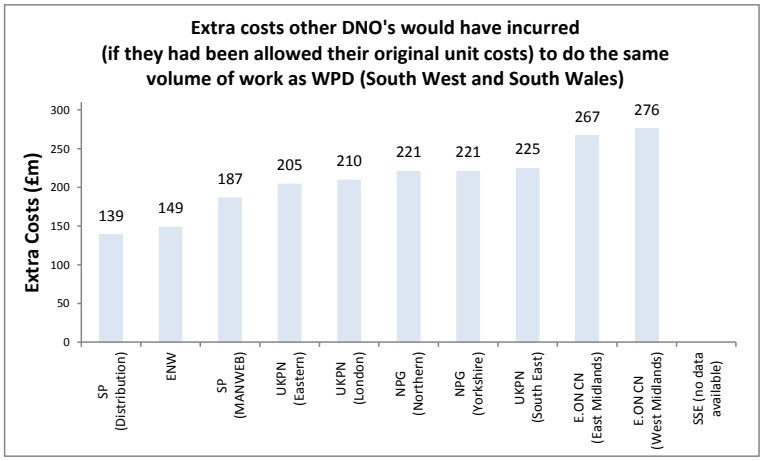
Proven efficient cost of delivery

4.17 WPD's business model, using locally based insourced staff, leads to work being delivered at low costs. This also has the benefits of retaining expertise within the company and flexibility where staff can be quickly redirected.

4.18 In setting allowances, Ofgem benchmark the DNOs to determine an efficient unit cost for each type of investment activity.

4.19 For DPCR5, replacement work accounts for 54% of all DNO network investment costs. Within Ofgem's benchmarking, South Wales and South West were assessed as having the most efficient unit costs for capital replacement works of all DNOs.

4.20 WPD unit costs were significantly lower than other DNOs in the first DPCR5 submissions made to Ofgem in 2007/08. The chart below illustrates the extra costs that companies would have incurred in delivering the South West and South Wales programmes if they had been allowed their submitted unit prices. The same work completed by the other DNOs would cost between £139m and £276m extra.



4.21 As a result of the WPD efficient costs being below the average and in recognition of the capital efficiency that WPD has been able to deliver, Ofgem rewarded WPD with an additional £66m capital allowance for DPCR5. WPD took the decision to use this additional allowance by investing it in further network automation. This will lead to better levels of reliability and service to our customers.

4.22 This difference was also used to demonstrate the potential efficiency savings that could be achieved following the acquisition of the East Midlands and West Midlands businesses. Under previous ownership, costs in these DNOs were the highest in the industry and they are now being driven down to the same level as the South Wales and South West businesses by the application of WPD working practices.

4.23 More details on business efficiency can be found in the Supplementary Annex (SA-08) Business performance, efficiency and benchmarking.

Proven management of network performance

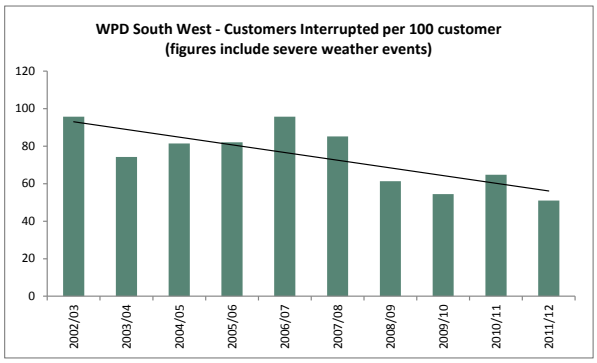
4.24 WPD has a proven track record of improving the network reliability for customers. A number of measures exist for determining how well a distribution business is performing.

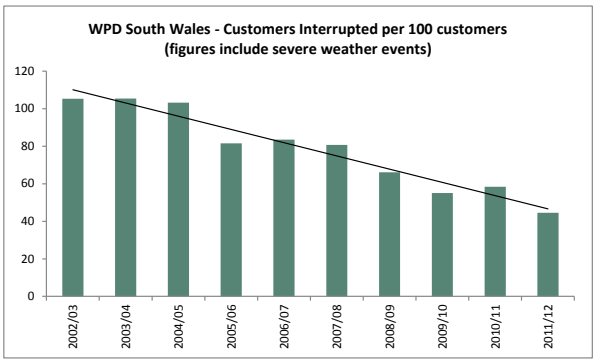
Customers Interrupted (CIs)

4.25 One measure is to record how many times customers are without an electricity supply for any duration over 3 minutes (measured per 100 customers). The data is externally audited annually to ensure we are correctly monitoring and accurately recording the impact on customers.

4.26 For DPCR5 we set out to outperform on the CI targets as set by Ofgem by at least 10% in both South West and South Wales businesses.

4.27 The long run performance trend of the South West and South Wales businesses including the effects of severe weather events is shown below:





4.28 By 2011/12 we had outperformed the CI target by 27% in the South West and 33% in South Wales.

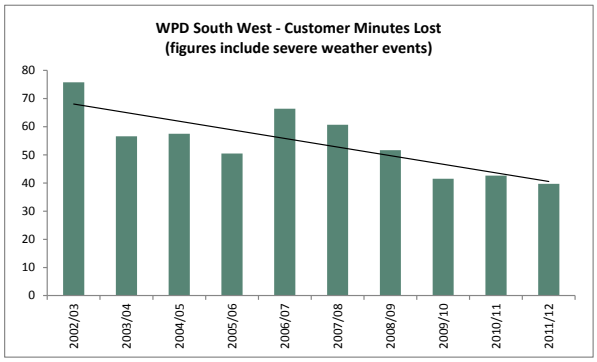
Customers Minutes Lost (CMLs)

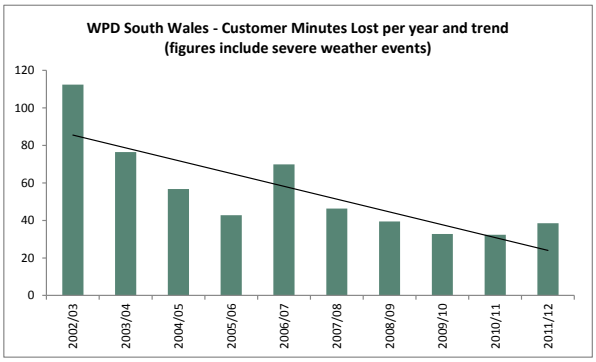
4.29 In addition to how many times a customer might be off supply a further key measure is the actual number of minutes a customer is off supply on average. This is known as "Customer Minutes Lost".

4.30 Our results in driving the number of customer minutes down reflects our desire and our ability to get the customer supplies back on quickly.

4.31 For DPCR5 we set out to outperform the CML targets as set by Ofgem by at least 12% in the South West and South Wales.

4.32 The long run performance trend improvements of our South West and South Wales businesses are shown below:





4.33 By 2011/12 we had outperformed the target by 22% in the South West and 30% in South Wales.

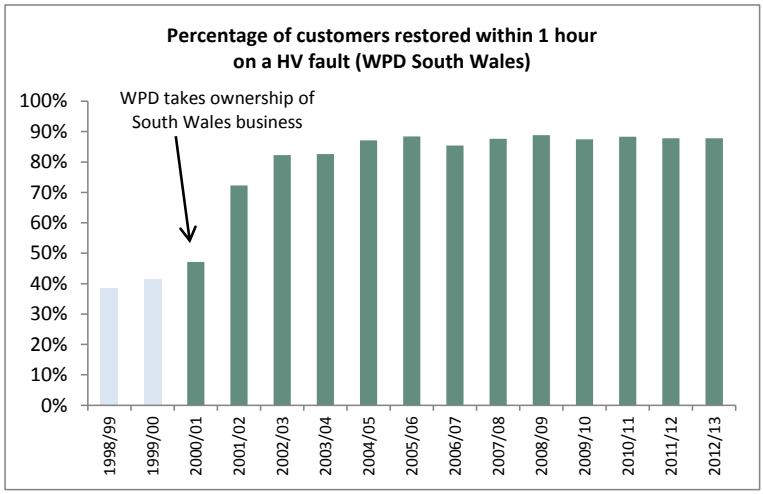
Target 60

4.34 One mechanism used by WPD to drive down the time for restoration is to have an internal target for the percentage of customers restored within 60 minutes of a high voltage (HV) fault, known as "Target 60".

4.35 All of WPD's staff recognise the importance of getting the maximum number of customers restored in the shortest time that they can. Healthy competition between operational teams ensures that the level of performance continues to improve. This has the consequential effect of reducing the average customer minutes lost.

4.36 Target 60 performance is displayed in all of the WPD depots and is monitored within the regional and executive board level key performance indicators.

4.37 The Target 60 philosophy was implemented in South Wales following WPD's acquisition of the business in 2000. The effect was both immediate and significant, as can be seen in the following chart:



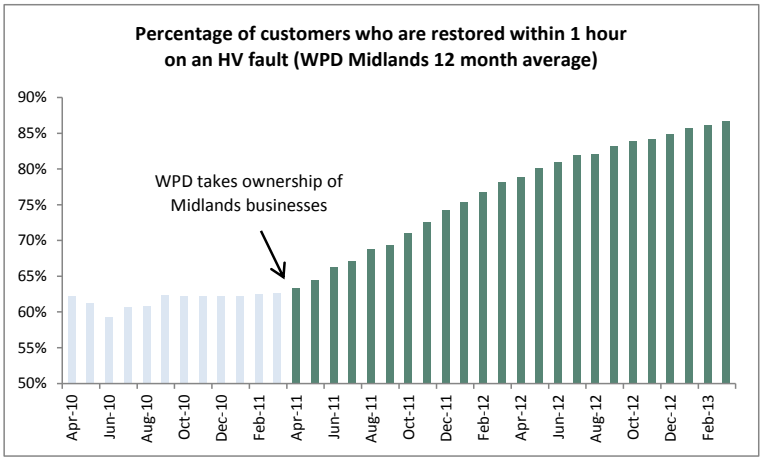
Target 60 performance in the Midlands following acquisition

4.38 Following the acquisition, in April 2011, of the Midlands businesses WPD set about changing working practices, providing clarity of business objectives to staff and applying greater managerial focus and commitment - in particular to the speedy restoration of electricity supplies in the event of a fault.

4.39 Key to this focus was ensuring that all staff understood that WPD was fully committed to improving the Midlands performance to match that capable of being achieved in both the South West and South Wales.

4.40 In the first month of WPD ownership, the Midlands areas were able to increase the number of customers restored within 60 minutes by over 10%. This was bettered to 15% in the second month and after the first full year of WPD ownership had been improved by 25% over the previous year.

4.41 This improvement has continued through the second year of WPD ownership and to date now stands at 36% higher than under the previous ownership. Almost 87% of Midlands customers are now being restored within one hour of an HV fault occurring.



Restoration of supplies within 18 hours

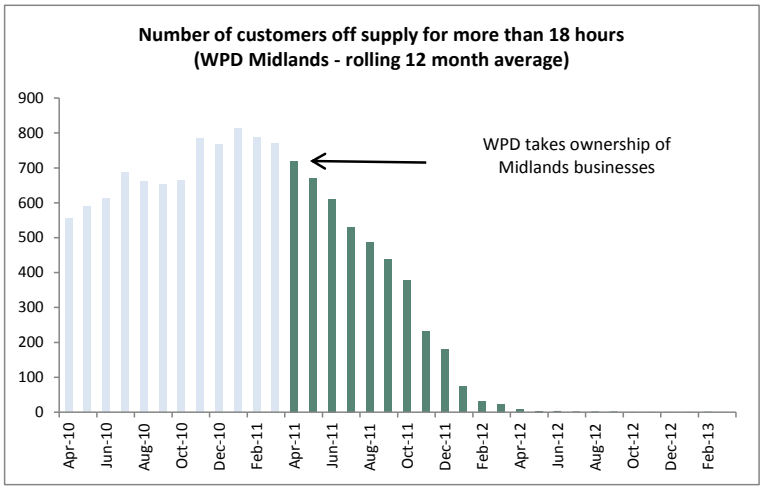
4.42 DNOs are required to report the number of times customers are without a supply of electricity for a period that exceeds 18 hours. A Guaranteed Standard of Performance (GSOP) exists that entitles customers to a compensatory amount of money.

4.43 WPD has always strived to ensure that it minimises the number of customers who suffer the inconvenience of being off supply for more than 18 hours.

4.44 Our performance levels have been the best of all DNOs for a significant period of time and have averaged less than 5 per annum on a rolling 12 month basis.

4.45 In contrast at acquisition the East and West Midlands businesses averaged some 800 customers per month who remained off supply for a period exceeding 18 hours duration.

4.46 We set out to dramatically lower the lower the number of customers in the Midlands being subject to these longer duration faults and in the first month of ownership of the Midlands businesses WPD was able to decrease the number of customers remaining off supply after 18 hours by over 87%. After our first full year of ownership the reduction achieved was in excess of 96%.



4.47 This improvement has continued throughout our second year of ownership with only 14 customers being affected out of a customer base of over 5 million. This contrasts with 9,463 customers affected over a similar period in the last year under previous ownership.

4.48 These incidents have been virtually eliminated through the commitment of staff and the use of more innovative measures to restore supplies. This focus and the consequent levels of improved performance allows WPD to be able to move readily towards a new measure under RIIO-ED1 of "customers who remain off supply for 12 hours".

Proven delivery of excellent customer service

4.49 Our simple Golden Rule, 'Treat customers the way you would like to be treated', has become second nature to all WPD staff. We empower staff and expect them to take ownership of any problems, concerns or complaints that customers may bring to us and to ensure that these are followed through with the customer being kept regularly informed. We do not transfer customers unnecessarily or 'bounce' them from one department to another.

4.50 This simple philosophy has enabled WPD to be recognised as the top performer in respect of customer satisfaction.

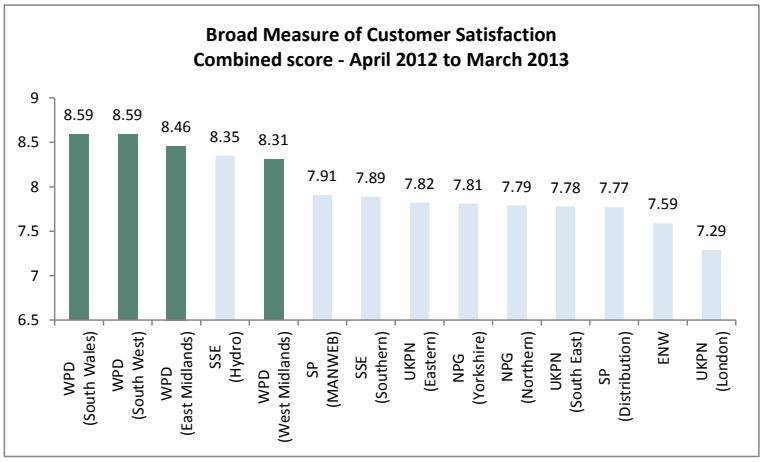
Ofgem's Broad Measure of Customer Satisfaction (BMCS)

4.51 Ofgem introduced the Broad Measure of Customer Satisfaction (BMCS) in the final proposals for DPCR5 that were to become effective in April 2012. Our corporate objective was to be ranked consistently in the top quartile under the new measures.

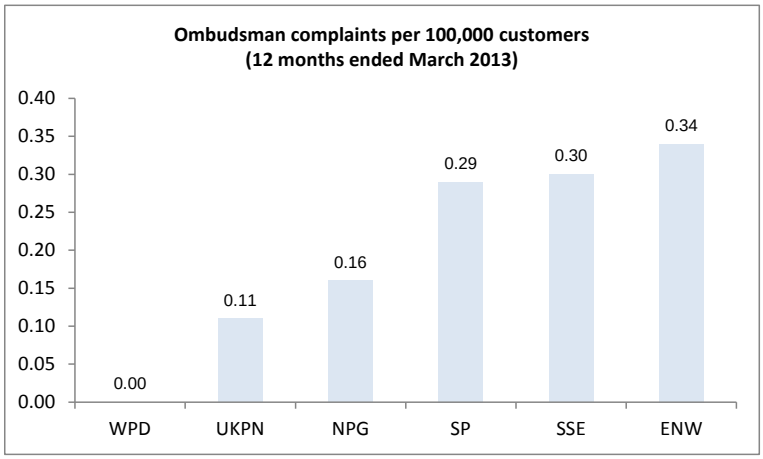
4.52 We conducted surveys from May 2011 to allow us to understand any areas of our delivery where our customers felt we could improve.

4.53 As a result of our own surveys we made a number of changes within the business to improve our customer service delivery ahead of the BMCS going live.

4.54 Since the formal introduction of the BMCS in April 2012, customer responses have consistently placed the four WPD businesses in the top five places. The results of the various questions are combined into an overall score for each DNO. This allows comparison across all of the 14 licenced DNO businesses.



4.55 The BMCS also measures the number of complaints that are upheld by an independent assessor called the Ombudsman. The WPD companies are ranked 1st, 2nd, 3rd and 4th in respect of best performers. In the 12 months ended March 2013 the four WPD businesses had zero complaints. In fact it is now 8 years since WPD South West or WPD South Wales have had a complaint against them upheld.

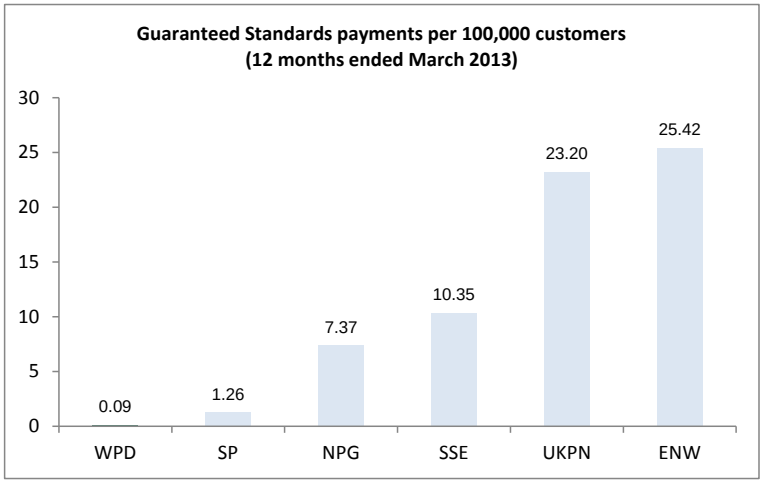


Guaranteed Standards of Performance (GSOPs)

4.56 Another measure of customer delivery is in respect of the volume of payments that a DNO must pay where it fails to comply with a range of different minimum GSOPs.

4.57 Our objective is to be the best performer with respect to GSOPs throughout the DPCR5 period.

4.58 Again WPD leads the way with the lowest payments per 100,000 customers.

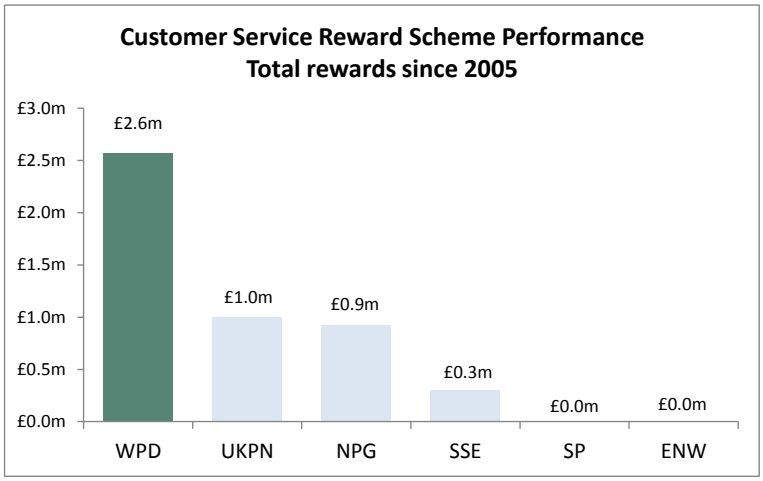


Ofgem Customer Service Reward Scheme

4.59 From 2005/06 to 2010/11 Ofgem conducted an annual Customer Service Reward Scheme for DNOs, designed to encourage innovation and improvements in customer service. Rewards were made to companies that were judged, by an independent panel of industry experts, to have exceeded their licence requirements and demonstrated that they are continually serving the best interests of customers.

4.60 The categories covered by the scheme included priority customer care, wider communication strategies and corporate social responsibility.

4.61 The WPD businesses were the top performers and recognised in every year of the scheme. WPD received the highest number of rewards of any DNOs and were commended for continually leading the way with innovations in customer service.



Proven delivery of reducing our environmental impact

4.62 In our plans for the DPCR5 period, we set out to deliver increased levels of environmental performance when compared to 2009/10 against seven key targets.

4.63 Within three years we have already met three of the targets:

- reduced CO2 emissions per vehicle by 5%;
- reduced the volume of waste being sent to landfill by 5%;
- reduced our own electricity usage in offices by 5%.

4.64 The remaining four targets have progressed significantly and are on track to deliver within the DPCR5 timeframe. These are to:

- increase our investment recovery (the recycling of scrap and equipment no longer required) by 5%;
- reduce the volume of SF6 gas leakage from our installed equipment by 25%;
- reduce the loss of oil from fluid filled cable leaks by 5%;
- complete a programme to establish oil retaining 'bunds' around 100% of our transformers (high volume oil filled transformers rated at 33kV and above) to prevent inadvertent ground pollution by oil. This has already been completed in South Wales and will be complete in the South West by the end of 2013.

4.65 In addition to the original seven targets we have obtained ISO 14001 certification for environmental management across all of our Midlands depots. This will be extended to South Wales by the end of 2013 and South West by the end of 2014.

Record of business-wide innovation

4.66 Innovation is not purely about studies, reports and large projects but is about real changes in working practices that deliver benefits to our business and our customers. Innovation happens across the WPD business and our willingness to adopt and embed innovations into our operating practices has contributed to making WPD the most efficient DNO group.

Technical and operational innovation

4.67 Technical innovation enhances working methods, speeds up processes and improves network performance. WPD has a history of developing and implementing a number of technical and operational innovations such as:

- using 'ENMAC Mobile' - that allows field staff to request and receive operational instructions on hand held devices and to provide real-time job-status updates. This significantly reduces the need for two way dialogue between field staff and the control room speeding up communication and allowing activities to proceed without delay.
- using mobile switchboards and high voltage generation for faster restoration of faulty equipment and quicker restoration of customer supplies;
- training apprentices in house and utilising a WPD developed 'Task completion' approach rather than NVQ modules reducing bureaucracy and allowing greater control and efficiency in the training of apprentices.

Customer service innovation

4.68 We have gained industry leading customer service by being innovative in how we interact with customers. Some examples of what we have done include:

- working in partnership working with WRVS (now known as RVS), British Red Cross and other organisations that can assist vulnerable customers and with Warm Front and National Energy Action in respect of fuel poverty;
- calling customers back to keep them updated about supply interruptions and to check that they are back on supply rather than expecting the customer to call us;
- 'Ramping up' contact centres – we have trained general office staff specifically in the use of contact centre and call taking systems. In the event of bad weather or storms we are able to increase the number of call takers significantly. This enables us to deal with high volumes of calls during the very busy periods whilst maintaining staff numbers at an efficient number for day to day work-loads. In addition we also enable staff to take calls from home by deploying contact centre systems into home locations. This ensures that the levels of service can be maintained even if staff are prevented from travelling to the office due to the severe weather.

Environmental innovation

4.69 We have established effective environmental management processes that have been assessed against ISO 14001.

4.70 We have undertaken a number of innovation and other projects which have a direct impact on the environment including;

- trialling the use of electric Transit vans and other small electric vehicles;
- refurbishing buildings to the highest BREEAM standards;

- applying PFT tagging of fluid filled cables - this adds a special tracer element to the oil that can then be detected from above the ground speeding up leak location, reducing the environmental impact of digging and reducing the volume of oil lost into the environment.
- completing the 'Registered Power Zone' (RPZ1) project which investigated the possibility of applying dynamic line ratings on the 132kV system. A traditional rating for how much load the conductor can carry is based on a one-off summer or winter calculation. By using wind speed and temperature sensors the rating of the line can be calculated continuously. This project was successful and its results are being developed into a WPD policy, marking the innovation's full implementation to become 'business as usual' in RIIO-ED1. The major benefit being that we can allow more LCTs to connect and avoid significant reinforcement costs that would have applied under a traditional approach.

Large scale innovation projects

4.71 Under Ofgem's Low Carbon Network Fund (LCNF), WPD has secured 5 of the 16 large scale projects funded through the competitive 'Tier 2' process and is managing 11 of the 31 self-certifying 'Tier 1' smaller projects. The following table summarises the scope of the five large projects aimed at developing networks that can deal with the challenges of low carbon technology.

4.72 These projects will enhance the speed and volumes of LCTs that can connect to our network:

Name	Project Description
LV Templates	This project uses statistical clustering techniques to identify patterns in electricity consumption behaviour. Nearly 1,000 substations are being monitored and analysis will develop an understanding of how low voltage networks can best cope with future demands of low carbon technology.
Project Falcon	Through this project we aim to get a better understanding of the dynamic nature of the utilisation of the 11kV network and to assess a number of alternative solutions to network reinforcement. It also aims to provide better knowledge of the IT and telecommunication requirements.
SoLa Bristol	This project aims to determine how community based battery storage can assist in deferring the need for network reinforcement by storing excess energy from photo voltaic generation and releasing it during peak demand. Providing large enough batteries for each customer would be prohibitively expensive and therefore lower capacity batteries are linked across the community taking advantage of the fact that customers use power at different times. The technology has been implemented in ten schools, one office and thirty homes.
Lincolnshire 33kV low carbon hub	This project aims to test methods for controlling load flows on the 33kV network in conjunction with new commercial arrangements with generators to avoid the costs that would normally be required for network reinforcement.
FlexDGrid	This project seeks to explore the potential benefits arising from trials of three complementary methods for managing fault level including enhanced fault level assessment; real-time management of fault level; and fault level mitigation technologies.

Proven record of resource recruitment

4.73 WPD has delivered its resource plans. Over the five year period from 2007 to 2012, in South Wales and South West, WPD recruited 307 staff to replace retirees and other leavers. 159 of the new recruits were apprentices joining our in-house industry respected apprentice training programme. Over the same period West Midland and East Midlands recruited 280 apprentices. All new apprentices are enrolled onto WPD's in-house scheme.

4.74 In the DPCR5 Business Plan, WPD submitted a need to recruit and train an additional 265 new staff specifically for the delivery of extra work programmes in DPCR5 and beyond. These staff were recruited, trained and established in front line roles within two years of the start of DPCR5.

4.75 WPD has the ability to train staff for all key operational roles within its own training schools based predominantly in two locations: Taunton in Somerset and Tipton in the West Midlands. With 32 skills trainers, 27 classrooms, 12 workshops and 5 training fields we are self-sufficient for the training of new starters, for the training of refresher courses for existing staff and for the 'upskilling' of existing staff in more advanced skills or operations.

Sharing best practice

4.76 WPD has always had an open approach with other companies in respect of demonstrating how we drive high standards of customer service and operational delivery. We continue to innovate throughout the business finding better ways to serve our customers and improve the efficiency of our delivery.

4.77 Likewise we are also keen to learn from other DNOs, utilities or related companies to ensure we apply best practices to our business. For example we have helped developed the cable fault sniffer from techniques used for gas leak location and incorporated self-quote packs for service alterations previously used in the gas industry.

4.78 We have regularly demonstrated and shared how we have achieved our very high standards with other DNOs or indeed other utility companies or other organisations who may wish to know. Ofgem has encouraged us to continue to do this as they can see the potential benefits to customers served by these other companies in respect of improved service levels and reduced costs.

4.79 Although the list below is not exhaustive it demonstrates that representatives from utility organisations including all of the other DNO groups have requested to visit and have been welcomed by WPD to review aspects of our customer service, operational IT systems or training school facilities and apprentice programmes.

Location	Business Activity	Visitors
Lamby Way, Cardiff, South Wales	Control, Contact centre, Operational despatch, High Volume Call Taker, Customer service.	Northern Power Grids, Scottish Power Manweb, Scottish and Southern, National Grid, Northern Gas, Wessex Water
Pegasus Office, Castle Donington, East Midlands	Control room, Operational despatch, Contact centre, Customer service, Stakeholder engagement	UK Power Networks, National Grid, Northern Gas, Wales and West Utilities, Severn Trent, Anglian Water, Scottish Power Networks, Scottish and Southern
Toll End Road, Tipton, West Midlands	Control room, Operational despatch, Contact centre, Customer service	Electricity North West
Avonbank, Bristol, South West	Information resources, Stakeholder engagement, ENMAC team, High Volume Call Taker, Customer services	UK Power Networks, Scottish Power Manweb, National Grid
Taunton Training Centre, Somerset and Tipton Training Centre, West Midlands	Skills training – overhead linesman, jointing and fitting, Apprentice programme, Graduate programme, Technical staff trainee programme, Operations training	Jersey Electricity, MANX Electricity authority, UKPN, ENA, ENW, S&SE, Environment Agency.

PAS 55 accreditation of asset management processes

4.80 Publicly Available Standard (PAS) 55 has been developed by the Institute of Asset Management as a standard for carrying out asset management. The standard covers 28 elements of asset management including the specification of objectives, risk management, performance and condition monitoring, development of work plans, progress monitoring, and continuous improvement, underpinned by the commitment of senior management.

4.81 As an asset intensive business, the approach taken to managing assets is critical to the long term operational and financial success of WPD. In recognition of this, WPD was the first DNO to attain accreditation against PAS 55 in 2006 and continued conformance is monitored through annual surveillance and 3-yearly recertification visits by Lloyds Register.

4.82 The last assessment was carried out in October 2012, where recertification was applied to all four licences. The auditors were impressed with how well the West Midlands and East Midlands businesses had been integrated into WPD in a very short time, finding consistency throughout the whole organisation. A letter from the auditors can be found at http://www.westernpower.co.uk/docs/About-us/Stakeholder-information/Our-future-business-plan/Supporting-documents-overview/PAS55-auditor-s-letter.aspx

5 Developing the plan for our business

5.1 The WPD RIIO-ED1 Business Plan builds on WPD's excellent track record as the leading DNO.

5.2 It considers business objectives and stakeholder requirements in the context of the business environment and long term strategy.

5.3 Extensive planning, analysis and consultation have been used to ensure that the plan delivers benefits for current customers and sets the foundations for the future.

5.4 Expenditure forecasts have been derived by considering many sources of information such as:

- national forecasts of future energy use;
- detailed analysis by independent expert organisations;
- comprehensive modelling using specially developed third party tools;
- bespoke in-house forecasting models;
- the proposals and requirements from specific WPD teams with expert knowledge;
- feedback from local teams on the observed state of the network;
- regulatory frameworks and incentive mechanisms;
- stakeholder views and requirements.

5.5 Stakeholder engagement is embedded in business processes and consultation is continuous. Since 2011, the focus of the engagement has been aimed at future requirements to be delivered in RIIO-ED1 and beyond. Stakeholder priorities, willingness to pay and scale of investment programmes have all featured in the consultations that have taken place.

5.6 Investment proposals continue the programmes developed for DPCR5, with refinements made for changes in the business environment and stakeholder requirements. The proposals have been under development since 2011 and an initial view of expenditure requirements was presented to Ofgem in July 2012. Since then, more detailed modelling and cost benefit analysis has led to updated proposals.

5.7 Senior managers with detailed knowledge of the business have contributed to the contents of the Business Plan. A core RIIO-ED1 group has co-ordinated the development of the plan and challenged the proposals to ensure that the work programmes meet the needs of the business and stakeholders.

5.8 The governance arrangements for controlling the development of the plan have been audited to confirm that robust arrangements were in place for recognising and managing key risks.

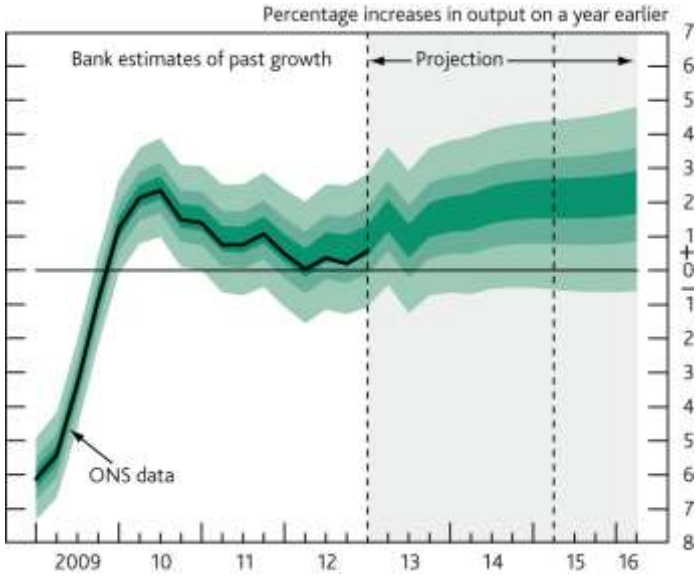
5.9 This has resulted in a well-balanced plan that improves network performance, provides excellent customer service and facilitates a move to a low carbon future.

Business environment

Economic conditions

5.10 The speed and scale of recovery from recession is uncertain. Bank of England projections (illustrated below) suggest that growth will continue at low levels leading up to the start of RIIO-ED1.

The Bank of England's May 2013 forecasts of GDP growth



5.11 This overall economic uncertainty carries over into uncertainty about growth in electricity usage and the number of new connections we can expect. It is also likely to impact on the willingness of customers to invest in LCTs as lower economic activity or confidence may delay capital investments by customers.

5.12 The introduction of any significant new subsidies to encourage LCTs is unlikely in the early part of the RIIO-ED1 price control period.

The Government's carbon reduction objectives

5.13 The UK Government has committed to undertake positive action on climate change by reducing the emission of greenhouse gasses and has developed a roadmap within its Carbon Plan.

5.14 For WPD the major impact will be changes to the network for LCTs used for electricity generation, transportation and heating. Part of WPD's role is to enable cost effective and timely connection of distributed generation (such as solar panels) and to provide sufficient capacity in the network to accommodate the increased loads from electric vehicle charging and heat pump domestic heating systems.

5.15 DECC has established forecasts for the scale of uptake of LCTs which will require the distribution networks to increase capacity and be more flexible to deal with fluctuations in generation and demand.

Changes to European Union (EU) legislation

5.16 The EU is considering the introduction of new legislation for the energy efficiency of 'small' transformers. This would require all new distribution transformers to be constructed to reduce electrical losses.

5.17 It is estimated that the cost of a transformer would double as a consequence. This price increase would add approximately £5m per annum to the costs of asset replacement and load reinforcement programmes.

5.18 As the timing and specific requirements are unknown, current cost forecast assume that the change does not occur during RIIO-ED1, but will have an impact in the longer term.

5.19 Other changes to EU legislation are detailed in the Supplementary Annex on Uncertainty (SA-06).

Business objectives

Business objectives

5.20 WPD's business objectives are simple. They are:

- to minimise the safety risks associated with WPD's distribution network;
- to improve the reliability of electricity supplies and to make the distribution network more resilient;
- to reduce WPD's impact on the environment and to facilitate low carbon technology;
- to consistently deliver outstanding customer service;
- to meet the needs of vulnerable customers;
- to engage with our stakeholders;
- to be efficient, effective and innovative in everything we do.

Returns for shareholders

5.21 In summary the main objective of the business is to deliver frontier levels of performance at an efficient level of cost.

5.22 The achievement of frontier performance will be reflected in a high return on regulatory equity (RORE), thereby rewarding our shareholders with an equity return above the 6.4% base assumption in our updated Business Plan.

Long term strategy

5.23 WPD's long term strategy is to deliver our business objectives through an efficient, flexible and scalable organisational structure; evolving to accommodate the challenges of the future.

Efficient organisational structure

5.24 The current flat organisational structure with locally based teams of in-sourced labour has been the foundation of WPD's success. It gives responsibility to front line staff to deliver work programmes and the absence of multiple layers of management minimises costs.

5.25 There are no plans to change this successful business model.

5.26 One of the big advantages of the geographical team structure is scalability. More staff can be added to an individual team where increases in future work cluster together or additional teams can be created where there are more widespread increases in workload. These changes can be achieved quickly.

5.27 The structure also enables WPD to refocus effort and resources very quickly to those areas that require it either on a short term or permanent basis.

Self-sufficiency

5.28 WPD's resourcing strategy is to use in-sourced labour. This ensures that knowledge is retained, allows greater flexibility to redeploy staff where needed and builds a strong culture of staff motivated to deliver business objectives.

5.29 The development of in-house apprentice schemes, training facilities, technical knowledge, operational capability and bespoke systems increases the self-sufficiency. This allows the business to respond quickly to new requirements and obligations and have better control over succession planning.

Investment in technology and innovation

5.30 Developing better ways of doing things is encouraged throughout the business. Innovative ideas are captured, tested and rolled-out into the business on a regular basis.

5.31 Technology can provide benefits of improved performance or efficiency. The deployment of technology is carried out in a way to ensure that compatibility is maintained. This applies equally to IT equipment, communications infrastructure and the roll out of new innovative network management techniques.

Understanding the long term needs of the network

5.32 Network monitoring, independent information sources and modelling techniques are used to predict investment requirements into the long term.

5.33 Asset replacement forecasts show that in the future more investment will be required to replace an ageing cable population. Monitoring of fault rates and analysis of causes will enable targeted investment programmes to be established. An example where this already exists is in the replacement of Consac cables that were installed in the 1970s but have since been found to have a greater than average fault rate.

5.34 DECC LCT forecasts suggest that there will be extensive requirements for network reinforcement growing exponentially into RIIO-ED2. Smart solutions are being trialled utilising innovation funding to develop lower cost ways of providing network capacity.

Economically doing more than the legal minimum

5.35 As a minimum the activities carried out aim to comply with licence obligations and the Electricity Act. Where identified as being in line with our business objectives, additional activities will be carried out to provide better service or provide additional network capacity.

5.36 This approach ensures that our incremental investment above legal requirement is made to bring about clearly identified benefits to our customers, stakeholders and our business.

Completing work programmes

5.37 WPD does not delay work programmes. Whilst short term savings would provide a financial benefit under the regulatory efficiency incentive (IQI) such action is not commensurate with providing a longer term reliable network for customers.

5.38 Unless objectives change, work programmes are completed.

Adapting the network for climate change

5.39 We engage with DECC and the industry to identify common climate change impacts and set about implementing changes to ensure that our networks remain reliable into the long term future.

5.40 We have used available projected climate data to assess risks resulting in three priority areas relating to increased lightning activity, flooding and impact of temperature rise on overhead lines.

5.41 Lightning activity is predicted to increase across the whole WPD area. Even in the medium term, by the end of the RIIO-ED1 period, we expect activity to increase by up to 11% in the South West and East Midland areas. The effects are being mitigated by adding lightning protection devices to the network.

5.42 Site specific flood risk assessments are used to identify the most prudent method to adopt. Mitigation measures include protection of individual items, protection of buildings, protection of the site as a whole or in extreme cases site relocation. This is also considered for the siting of new infrastructure.

5.43 Predicted increases in ambient temperature will not only mean that thermal expansion will affect the overhead line clearances but also the thermal loading limits will be reached more quickly. We have introduced new overhead design requirements including new conductor ratings and increased ground clearance requirements for overhead lines to ensure our network remains compliant and resilient.

Governance of Business Plan development

5.44 The Business Plan has been developed following extensive engagement with our stakeholders, ranging from domestic customers and large users to electricity suppliers and Ofgem. We have listened to all of our stakeholders to ensure we formed a balanced view as we developed this Business Plan.

5.45 The RIIO-ED1 project governance structure was set up and agreed by the Executive Management Council in September 2011 to ensure clarity of roles and responsibilities along with a formal and accountable reporting structure. An overview of the project structure is below:

5.46 The WPD Board has been fully involved in the development of this Business Plan. The proposals we have set out deliver the company's objectives while providing real value for money.

6 Developing the plan for our stakeholders

6.1 WPD regularly engages with stakeholders.

6.2 Stakeholder engagement is embedded in our business. True improvements in customer service and business delivery come from understanding the areas where we can do better.

6.3 On an on-going basis we undertake a wide range of engagement activities with different stakeholders including:

- domestic and business customers;
- major energy users and suppliers;
- local authorities;
- parish councils;
- other DNOs;
- other utilities (including electricity suppliers);
- environmental groups;
- regulatory bodies;
- vulnerable customer representatives;
- emergency planners;
- educational institutions;
- connections customers;
- distributed generation customers and developers;
- future customers;
- all WPD staff.

6.4 Stakeholders have influenced and shaped all aspects of the Business Plan.

What sets our stakeholder engagement apart

6.5 **Breadth and quality:** We have engaged with over 4,200 stakeholders on our RIIO-ED1 Business Plan. Many different stakeholders have been involved throughout the process and have become more knowledgeable about our business. This has enabled them to critically evaluate our plans in considerable and increasing detail. We place a strong emphasis on talking directly to stakeholders face-to-face at events co-facilitated by WPD staff.

6.6 **Business-led:** Stakeholder engagement is not separate to our day-to-day activities. Members of the WPD senior management team, including local Distribution Managers, who will be responsible for operationally delivering the work, have facilitated our stakeholder workshops so they can learn from our customers first hand.

6.7 **Transparent:** After every stakeholder event we publish an independent report of the findings, followed by a WPD response including an action plan for how we will act on our stakeholders' feedback.

6.8 **Innovative:** We use a wide range of engagement methods and are innovative in our approach. WPD's fourth annual customer awareness campaign began in February 2013 with the unveiling of a brand new TV advert - a bold and novel approach to engagement with millions of customers who have little prior knowledge of WPD. The month-long 'Power for life' campaign, including the screening of the TV advert, also included local newspaper advertising and a four-page leaflet delivered to every home and business in our region, which invited customers to participate in our stakeholder workshops.

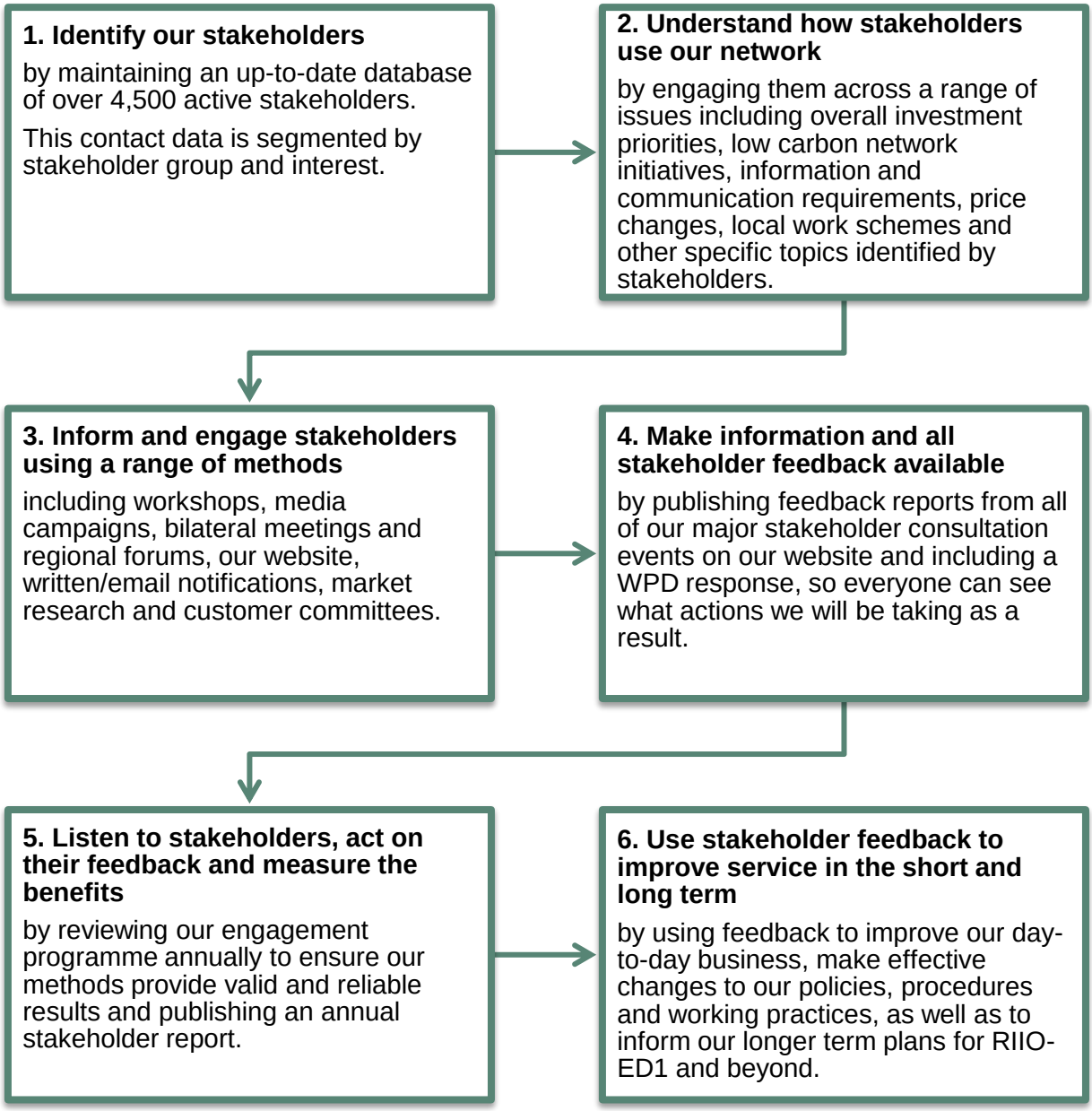
6.9 **Inclusive:** We have given 'future bill payers' the opportunity to have a say in our plans, through bespoke university events. We also recognise WPD staff as key stakeholders. WPD's Chief Executive personally conducts 50 staff road shows each year, seeing over 6,100 staff, to communicate the key aspects of our business plans and the role staff will play in delivering our promises to customers.

6.10 **Valued by stakeholders:** Our stakeholder workshops have received 99% satisfaction ratings from the participants for usefulness and value.

6.11 **A phased approach:** Stakeholders have influenced and helped to shape all aspects of our Business Plan. We have used a phased approach with our stakeholders to build our Business Plan. We began by identifying broad stakeholder priority areas, then developed these into specific proposals for service level improvements, gave stakeholders multiple options for investment including costs, before finally consulting on our draft Business Plan in full, including all proposed outputs.

Our stakeholder engagement strategy

6.12 Our CEO reviews and approves our stakeholder engagement strategy annually. The strategy is to:



6.13 When devising our RIIO-ED1 stakeholder engagement programme, we chose to extend our core engagement approach. To ensure our consultation programme was of the highest quality, scope and effectiveness, our stakeholder workshops and events have been underpinned by 4 key goals:

Size and breadth

Our programme will engage the largest number of stakeholders, from as wide a range of backgrounds as possible.

The scale of our engagement gives greatest value and integrity to our results.

- We have consulted over 4,200 stakeholders about our Business Plan via a range of methods.
- Our 20 stakeholder workshops attracted an average of 32 attendees per session.
- Each table included a minimum of 8 stakeholders, all from different perspectives/representative groups to ensure discussions were balanced.

Detail

Our programme will develop stakeholder understanding of our business and help ensure their views are well informed.

- We provided comprehensive information – including detailed expenditure figures.
- We consulted on options for investment in 10 core service areas giving customers actual costs and impacts on bills.
- We published our draft Business Plan in March 2013, a month prior to six follow-up stakeholder workshops.
- Stakeholders discussed and evaluated all 67 outputs proposed in our draft Business Plan.

Expert-led

Our stakeholder engagement programme will be led by those responsible for developing the plan.

Every workshop is presented and facilitated by contributors to the Business Plan, including those directly responsible for the six output sections.

This ensures that stakeholder engagement is truly embedded in the Business Plan development process and not merely a bolt on box ticking exercise.

Deliverer-led

We will learn from our stakeholders and act on improvement opportunities.

All our workshops are attended and facilitated by local WPD Distribution Managers who will be responsible for delivering the work programme when it is agreed. This allows them to hear first-hand what matters most to stakeholders, and to understand how these priorities are being addressed in our Business Plan.

It also gives stakeholders the opportunity to speak to engineers with local knowledge, to discuss the practicalities of delivery and explore opportunities for co-working and to co-ordinate planning and scheduling.

We will not wait for RIIO-ED1 to deliver improvements that can be done now.

Our approach to stakeholder engagement for RIIO-ED1

6.14 Our RIIO-ED1 engagement programme has the following five phases:

Phase	Timing	Objective
1 - Preliminary engagement	January 2010 – December 2011	To ensure all stakeholders' interest areas have been recognised and suitable representatives identified. We also sought to understand their preferred method of communication and to hear first-hand the issues that most concern them.
2 - Willingness to pay research	January 2012 – August 2012	To group stakeholders' priorities into common areas for focus within the Business Plan, to identify specific levels of service improvement achievable under each priority area and to understand customers' 'willingness to pay' for improved performance.
3 - Business Plan development and consultation	September 2012 – July 2013	To provide stakeholders with the opportunity to shape the WPD Business Plan by presenting stakeholders with options for network investment, the level of service improvement each option would deliver, the overall costs and the impact on the average electricity bill.
4 - Business Plan outcomes	July 2013 – Ofgem decision (February 2014)	To communicate how we incorporated stakeholder feedback into our Business Plan, highlight any significant changes from our previous proposals, and to identify the key performance measures stakeholders would like us to use to monitor our progress and enable them to hold us to account for delivering on our promises.
5 – Business Plan delivery/performance review	April 2015 onwards	To provide an update on our progress in delivering the investment plans, our performance against key output measures and to identify areas of emerging stakeholder interest or concern.

Our methods of engagement:

6.15 We have used a range of engagement methods, tailoring them to individual stakeholder's knowledge, interest and understanding of our business. Since 2010, we have engaged with over 4,200 external stakeholders specifically on our plans for RIIO-ED1, via:

- 20 stakeholder workshops (with a wide cross-section of stakeholders);
- 2 'future customers' workshops (with university students);
- 2 'social obligations' workshops (with vulnerable customers, representatives and agencies);
- 7 Customer Panel meetings (with "expert" stakeholders);
- 8 focus groups (with domestic customers);
- 1,208 'willingness to pay stated preference' interviews (with domestic customers);
- 426 'willingness to pay stated preference' interviews (with business customers);
- 6 connections and distributed generation surgeries;
- 774 distributed generation customer interviews;
- 408 vulnerable customer surveys (with customers on the Priority Service Register);
- 2 energy supplier forums;
- 50 staff roadshows.

6.16 Following stakeholder workshops, Customer Panel meetings and willingness to pay research, we publish reports on our website detailing all of the feedback received, as well as a WPD response outlining the conclusions we have reached and how this will impact on our plans.

6.17 Examples of our key methods of engagement, per stakeholder knowledge and interest level, include:

Level One – Expert:

WPD Customer Panel

6.18 We have established a permanent Customer Panel that gives a broad range of stakeholders the chance to shape our thinking and future priorities at a strategic, highly informed level.

6.19 The Customer Panel is attended by WPD's Chief Executive and members meet quarterly to voice their opinions, concerns and ideas in an open forum.

6.20 The Customer Panel has been in place since 2009.

6.21 Through their expert knowledge, the Customer Panel is able to shape our broader strategic thinking and offer expert analysis and refinement of our Business Plan as a whole. Outputs from all meetings are published on our website, with detailed minutes and actions formally recorded.

6.22 Each Customer Panel member represents one of our stakeholder segments. The Customer Panel's membership is therefore regularly evolving to ensure it continues to be representative of our diverse customer base. Growing from 11 original attendees, there are now 20 permanent members from regional and national groups including: the British Red Cross, Major Energy Users' Council, B&Q, Energy Saving Trust, the Co-Operative, RVS, Warwickshire Police, Severn Trent Water, West Coast Energy, Clearwell Parish Council and Lincoln University.

WPD Customer Panel – Joint statement of endorsement from members
"Western Power Distribution (WPD) was the first DNO to adopt open and enduring stakeholder engagement, long before RIIO-ED1. They have led the way by giving stakeholders a clear say and involvement in strategic decisions for the future of the business. WPD's Customer Panel was the first of its kind and currently enables us to regularly meet the senior company managers, see the company at work and learn more about what WPD is doing, where and when. The transparent and open approach affords us the opportunity to comment on policy and feedback concerns and suggestions to management and key decision makers directly. Collectively the professional experience and knowledge of the invited members have enabled consideration of the outputs proposed by WPD for RIIO-ED1 in order to submit a plan that would be most beneficial for stakeholders and customers. WPD respect both positive and negative responses and address issues accordingly. WPD's approach to engagement is transparent, genuine and well thought out, using a wide range of methods. Meetings are a worthwhile use of our time as we see our suggestions implemented to ensure customers continue to receive the best possible overall customer service."

Level Two – Interested:

Stakeholder workshops

6.23 We have held 20 stakeholder workshops since 2010 in relation to our RIIO-ED1 Business Plan.

6.24 The events focussed in detail on various aspects of our business that stakeholders had indicated were important to them. The events allowed WPD to identify stakeholder priorities and suggestions for improvements to services and processes. We were able to test and refine our proposals, identify areas for further consultation and, where required by stakeholders, provide additional detail.

6.25 The events have attracted 650 stakeholders representing a broad cross-section of customer groups. Stakeholders included large customers, suppliers, manufacturers, local authorities, emergency planners, environmental groups, vulnerable customer representatives, parish councils, health trusts and universities. Each table featured an average of 8 stakeholders, all from a different stakeholder interest groups, which allowed for fair and balanced discussions from a wide range of perspectives.

6.26 Sessions were held in urban and rural locations across WPD's regions to ensure a representative view. Events were held in Nottingham, Birmingham, Cheltenham, Gloucester, Exeter, Cardiff and Bristol.

6.27 All round-table discussions were run by independent facilitators to stimulate conversation and to ensure workshop reports were independent and unbiased.

6.28 All tables included a senior manager from WPD to provide context and to answer stakeholder questions.

6.29 The full-day sessions involved presentations from WPD to give an overview of the company and our activities and to provide important context to the topics for discussion, including current WPD performance and a detailed explanation of our future plans.

6.30 Stakeholders then participated in facilitated, qualitative round-table discussions followed by quantitative electronic voting, to give stakeholders an instant overview of the consensus amongst those in attendance. In the afternoon there were optional sessions where stakeholders could discuss topics of specific interest with a relevant "expert" from WPD who is operationally responsible for that service area.

Level Three – No prior knowledge:

'Power for life' media awareness campaign

6.31 Stakeholder feedback, in particular from vulnerable customers, students and young people, is that raising awareness of WPD should be a high priority.

6.32 We therefore run a month long 'Power for life' awareness campaign every year where we send a newsletter to every customer and run a series of television adverts.

6.33 The purpose of the campaign is to:

- raise awareness of who we are and what we do;
- report on our current performance and what we are doing to improve our service;
- invite customers to have an input in our stakeholder engagement programme and help shape our future investment plans.

6.34 WPD's fourth annual awareness campaign began in February 2013 with the unveiling of a brand new television advert - a bold and novel approach to engagement with millions of customers who have little knowledge of WPD.

6.35 The month-long campaign, could be viewed on all ITV regions serving our operational area, as well as on S4C in Wales and the 'On Demand' services for ITV and Channel 4. The advert and a range of other information about the campaign are also featured on the WPD website.

6.36 In addition, a four-page information leaflet was delivered to every home and business (7.8 million) in our region, whilst advertising appeared in every regional daily and evening newspaper and included contact information for people wishing to get in touch.

6.37 The 'Power for life' newsletter included an overview of our stakeholder engagement programme, our plans for RIIO-ED1 and an invitation for customers to participate in our consultation process.

6.38 This ensured that customers with little or no prior knowledge of WPD were given the opportunity to understand our business and have their say on our future plans. In 2012, respondents to our media campaign

took part in our 'willingness to pay' research, one month later. Several have also attended Business Plan workshops.

6.39 Over 2,000 customers from 20 major towns and cities across our region took part in face-to-face opinion research, pre and post campaign. This was designed to gauge awareness levels, preferences about what information they would like to receive from us and their preferred method of receiving it.

6.40 Following the 2013 campaign there was a considerable increase in awareness of WPD – 56% amongst those who recalled the campaign – compared with 28% of those who could not.

6.41 Customers also endorsed the methods used by WPD, by highlighting newsletters, TV and radio, and the WPD website as their preferred methods of receiving information from us.

Level Four – Future:

Future customers workshops

6.42 Given that WPD's Business Plan covers the period up to 2023, we have identified a new stakeholder segment for specific consultation. In 2013 we ran a series of workshops with university students to give future electricity bill payers the opportunity to influence and feedback on our plans.

6.43 The sessions at Nottingham University and Bristol University were attended by a number of interested students.

6.44 Every effort was made to engage with as broad a range of students as possible. At Nottingham University, we used the university's own database of 209 societies and sent invitations by email. At Bristol University, we placed a number of posters at locations around the Students' Union building and also emailed students directly, using a specialist student marketing company.

6.45 Following an introductory presentation from WPD, we held facilitated, qualitative round-table discussions about WPD's future plans with respect to:

- reducing power cuts;
- customer communication methods and the use of social media;
- climate change mitigation and protecting the network from severe weather;
- smart networks and low carbon technology.

Key findings

6.46 WPD has carried out an extensive programme of stakeholder engagement, seeking feedback on a range of different options for future service and network investments. The following provides a high level summary of the key findings.

Network reliability

86% of stakeholders agreed with WPD's draft plans and outputs to improve network performance.

91% agreed with WPD's draft plans and outputs to enhance network resilience to severe weather.

6.47 **Network reliability is the number one priority for our stakeholders**: Stakeholders are not willing to see any deterioration in service.

6.48 **Network reliability during normal weather conditions**: Stakeholders would like to see, as a minimum, a 10% reduction in power cut frequency and duration.

6.49 **Network reliability for worst served customers**: Stakeholders support Ofgem's decision to change the definition from 15 power cuts in 3 years (lasting 3 minutes or more), to 12 power cuts in 3 years. They would like to see the number of worst served customers reduced by 20%, from 20,000 to 16,000 customers. When WPD proposed to go further (improve by 40%) stakeholders told us to scale-back our plans to, what they felt was, a more reasonable cost per benefitting customer.

6.50 **Network resilience to severe weather and flooding**: The importance of this topic has increased significantly over the last 18 months, and is now viewed as one of WPD's top three priorities. Most stakeholders would like to see the initial resilience tree cutting programme accelerated to be completed in a total of 20 years. They would also like to see our flood mitigation measures extended to protect more substations from flooding.

Environment

82% of stakeholders agreed with WPD's draft plans and outputs to reduce the environmental impact of the network.

74% agreed with WPD's draft plans and outputs to facilitate increased volumes of Low Carbon Technologies (LCTs).

6.51 **Reducing oil and gas leaks from equipment:** Minimising WPD's environmental impact by reducing oil and SF_6 gas leaks from equipment is seen as a key issue by stakeholders, although it is viewed as a 'medium' priority when placed in context with other priorities for investment. Stakeholders would like to see continued incremental improvements, but do not support significantly increased investment.

6.52 **Improving visual amenity:** Undergrounding overhead lines in National Parks and Areas of Outstanding Natural Beauty remains a priority area but this is a polarising issue for many stakeholders and our proposals have received a mixed response. Stakeholders have told us they would like to see an increase on the current rate of undergrounding schemes (5km per year, 40km in 8 years) but did not support the initial proposal to significantly increase the amount (to 70km in 8 years), which was rejected by 64% of stakeholders.

6.53 **Low carbon technologies:** Future-proofing the network is a high priority, but stakeholders are very conscious of the uncertainty surrounding the timing and uptake of low carbon technologies. They would like WPD to strike a balance in RIIO-ED1; increasing investment where there is confidence the need exists, but not to go too far ahead of need.

6.54 A number of stakeholders were of the view that WPD's initial low carbon technology projections were too high, particularly regarding the uptake of electric vehicles and heat pumps. As a result, we have undertaken a detailed forecasting exercise with the Centre for Sustainable Energy (CSE) to ensure that our 'best view' scenario is evidenced and can be supported.

6.55 'Demand Side Management' (DSM) is the term used to describe the ability of a DNO to switch off or reduce a customer's electricity consumption when overall demand on the network is high. To allow this to happen a DNO will have had to reach agreement with the customer beforehand. In return for this the customer will be in receipt of lower electricity unit charges or could be rewarded with a set payment. This agreement allows a DNO to avoid the additional costs of reinforcing its electricity network for situations where the peak load on the network occurs infrequently and/or is of short duration. Whilst stakeholders can see a role for some application of DSM, the majority felt that this would be restricted to commercial/industrial customers in the foreseeable future. Also this is not seen as a long term solution as businesses may move or change and agreements will need to be renegotiated.

Connections

86% of stakeholders agreed with WPD's draft plans and outputs to make the connections service faster and more efficient.

94% agreed with WPD's draft plans and outputs to improve communications during the connections process.

6.56 Stakeholders are very clear that this is an area where we can still do better, despite WPD having the highest satisfaction rating in the industry for our connections service. Stakeholders believe we should shorten the overall time it takes to provide a quotation, and once the quotation is accepted, the time it takes for the connection to be completed.

6.57 Customers would also like us to make the process easier by providing more frequent, timely communication and alternative methods by which they can access information. For example, stakeholders overwhelmingly supported the introduction of an online self-service system for enquiries, applications, payments and progress tracking.

Customer satisfaction

96% of stakeholders agreed with WPD's draft plans and outputs relating to customer service and complaints.

94% agreed with WPD's draft plans and outputs relating to customer communication.

6.58 Stakeholders recognise that WPD currently has the highest overall customer satisfaction of any DNO group and support continuing the existing ways of monitoring customer satisfaction.

6.59 Stakeholders have told us that the telephone remains their preferred method of communication during a power cut and that having accurate, useful and up-to-date information is key. However, stakeholders would also like a choice of communication methods to use, such as social media and real-time power cut information on our website. Acting on this feedback we have already introduced real time online power cut information.

Social obligations

6.60 Stakeholders believe that WPD has a key responsibility to continue to support vulnerable people, by providing practical support during power cuts and proactive preparation advice and information in advance of an interruption. Stakeholders strongly supported expanding our current support services and increasing the amount of information provided to customers.

6.61 Stakeholders state that we must take ownership for maintaining and ensuring the quality of data on our Priority Services Register and liaise with partner agencies to keep this up to date.

6.62 Stakeholders believe there is a role for WPD in tackling wider social issues such as fuel poverty and WPD are uniquely placed to support customers due to the interaction we have with them and also the that fact that we do not directly bill customers. However, they state that we must not duplicate the responsibilities of other agencies, or deviate too far from our core responsibility to support people during power cuts.

7 Incentives

7.1 Incentives are a fundamental element of the RIIO regulatory framework. They are used to drive innovation and the delivery of outputs, rewarding DNOs that do well but also applying penalties for poor service. Incentive measures and monitoring of appropriate outputs is an important part of ensuring that the services that customers receive are delivered at an appropriate cost.

7.2 For a financial incentive to apply there needs to be:

- clarity of the output being incentivised;
- confidence in the data being used to assess the output;
- evidence that the output is important to customers;
- assurance that the output is not covered by other incentives or other obligations.

7.3 The following describes the incentives that we and our stakeholders believe should be active in the RIIO-ED1 period.

Interruptions Incentive Scheme (IIS)

7.4 Keeping the lights on is at the top of stakeholders requirements. IIS rewards outperformance (and penalises underperformance) against targets for the number of interruptions and the duration of those interruptions. Since its introduction, IIS has resulted in improvements to network performance and WPD's resource management, business processes and network investment have enabled WPD to outperform the targets.

Broad Measure of Customer Satisfaction (BMCS)

7.5 The BMCS quantifies customer views on the service level we provide and rewards outperformance. It incorporates general customer satisfaction, how complaints are resolved and the effectiveness of stakeholder engagement. Excellent customer service is a key WPD business objective and this incentive provides the opportunity for WPD to be rewarded for providing industry leading customer service. WPD is the best performing DNO group under BMCS.

Network Innovation Competition/Network Innovation Allowance (NIC/NIA)

7.6 Ofgem has proposed replacing the current Low Carbon Network Fund and Innovation Funding Incentive with the Network Innovation Competition and Network Innovation Allowance. Stakeholder feedback has highlighted the importance of innovation and preparation for a low carbon economy. This incentive allows innovation trials to be undertaken in preparation for larger scale rollouts as the use of the network changes.

Guaranteed Standards of Performance (GSOPs)

7.7 There are a range of GSOPs covering the provision of connections, supply interruptions and response to problems such as voltage complaints. They represent minimum levels of service and therefore where failures occur, customers are entitled to standard payments, set by Ofgem. WPD targets zero failures against the standards, and is the best performing DNO group under this incentive. However should a failure occur during RIIO-ED1, WPD will voluntarily double the value of each payment.

Time to Connect Incentive

7.8 Connection customers suggest that the time taken for a new connection is an important aspect of good customer service for them. The time to connect incentive combines the time to provide a quotation and, once the offer is accepted, the time to complete the works. Improving the overall time taken will provide customers with a better service.

Incentive on Connections Engagement (ICE)

7.9 Major connection customers have a requirement for more detailed interactions with DNOs. ICE will support the development of engagement strategies that will improve the information provided and service delivered. Delivery against these strategies will be assessed by Ofgem and where engagement is inadequate a penalty will be applied.

Information Quality Incentive (IQI)

7.10 The IQI drives DNOs to provide realistic cost forecasts for investment requirements and shares the benefit of underspending or penalty of overspending against those forecasts with customers. WPD has the best record of any DNO group for both forecasting accurately and for delivering the work promised. What the IQI incentive means is that where WPD can find more efficient ways of delivering work, there is a financial reward for the efficiency saving. Such savings also benefit customers as a proportion of the savings are returned to customers through lower DUoS charges.

Environmental incentives

7.11 Whilst the measurement of electrical losses is difficult, it is important that we continue to seek ways to reduce losses on the network. Ofgem will assess our actions during the RIIO-ED1 period and a discretionary reward is available. In addition, we will continue to report our business carbon footprint, which will be published in Ofgem's Electricity Distribution Annual Report.

8 Innovation

8.1 WPD has invested to develop more innovative ways of working and this has helped make us the best DNO for operational performance. We have improved efficiency in all areas of our work at least in part by making innovation part of our business as usual.

Our approach to innovation

8.2 The purpose of the development of new technology, techniques and working practices is to respond to customer needs, reduce the investment required in the network and improve customer service levels.

8.3 Our key goals of safety, network reliability, customer service, business efficiency, cost effectiveness and carbon reduction underpin the strategy for innovation.

8.4 We identify and test new ideas and when they are proven we adapt them as necessary to be deployed as "business as usual" solutions.

8.5 We deliver innovation through a small team of our own specialist staff that implement their work using our networks teams. The reporting arrangements for the innovation team set them within the core of the company's Policy department where they interact with the specifiers and technical experts. This close relationship allows ideas for innovation projects to be developed quickly into workable solutions.

Innovation to date

Customer service and commercial innovation

8.6 Customer service and commercial innovation improves business efficiency and the way we interact with our customers and other stakeholders. WPD has developed and adopted a significant number of innovative ideas including:

- working in partnership with RVS, British Red Cross and other organisations that can assist vulnerable customers;
- using 'ENMAC Mobile' that allows field staff to provide real-time job-status updates from hand held devices. These devices integrate real time with our customer service systems allowing our contact centre staff to have up to date information to pass on to our customers. The data is also used to automatically update our messaging provided to callers who do not wish to talk in person to a call taker;
- carrying out fuel poverty work with Warm Front and National Energy Action;
- establishing a broad Customer Panel that meets with the CEO every three months;
- self-quotation packs for simple service alterations allowing customers to quickly estimate an approximate cost and make informed decision about whether to make a formal request. Two benefits are derived: for the customer it provides a very quick process for obtaining an estimate to allow informed decisions; for WPD it reduces the volume of speculative requests for quotations and drives greater efficiency;
- calling customers back to keep them updated about supply interruptions and check that they are back on supply;
- introducing out-bound text messaging providing information about outages and restoration times for customers;
- providing empathy training for contact centre staff to improve their listening skills and know-how to deal with people suffering difficulty;
- 'ramping up' contact centre – we have trained general office staff specifically in the use of contact centre call taking systems. In the event of bad weather or storms we are able to increase the number of call takers significantly. This enables us to deal with high volumes during the periods of very bad weather but an efficient contact centre number during normal day to day work-loads;

- enabling staff to take calls from home by deploying contact centre systems in home locations. In addition to training general office staff to carry out contact centre activities, we also ensure that the levels of service can be maintained if staff are prevented from travelling to the office due to the severe weather or for business continuity (e.g. flu pandemic).

Technical and operational innovation

8.7 Our track record of network performance and cost efficiency has been built on our ability to find new ways of doing things. Some examples include using:

- mobile devices to control and manage high voltage switching operations. (We are the first DNO to do so). By using a hand held device innovatively we have reduced the volume of voice traffic to our control centres and increased productivity within our field teams. The handheld devices are in continuous communication with ENMAC, which means our operational status and customer messaging remain up to date in real time;
- technology from the gas industry to develop cable fault location equipment that detects the gas produced when a cable fails rather than only using the electrical characteristic of the cable. The new technology identifies the position of the fault more quickly, without the need for more specialist electrical testing. The accuracy of the method reduces the size and number of excavations required when repairing faults and reduces the inconvenience to customers;
- early innovation funding to complete the 'Registered Power Zone' (RPZ1) project. This project investigated the possibility of applying dynamic line ratings on the 132kV system. By using wind speed and temperature sensors the rating of the line can be calculated continuously. This allows additional load to be carried on a given conductor over and above its traditional rating where conditions allow - such as on cool windy days;
- network automation that quickly reconfigures networks when faults occur to allow as many customers as possible to have power restored before the fault is found and fixed.
- helicopter mounted thermal imaging for the detection of hot spots on overhead lines and in substations that shows where faults are likely to occur;
- mobile switchboards and high voltage generation for faster restoration of faulty equipment and quicker restoration of customer supplies;
- 'hot glove' techniques that allow certain overhead activities to be done live at 11kV reducing the need to turn off supplies to customers;
- our own fire engines to quickly deal with the pumping out of flooded sites;
- our in-house apprentice scheme, moving away from NVQ to reduce bureaucracy and allowing the quicker training of apprentices.

Environmental innovation

8.8 We have established effective environment processes that have been assessed against ISO 14001.

8.9 We have undertaken a number of innovation and other projects which have a direct impact on the environment such as:

- completing the 'Registered Power Zone' (RPZ1) project which investigated the possibility of applying dynamic line ratings on the 132kV system and applying the results in policy. The major benefit being that we can allow more LCTs to connect quickly and avoid significant reinforcement costs that would have applied under a traditional approach;
- the trialling of electric Transit vans and other small electric vehicles;
- refurbishing buildings to the highest BREEAM standards;
- using PFT tagging of fluid filled cables - this adds a special tracer element to the oil that can then be detected from above the ground, speeding up leak location and reducing the volume of oil lost into the environment.

Historic and current DPCR5 innovation funding within the UK

8.10 During DPCR4 (2005 to 2010) Ofgem set up the Innovation Funding Incentive. Its purpose was to improve the quality of research and development within the UK electricity industry.

8.11 During DPCR5, Ofgem introduced the Low Carbon Networks Fund (LCNF). This fund is designed to support the development of low carbon technologies and facilitate the changes required by the Government's Carbon Plan. In the RIIO-ED1 period the 'Network Innovation Allowance' and 'Network Innovation Competition' will replace the current funding schemes.

8.12 The Engineering and Physical Sciences Research Council and the Technology Strategy Board support innovation and we have already worked with them on various projects.

8.13 Within the Ofgem Low Carbon Networks Fund we are the most successful DNO group. Of the 16 larger projects awarded up to 2012 (Tier 2), WPD is running 5 (31%). Of the 31 smaller (Tier 1) projects, WPD is running 11 (35%).

Future plans for innovation funding

8.14 We will request a Network Innovation Allowance of 0.5% of total regulated revenue, approximately £55m throughout the period. We will also work with partners to provide innovative proposals for larger projects to be funded through the Network Innovation Competition. Together these projects will lead to investment of over £130m in innovation.

Drivers for innovation in RIIO-ED1 and beyond

8.15 We are striving to deliver ever higher levels of customer service whilst simultaneously improving the overall efficiency of our operations.

8.16 Innovation has always been a part of all areas of WPD's operations and we are now using our expertise to adapt the network to meet the needs of the Government's Carbon Plan.

8.17 The Carbon Plan includes scenarios which show the effect of the introduction of new technologies to reduce carbon emissions.

8.18 The Smart Grid Forum has refined the DECC scenarios to produce their report "Assessing the Impact of Low Carbon Technologies on Great Britain's Power Distribution Networks". This report sets out the areas of interest for the development of smart solutions which we are addressing in LCNF and Innovation Funding Initiative (IFI) projects.

8.19 The Carbon Plan and the smart meter roll out will change the way customers use the network. We cannot plan in isolation. We will use regular stakeholder engagement to make sure that our plans are consistent with our customers' changing needs.

8.20 The existing network is designed and built to serve one way power flows from centralised generation to end customers. The growth in distributed generation on the network is causing a move away from this and we will need to develop systems that can manage a variety of sources of generation and also allow for two way flows of power.

8.21 If large volumes of LCTs connect to the networks it will increase electricity demand and change the way networks are operated. There is uncertainty about where and how new technologies will be deployed and so we need to be able to react flexibly to how customers and generators need networks to operate.

8.22 In future, network design and operation will include elements of automatic network control and reconfiguration, flexible approaches to loading and capacity, local storage of energy, demand side management of overall load and flexible meshed networks.

Preparations for the future

8.23 The number and technical specification of new forms of generation and demand will become more certain over time. It is likely that certain products, like domestic DSR, will not be commonplace until the smart meter programme is completed in 2020. Electric vehicle usage will also increase as new widely affordable models become available and customers replace their petrol or diesel cars. Changes in Government incentives may alter the rate of take up or may introduce new applications.

8.24 During the development of these LCTs we will continue to deliver electricity to customers by constructing new network and reinforcing existing assets in response to known load increases and forecasts.

8.25 Where appropriate we will use simple solutions to reduce future costs e.g. installing devices that avoid the costs of having to change the assets again in the future when load changes.

8.26 Innovative preparations in the current review period include specifying low voltage distribution cabinets with higher class current transformers (CTs) fitted. These CTs provide greater accuracy and will allow us to be ready to monitor load if required. The additional cost of fitting the higher class CTs is very low (1.4% of the total cost of the cabinet) and, as at 2012, we are the only DNO making this preparation.

8.27 In a similar way, we specify that all of our 11kV distribution switchgear is pre-wired ready for remote actuators to be fitted. These actuators allow the switchgear to be operated from a remote location allowing us to increase or decrease load on parts of the network immediately in response to changing demands. Whilst the cost of actuators is high the cost of including pre-wiring is low (1.5% of the total cost).

8.28 Both of these initiatives have the added benefit of allowing us to return later to fit automation and monitoring equipment without having the need to interrupt customers or replace assets again.

8.29 Using socio-economic customer profiles data provided by the Centre for Sustainable Energy (CSE) we will identify areas on our network where the take up and clustering of LCTs is likely to create a load related problem on the network in the future.

8.30 Present information from the CSE shows that there is a forecast high uptake of LCTs on specific circuits that make up approximately 7% of our network.

8.31 This information will be incorporated within WPD planning systems allowing these LCT forecasts to be considered within the business when either customer driven load or generation requests have been received or when WPD asset replacement work is planned. This will enable informed decisions to be made with respect to the size of the replacement assets.

8.32 Where a high density of LCT connections is forecast there will be an opportunity to increase transformer or cable capacity whilst carrying out asset replacement. We estimate that this opportunity will occur at 95 sites and on 75km of cable. The additional costs are £0.11m and £0.3m per year respectively.

8.33 Taking the opportunity to oversize assets for a small incremental cost avoids the need to change transformers or lay bigger cables at a later date. This will save the future costs of £1m per year of changing transformers again and £5m per year on laying additional cable for a second time.

8.34 This targeted approach, where there is a high confidence of LCT clustering, will ensure that we only install larger capacity assets ahead of need where there is a strong likelihood that the higher capacity asset will be required in the future.

Identifying and delivering solutions from LCNF projects

8.35 To ensure that we learn as much as possible from each of the innovation projects we have assigned specific individuals as points of contact for the other DNOs and their suite of projects. These staff will make sure that we capture and apply learning from other DNOs and assimilate it, with our own learning, into business as usual.

8.36 The suite of LCNF Tier 2 projects will provide an excellent source of learning to help develop future networks and applications. The timescales of these projects mean that the majority of the learning and outcomes will be provided in the next few years and into the RIIO-ED1 period.

Rolling out the learning from innovation projects

8.37 We deliver innovation through an in-sourced model with a small team of specialists using the resources of our operational teams to deliver tools or products onto the network. The innovation team is part of the company's Policy department where they interact with equipment specifiers and technical experts of the wider business. Whilst the team is in-sourced, it provides the link to expertise outside of the company or industry.

8.38 Once trials are successfully completed, the outputs are taken forward and replicated across our network.

8.39 We monitor all the LCNF projects as they develop and make use of learning and outcomes as they are reported. An example of learning that we have used can be seen in our Tier 1 Community Energy Action project where we are using smart commercial agreements from UKPN's Flexible Plug and Play project rather than developing our own agreements.

8.40 Our RPZ1 project has developed a practical application for Dynamic Line Ratings (DLR) on our 132kV overhead lines. The project results have been embedded into business as usual and are documented in a dynamic line rating policy. On the circuit where the dynamic solution was developed, we have identified 19MVA of capacity that can be offered using DLR. This is a 20% increase on the static capacity values. Similar values will be achieved on circuits which are operated in a dynamic way.

Sharing our results

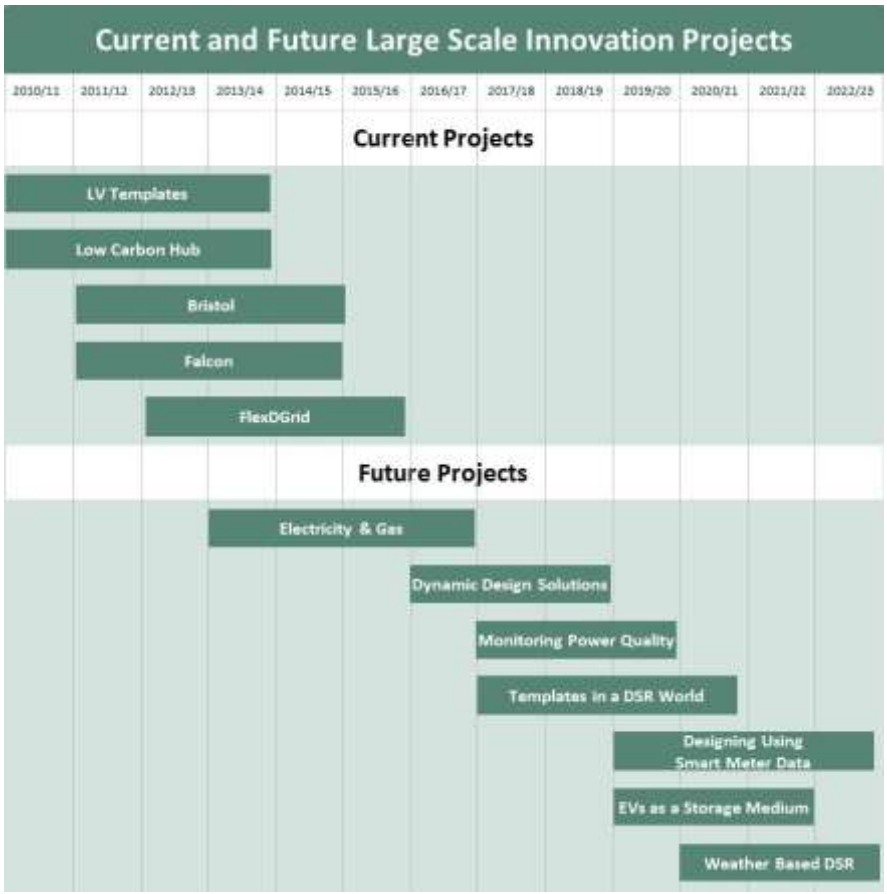
8.41 WPD has links with a wide range of universities and businesses, both in the UK and across the world. When we choose partners we look to find an organisation that has a unique capability for the work or project being undertaken. Some projects include technology that is not from within the electricity industry and in these cases partners who would not be obvious matches can provide us the best resource.

8.42 To maximise the effect of research and innovation we participate in industry wide groups, such as those developed with EA Technology. In everything we do it is important that we learn from others and do not waste time or resources duplicating effort on topics which are consistent across the industry.

8.43 A key feature of the LCNF is the requirement for us, in common with all other DNOs, to share our learning on the projects we are completing. The main annual event for knowledge sharing is the LCNF conference which we actively support. We were pleased to be able to host the very successful 2012 event in Cardiff.

8.44 Within each of our Tier 2 projects there is a requirement for individual knowledge sharing which is achieved by specific knowledge dissemination events. We have hosted events for individual projects and for our whole portfolio of projects. Often the most important thing that we can share from our projects is data and results. We have two dedicated websites where interested parties can find out information on our projects. The www.westernpowerinnovation.co.uk site gives details of all our projects and the results they are producing. The www.lowcarbonuk.com site is aimed more at the research community and provides more details of the data and results seen on the projects.

Our large scale innovation projects



Our current innovation projects

LV Templates

8.45 The electricity network was designed to carry power from large, centralised power stations and major grid infeed points to distant load centres in town and villages. Historic load profiling data for network design used this basic operating model.

8.46 The shift to distributed low carbon generation such as from wind or solar sources has already moved a significant amount of generation closer to the customer load. At the same time homes are being made more energy efficient through better insulation. These changes require an overhaul of the basic planning assumptions that have been used when assessing power flows and energy consumption.

8.47 The LV Templates project was use to evaluate how low voltage (LV) electricity networks can best accommodate the low carbon future.

8.48 In 2011, 951 substation sites in South Wales were fitted with data monitors and communication equipment. The project also required voltage monitors to be fitted at the ends of the LV circuits that are fed from these substations. This required over 3,500 monitors to be installed to collect the data and send it remotely back to WPD.

8.49 The project monitored energy usage and used statistical clustering techniques to identify more accurate patterns in electricity consumption. This allowed us to develop new planning assumptions and embed them in templates that can be used to facilitate more accurate network planning.

8.50 This project completed in 2013 and has shown that low voltage solar generation normally generates onto the network at around 80% of its rating. We are now altering our design assumptions to reflect this, which will increase the volume of PV generation which can be accepted onto the network.

8.51 We have also shown that voltage rise effects from PV are less than expected. Both these results will be used within the business and will influence national design policies and solar generation acceptance criteria.

8.52 We have already published network templates data making it available for all DNOs to use in planning LV network solutions. The final project reports in the autumn of 2013 provide full template data and conclusions.

8.53 We will use the results from the LV Templates project to change the way we design networks. We are initially implementing a templates based planning approach in South Wales that will make relevant changes to network planning tools. Once successful we will roll this out to our other licence areas.

8.54 The templates will allow us to better predict the effect of low voltage generation and load and ultimately enable us to accept more on to our existing network. We will also incorporate the learning from SSE's 'Thames Valley Vision' project in our implementation. Furthermore we will use more detailed weather and climate simulations to improve our understanding and adjust the templates accordingly. Scottish Power's (SP) 'Flexible Networks for Low Carbon Future' project will also provide additional knowledge on the acceptance of low voltage generation and the design of flexible ratings.

8.55 Although the project is formally closed we are continuing to collect data and process it under business as usual. This will allow us to identify demand profile changes as customers adopt LCTs and we will re-model the templates accordingly. The data collection and network monitoring infrastructure will also be used to support new innovation projects without the need to recreate a monitored network.

8.56 We have also published a discussion paper on the possibility of harmonising statutory voltage limits with those in the rest of the EU. The paper has been presented to industry groups including DECC, the Welsh Assembly Government and Ofgem. The consequences and benefits have also been debated at the ENA and with National Grid. We are now progressing the design of controlled trials within the South Wales area. Findings of several Electricity North West (ENW) projects will also help determine next steps.

Lincolnshire Low Carbon Hub

8.57 The Lincolnshire Low Carbon Hub has been designed to test a variety of new and innovative techniques for integrating additional low carbon generation onto electricity networks with limited capacity. The aim is to avoid the costs that would normally be associated with more conventional reinforcement.

8.58 We will offer Dynamic Line Rating solutions and Flexible Generation Capacity Agreements on this project. Both of these will improve the utilisation of our assets. The cost of connections and time to connect for generation customers will also reduce as a result of these initiatives.

8.59 The Lincolnshire Low Carbon Hub project will demonstrate how we can dynamically operate a network to accommodate additional generation. The project will make use of dynamic line ratings and voltage optimisation to alter the network running arrangements at 33kV. Electricity North West's (ENW's) 'Capacity to Customers' project will consult on changes to P2/6, and we expect their learning to also increase connected generation. We will develop the systems to achieve this using learning from our project and the ENW project. Both projects will be complete by the end of 2015 and we plan to deploy the solution to 11 identified sites between 2015 and 2018.

Project FALCON

8.60 Project FALCON is a £16m project focused on providing an understanding of the dynamic nature of utilisation of the 11kV network. FALCON aims to facilitate the installation of low carbon technologies by delivering faster and cheaper connections on the 11kV network.

8.61 It will be used to assess a number of alternative solutions to conventional network reinforcement. The project will develop modeling tools that use real-time data to inform network planning decisions, rather than traditional indicators such as total demand and generic engineering guidelines.

8.62 The FALCON telecommunications solution, based on mesh radio, will become our preferred standard for primary substation to distribution substation communications. It will be developed during RIIO-ED1 and will eventually replace the legacy analogue based systems.

8.63 The uptake of demand side response within the FALCON project is set to exceed the 9MW target. This will be achieved through a mix of bilateral contracts and services provided through aggregators. Uniquely, the service is being offered as complementary to the National Grid STOR service, meaning that customers can engage with us and National Grid at different times. We are currently working with the other DNOs and National Grid on a common framework.

8.64 The outcomes from the FALCON project will produce an energy modelling simulator that will be used to design and operate the network in a more efficient way. UKPN's 'Flexible Plug and Play' project will also deliver tools to design and operate to allow cheaper and quicker generator connections, and we will incorporate these tools in our design templates.

8.65 The network management functionality trialled in FALCON will be implemented into ENMAC, and the prototype system decommissioned. The new functionality will become available to implement across WPD networks from 2015, leading to the widespread rollout of load balancing automation schemes as loads grow with the increase in adoption of LCTs.

BRISTOL

8.66 The BRISTOL project aims to provide an innovative approach to operating networks utilising battery storage in a customer's premises. The battery will store output from PV generation and utilise it in many ways. A DC network for lighting and USB type charging, an inverter controlled by the customer and WPD, and new tariffs will help manage the PV generation locally.

8.67 The project will seek to address issues associated with the large-scale deployment of PV generation. The technologies will be implemented in ten schools, one office and thirty homes, all connected to 13 distribution substations.

8.68 The project is testing the coordination of a local micro-grid but has also provided an excellent storage and DC power test bed. The BRISTOL solution will not immediately be ready for rollout by DNOs; probably requiring further refinement and standardisation as a proportion of the installation is beyond the customer's meter. We are developing this work with Siemens, in association with Northern Powergrid.

FlexDGrid

8.69 The connection of generation to urban HV networks can lead to fault levels that exceed the design capability of existing networks. Traditionally higher capacity assets would need to be installed to enable the generation to connect.

8.70 The FlexDGrid project is based in Birmingham and seeks to explore the potential benefits from three complimentary methods:

- enhanced fault level assessment;
- real-time management of fault level;
- fault level mitigation technologies.

8.71 Recent forecasts by National Grid and the Energy Technologies Institute (ETI) point toward an increase in the use of combined heat and power (CHP) in urban areas. This increase in distributed generation will lead to higher fault levels in most of the larger cities in the WPD area during the latter part of RIIO-ED1.

8.72 Even though this project is less than 12 months old, it is already providing data which may change how we calculate fault level and allow us to accept more local generation and CHP onto our network. As this assessment work completes and reports, it will be used to alter design principles.

Our future plans for innovation projects

8.73 We have identified the areas we will explore and develop through the Network Innovation Competition up to the end of RIIO-ED1. Many are still at a conceptual stage and build upon anticipated learning from existing projects. The scope of each project will become clearer as current learning in WPD and other DNOs is revealed.

8.74 The 'Electricity and Gas' project was developed as our Tier 2 proposal for 2013. It was to investigate the use of hydrogen as a storage medium. There are parts of the network where there is more generation output than can be accommodated by the network. This means that the output of the generation has to be constrained, limiting the low carbon benefits of the generation capacity. Reinforcement of the network often requires the replacement of EHV or 132kV network at high cost.

8.75 This project sought to use the excess generation output to produce hydrogen which can either be used as fuel to produce electricity when the output from generation is lower or it can be injected as a source of additional gas into the local gas network. The project was not selected for funding in the 2013 LCNF competition. Discussions are now underway to review alternative approaches at a smaller scale and to identify an appropriate funding source for this cross energy sector project.

8.76 Our current methods of designing the network generally assume that the network will operate in a passive way. Our 'Dynamic Design Solutions' project will review and create new design solutions to be included in the standard options available to planners. This project will investigate how the existing planning design tools need to change and implement those changes.

8.77 The increased range of power electronics and distributed generation that we will see on our network is likely to have a detrimental effect on power quality. The 'Monitoring Power Quality' project will investigate ways of monitoring power quality to ensure that we understand their impact and develop techniques to continue to operate the network within power quality requirements.

8.78 'Templates in a DSR World' will build upon the existing LV Templates work. The project will refine the planning assumptions to accommodate the various combinations of demand side response and management that we will begin to see on our networks.

8.79 Through our 'Designing Using Smart Meter Data' project we will investigate how this data can be used to model, design and manage our network more effectively. We already plan to provide a geographically based dataset and this project will help develop the detail for that.

8.80 More electric vehicles are also likely to be used in the latter years of RIIO-ED1. 'EV as a Storage Medium' will investigate how electric vehicles can be used for energy storage when there is excess generation and used to release the stored energy at times of peak demand to smooth load profiles and potentially defer network reinforcement.

8.81 By the end of the RIIO-ED1 period we expect demand side response and management to be a key part of our network management processes. With this in place, additional weather data and forecasting tools will allow us to more proactively deploy DSR/DSM to smooth load profiles in response to weather conditions and our 'Weather Based DSR' project will develop appropriate design solutions to a variety of constraints.

Our plans for RIIO-ED2 and beyond

8.82 Future improvements to the communications network will bring additional benefits in the way that we can use LCTs to manage a more flexible electricity network by the beginning of RIIO-ED2. The bandwidth and reliability of communications will increase and the cost of bandwidth is expected to fall. Greater levels of network control from better communications will enable more specific and targeted management of the network.

8.83 By the end of RIIO-ED2 a significant number of the domestic LCTs installed during RIIO-ED1 will be coming to the end of their useful lives. Future generations of these technologies will provide additional services for customers and by working with manufacturers we will encourage the development of features that will also enhance our ability to manage the network.

9 Outputs

9.1 Outputs are what we deliver through our investment programmes, network management decisions and customer service initiatives.

9.2 Stakeholder engagement has refined the outputs WPD will deliver for the eight years of RIIO-ED1.

9.3 Outputs have been defined in each of the six categories of the regulatory RIIO-ED1 framework and their main objectives are described below:

- **Safety** – minimise the safety risks associated with operating the network;
- **Reliability** – maintain a reliable supply of electricity through a more resilient network;
- **Environment** – reduce WPD's own impact on the environment and facilitate lower carbon technology;
- **Connections** – provide an excellent service for customers connecting to the network;
- **Customer satisfaction** – provide excellent customer service;
- **Social obligations** – meet the needs of vulnerable customers.

9.4 The following sections provide a summary of the outputs that will be delivered.

Outputs – Safety

9.5 Safety is at the heart of everything we do and we will continue to target improvements in our overall safety performance.

9.6 The objective of safety outputs is to minimise the safety risks to people. During RIIO-ED1, we will deliver the following outputs:

Compliance with health and safety law

- Target zero improvement notices, prohibition notices and prosecutions from the Health and Safety Executive;
- Complete work programmes to achieve compliance with ESQCR statutory clearance to structures or the ground;
- Complete inspection and maintenance programmes every year.

Reducing accidents

- Reduce our overall accident frequency rate by 10%;
- Maintain our active participation in the ENA SHE 'Powering Improvement' initiatives that lead to improved safety performance;
- Work with our trade unions to enhance safety performance including the provision for additional 'Behavioural Safety' initiatives;
- Investigate all accidents involving members of the public, contractors or our own staff to ensure that learning points are quickly understood and communicated.

Substation security and theft of equipment

- Enhance security measures at higher risk substations sites to reduce the number of repeat break-ins.

Educating the public

- Organise and run over 1,000 school days to provide safety information to over 400,000 school children;
- Continue to publish literature on maintaining safety around electricity apparatus and send approximately 500,000 copies of this literature to targeted landowners, businesses or leisure operators.

Compliance with health and safety law

9.7 The Government seeks to promote the right safety behaviour of organisations and people through an extensive range of health and safety law. The Health and Safety Executive (HSE) has the responsibility of enforcing health and safety legislation and its inspectors work with the industry to prevent incidents.

9.8 We have created a strong safety culture throughout WPD and procedures will continue to be refined to improve upon the existing safety performance to minimise the need for intervention by the HSE.

9.9 We will ensure that assets are regularly inspected and maintained, in line with good asset management practice, carrying out appropriate remedial actions. In addition we will complete the work programmes to provide sufficient clearance between overhead lines and structures, and height above the ground.

9.10 We will work cooperatively with the HSE to ensure our practices and policies continue to be compliant with health and safety legislation but also to seek out and apply best practice in the management of safety.

Reducing accidents

9.11 Whilst the electricity distribution network and work upon it has many inherent hazards, the design standards, operational processes, working methods and bespoke training adopted by WPD minimise the risk of injury to staff, contractors and the public.

9.12 We will seek to reduce the overall accident frequency rate involving our own staff by 10%. This will be achieved by working with staff, trade unions and the industry to understand the causes of accidents.

9.13 Whilst incidents or accidents involving members of the public are rare when they do occur WPD will continue to quickly investigate the causes and ensure any appropriate action is undertaken without delay.

9.14 We will continue to work with Trade Unions and their appointed safety representatives within the business to ensure that industry best practices are shared and applied within WPD. We will look to further enhance the safety of our staff through additional training in the understanding of behavioural safety.

Substation security and theft of equipment

9.15 Increases in the value of metal have led to high levels of theft from the network. Long range forecasts suggest metal prices will remain high throughout RIIO-ED1. In addition to the potential for electricity supplies to be interrupted, intruders to substations often leave sites in a hazardous state potentially exposing members of the public to increased risks.

9.16 WPD has been proactive working with police forces to assist in crime prevention. We have provided guidance to improve the identification of recovered stolen materials. Furthermore we have facilitated meetings with neighbouring forces to ensure that intelligence is shared across police area boundaries.

9.17 Enhanced substation security measures will be installed at higher risk sites and incidents will continue to be investigated to minimise criminal acts against WPD.

Educating the public

9.18 School children are not always aware of the potential dangers of electricity or the electricity network. During RIIO-ED1 we will provide education sessions to 400,000 school children about the potential dangers of electricity via our on-going programme of school visits. These visits provide an opportunity to make children aware of the dangers, helping them to recognise overhead lines and substations and explaining what they should avoid doing near to electricity distribution equipment.

WPD will educate 400,000 school children about electrical safety and send out 500,000 safety books to targeted landowners, businesses or leisure operators to enhance their understanding.

9.19 Similarly, people engaged in work or taking part in recreational activities near network assets are usually focussed on what they are doing and can be unaware of the potential hazards around them. We will continue our practice of targeted mailshots of our safety literature. During RIIO-ED1 we will send out approximately 500,000 copies to specific landowners, businesses or leisure activity providers whose activities could be higher risk if undertaken near to our equipment.

Stakeholder views

9.20 WPD maintains regular contact with the HSE and is subject to periodic inspections. These interactions serve to identify areas where improvements can be made. WPD will respond to all observations to ensure that necessary corrective actions are taken.

9.21 Other stakeholders regard safety as a 'given' requirement and therefore it remains a high priority for the way that work is carried out and how WPD interacts with customers, landowners and other parties.

Outputs – Reliability and availability

9.22 The objectives of our network reliability and availability outputs are to deliver improvements in our performance so that our customers have fewer and shorter power cuts.

Network performance

- Improve network performance by the end of RIIO-ED1 so that on average customers will have 16% fewer power cuts and have their electricity supplies restored 23% quicker.
- Ensure that a minimum of 85% of customers have their power restored within an hour on HV faults.

Guaranteed Standards of Performance

- Reduce by 20% the number of customers experiencing a power cut lasting 12 hours or more.
- Target zero failures on all other GSOPs.

Worst served customers

- Reduce by 20% the number of customers classified as worst served.

Enhancing network resilience

- Apply flood defences to 75 substations, reducing the risk of both damage to equipment and power cuts due to flooding.
- Accelerate the programme of tree clearance for resilience by 40% with the objective to deliver the programme five years earlier than suggested by Government guidelines, clearing 700km of overhead line per annum.
- Enhance substation battery life to be resilient for 72 hours in the event of major power losses.

Network performance

9.23 Customers expect power to be available all the time with many household activities and business processes relying on electricity. As a low carbon future becomes reality there will be a greater requirement and reliance on electricity as a source of energy. This will mean that reliability and availability become even more important.

9.24 Since 2002, Ofgem has incentivised distribution companies to improve network performance through the Interruptions Incentive Scheme (IIS) where rewards are available for outperformance and penalties applied where targets are not met. IIS measures the average number of interruptions per 100 customers and the average length of time in minutes each customer is without power (it excludes power cuts that are under three minutes).

9.25 The measures can be subdivided into three main controllable factors:

- fault rate – the number of faults that occur;
- customers interrupted per fault – the average number of customers that go off supply when a fault occurs;
- duration of a fault – the average length of time it takes to restore supplies.

9.26 The number of faults is influenced by a range of activities (described under RIIO-ED1 as 'secondary deliverables'). During RIIO-ED1, we will:

- replace the assets where the assessment of condition and the assessment of consequence of failure creates the highest overall risk;
- reinforce the network using both smart and traditional solutions to provide enough network capacity to prevent assets overloading and failing;
- remove defective poles from the network within one year of being assessed as defective so as to prevent in-service failures (particularly during high winds, snow or icy conditions);

- complete 100% of the tree clearance programmes to reduce the likelihood of branches and windborne debris affecting overhead lines;
- complete maintenance programmes to ensure equipment will last for its expected life.

9.27 We will install more network protection and automatic network switching devices to reduce the number of customers affected by power cuts.

9.28 The duration of interruptions will be minimised through a clear business focus on restoring supplies quickly using technology, the effective deployment of resources and the installation of mobile generation.

9.29 As a result of these actions we will improve network performance for unplanned interruptions so that customers are on average interrupted for no more than 38 minutes (a reduction of 23%) and experience no more than 6 interruptions in ten years (a reduction of 16%). (Both reductions are set against the 2011/12 numbers verified by Ofgem).

On average, WPD customers will have their power restored 23% faster

Guaranteed Standards of Performance (GSOPs)

9.30 The Electricity (Standards of Performance) Regulations 2010 define the standards that companies are required to meet and the level of payments to customers for failures.

9.31 WPD is the best performing company for GSOPs.

9.32 The most significant change to the standards, for RIIO-ED1 will require a payment to customers when they have been off supply for more than 12 hours. This reduces the timescale from 18 hours, which has been in place since the standards were implemented.

9.33 This change will require DNOs to respond even more quickly to power cuts. WPD has already introduced internal key performance indicators (KPIs) as a result of the proposal in Ofgem's initial consultation document for RIIO-ED1. These KPIs will allow the business to develop the correct 'mind-set' and work towards meeting the new requirements by the start of RIIO-ED1. WPD proposes to reduce by 20% on average the number of customers experiencing interruptions lasting 12 hours or more when compared to DPCR5.

WPD will ensure that 20% fewer customers suffer long power cuts

9.34 WPD will continue to aim to never fail the other standards covering the following areas:

- response to failure of a fuse (EGS1);
- multiple interruptions (EGS2A);
- supply restoration during events affecting more than 5,000 customers (EGS2B);
- supplies affected by rota disconnections (EGS2C);
- supply restoration during severe weather (EGS11).

9.35 Whilst the payments for failures are defined in the regulations, WPD proposes to voluntarily double the amount paid to customers as a demonstration of commitment to them.

WPD will voluntarily double the value of payments made for Guaranteed Standard failures

Worst served customers

9.36 Ofgem defines worst served customers as those that regularly experience 12 or more higher voltage interruptions over a three year period. Often these customers are connected to remote parts of the network that are predominantly overhead.

9.37 In DPCR5, Ofgem introduced a new way of funding whereby a DNO could recover costs for improving service to worst served customers provided they could demonstrate that performance improvements had been achieved. The cost recovery was capped at £1,000 per customer.

9.38 WPD recognises the inconvenience of frequent power cuts and has invested to make improvements for worst served customers. Further improvements will be made during RIIO-ED1 to reduce the number of worst served customers by 20%.

WPD will reduce the number of worst served customers by 20%

Enhancing network resilience

9.39 Severe storms can cause network faults and lead to interruptions in supply for large numbers of customers. Restoring supplies can take a long time when resources are dealing with multiple incidents or complex issues.

9.40 In particular strong winds can lead to overhead lines being damaged by trees. Following storms in 2002 new legislation was introduced that requires DNOs to clear trees from lines to a resilient standard that prevents damage should a tree be blown over. The rate of resilience tree clearance will be accelerated by 40% to complete the programme five years earlier than had been planned in DPCR5.

9.41 Flooding can affect substations causing supplies to be interrupted to a wide area. The risk can be reduced by erecting temporary barriers in response to floods, constructing permanent barrier walls around the perimeter of sites or critical equipment, or installing equipment higher up on structures. We will protect an additional 75 sites that are at risk of flooding.

9.42 A number of 'blackouts' around the world have increased the concern about widespread interruptions, resulting from coincidence of events on the electricity system causing a 'cascade' of disconnections. Whilst the likelihood of such an event is low, we will ensure that battery systems for communication and operation of the equipment can last 72 hours; the length of time it is expected it will take to recover from a widespread interruption.

Stakeholder views

9.43 Stakeholders have provided a very strong view that they do not want network performance to deteriorate; keeping the lights on should remain the number one priority.

9.44 Initial stakeholder engagement, indicating that improvements are expected, was reinforced during Business Plan discussions where two thirds of stakeholders stated that reducing the number and average duration of power cuts should be a high priority. Over half agreed with WPD's proposals to reduce average frequency and duration of power cuts and a further 30% wanted even greater reductions.

9.45 Stakeholders have strongly requested a reduction in the duration of power cuts and therefore WPD will make further improvements to fault management processes and increase the use of mobile generation.

9.46 Stakeholders recognise that living in remote areas makes power cuts more likely and they support investment where it improves performance for customers receiving the poorest performance.

9.47 A number of high profile floods during 2012 made stakeholders more aware of the disturbance flooding can cause and therefore flood defences are becoming increasingly important to them.

9.48 Tree clearance to reduce the impact of storms was also supported by stakeholders, with half endorsing WPD's existing programme and over 40% wanting acceleration of the programme.

Outputs – Environment

9.49 Outputs for the environment can be subdivided into two broad categories: those that help increase the amount of low carbon technology connected to our network and those that reduce WPD's environmental impact. Each category is considered separately below.

Helping to increase the volumes of low carbon technologies (LCTs)

9.50 LCT related outputs are to facilitate the connection of low carbon generation and provide network capacity to accommodate the increased use of low carbon technologies. During RIIO-ED1 we will:

Facilitate increased volumes of low carbon technologies (LCTs)

- Improve the time to provide a response to customers wanting to use LCTs by 20%.
- Identify LCT hotspots using data from smart meters, expert organisations and local authorities and use this to inform decision making.
- Selectively carry out asset replacement using larger sized assets.
- Reduce costs for future customers by developing smart solutions to provide alternative and innovative techniques for network management.
- Provide additional network capacity through utilising traditional methods or smart intervention.

9.51 The Government has committed to undertake positive action on climate change by reducing the emission of greenhouse gasses.

9.52 For DNOs the major impact is in respect of the increasing number of LCTs used for electricity generation, transportation and heating for buildings. Part of WPD's role is to enable cost effective and timely connection of distributed generation (such as solar panels) and to provide sufficient capacity in the network to accommodate the increased loads from electric vehicle charging and heat pump domestic heating systems.

Provide a faster response to customers

9.53 The volume of LCTs connecting to the network is expected to grow significantly. We will improve the processing of requests during RIIO-ED1 to ensure a 20% reduction in response time. As current volumes are low we propose to establish a benchmark based upon the response provided in the last year of DPCR5.

Identification of LCT hotspots

9.54 DECC has published forecasts for the scale of uptake of LCTs that will require the distribution networks to increase capacity and be more operationally agile in order to deal with fluctuations in generation and demand.

9.55 We have used socio-economic information to predict where LCTs may connect and have then analysed the consequential impact on the network. During RIIO-ED1 we will continue to use expert organisations, information from local councils and data from smart meters to build up a better view of areas that become LCT hotspots i.e. those areas with a high probability of requiring additional capacity in the near future. We will develop a clear link to WPD network planning tools to ensure that the information is readily available for team planners dealing with future customer load enquiries.

Asset replacement using larger assets in LCT hotspots

9.56 When assets reach the end of their useful lives they are normally replaced on a like-for-like basis. In areas identified as LCT hotspots, it may be prudent to install larger capacity transformers to provide adequate capacity for load growth, especially where there is high confidence that the load will increase. This will provide a lower overall cost of running the network as it will avoid the need to reinforce assets again. We will use the information about LCT hotspots to selectively install larger assets during asset replacement work.

Development of smart solutions

9.57 Where demand increases do not coincide with assets reaching the end of their useful lives alternatives to the traditional approaches to reinforcing the network by installing larger capacity assets can be more appropriate and more cost effective. Smarter ways of operating the network and providing capacity are being researched, trialled and tested. WPD's existing extensive innovation programme will continue into RIIO-ED1 and new techniques will be adopted to become 'business as usual'.

WPD will develop smart solutions for providing network capacity

Network reinforcement using smart solutions

9.58 Future network development will incorporate both traditional and smart network reinforcement approaches. The solution used will be dependent upon the rate of load growth and the local circumstances. It will be chosen to ensure that adequate network capacity is provided to deal with LCT hotspots whilst minimising costs for future customers are minimised.

9.59 Dynamic Line Ratings for EHV overhead lines will be developed into WPD policy to apply across the whole business. This will result in more flexible arrangements with customers allowing the quicker connection of load or generation without the need for more traditional reinforcement – lowering costs and reducing the time to connect. This will mark the innovation's full implementation to become 'business as usual' in RIIO-ED1.

9.60 Analysis of real time customer load from our 'LV Templates' project will be applied to our planning and design tools. This will ensure that the understanding and knowledge from the project is actually applied as a business tool to improve the ability to connect LCTs.

9.61 Apply the knowledge gained from the Lincolnshire 33kV low carbon hub project across the whole business. This will allow us to control load flows on the 33kV network in conjunction with new commercial arrangements with generators and large customers avoiding the need for network reinforcement.

Stakeholder views

9.62 Whilst some stakeholders are sceptical about the scale of adoption of electric vehicles and heat pump heating systems, they acknowledge that significant changes can arise in a short period of time as has been illustrated by the rapid uptake of domestic solar panels.

9.63 Provided sufficient incentives are available, stakeholders generally believe that there will be an increase in LCTs which will have an impact on the networks and WPD will need to respond by accommodating these in a cost effective manner.

Reducing the overall impact of WPD operations on the environment

9.64 The second area of WPD's Environmental Outputs has the objective to reduce the impact of the WPD business operations on the environment by reducing greenhouse gas emissions, limiting pollution, improving waste management and improving visual amenity.

9.65 During RIIO-ED1 WPD will:

Reduce technical network losses

- Install larger sized transformers when replacing assets at highly loaded locations.
- Use larger sized cables when installing new network in LCT hotspots.

Reduce the carbon footprint of the business

- Ensure all replacement vehicles have lower CO_2 emissions than those they are replacing.
- Ensure all new or substantially refurbished buildings meet, as a minimum, the 'excellent' standard under the Building Research Establishment Environmental Assessment Method (BREEAM).
- Reduce the amount of residual waste sent to landfill by 20% over the first two years of RIIO-ED1. and 5% per annum thereafter.
- Reduce the carbon footprint of the business by 5%.

Reduce the environmental risk of leaks from equipment

- Reduce by 75% the volume of oil lost through leaks from oil filled cables.
- Reduce by 17% the volume of SF_6 gas that is lost from switchgear.
- Install effective oil containment 'bunds' around plant containing high volumes of oil.

Improve visual amenity in National Parks and Areas of Outstanding Natural Beauty (AONBs)

- Underground 55km of overhead lines in National Parks and AONBs.

Reduce technical network losses

9.66 When assets reach the end of their useful lives they are normally replaced on a like-for-like basis. We will utilise additional information from our innovation projects and the new data to be provided following the installation of smart meters to identify heavily loaded distribution sites.

9.67 At these sites it may be appropriate to install larger transformers or an alternative cable size and we will consider the electrical losses on our equipment before deciding on the most appropriate replacement.

Reduce the carbon footprint of the business

9.68 Our business can also have an adverse impact on the environment and, as a minimum, we ensure that it meets legal obligations. Wherever possible we aim to exceed those requirements and seek to adopt best practice where legal requirements do not exist.

9.69 The network is spread over an area of 55,500km^2 and consequently we need to operate a significant fleet of vehicles to allow our staff to serve this territory effectively. When our vehicles reach the end of their useful lives they are replaced with modern vehicles. We always ensure that the opportunity is taken to replace them with more fuel efficient engines. Having already trialled electric commercial vehicles for some time, the use of electric vehicles will also be considered where they are available and can be deployed effectively. The cumulative effect of this fleet replacement is a progressive reduction in carbon and gas emissions.

9.70 In addition, we will provide driver training to staff to teach them how to adopt driving techniques that will reduce fuel consumption with the consequent lowering of carbon emissions and noxious exhaust gases.

9.71 WPD operates from 59 offices and non-operation sites that vary in age and construction. There are opportunities to refurbish some buildings and improve their energy efficiency. When building refurbishment takes place it will be carried out to the 'excellent' standard under the Building Research Establishment Environmental Assessment Method (BREEAM) to reduce energy consumption where appropriate and effective to do so.

9.72 WPD's business activities create waste. Many of the items can be recycled and therefore WPD has, for a number of years, segregated waste to limit the amount being sent to landfill. During RIIO-ED1 further efforts will be made to reduce the amount of residual waste being sent to landfill by 20% over the first two years and 5% per annum thereafter.

Reducing the environmental risk of leaks from equipment

9.73 Older types of higher voltage cables (33kV and above) contain oil based fluids to assist in the insulation and cooling of the cables. During RIIO-ED1 the cables with the highest leak rates, caused by poor condition, will be replaced. In addition, a chemical tracer tagging system will be applied to all cables with a history of leaks to speed up the location of leaks. Together this will reduce the volume of oil escaping and affecting the environment by 75%.

9.74 SF_6 gas is used throughout the industry as an insulating medium in switchgear. Whilst it provides many benefits, it is a potent greenhouse gas. Since there are no current alternatives to SF_6, WPD will target the replacement of 1% of switchgear with highest leak rates to reduce the volume of SF_6 lost by 17%. We will also continue to engage with organisations that are looking to replace SF_6.

9.75 Large transformers and some items of switchgear contain large volumes of oil posing a risk of contamination should a leak arise. Containment walls or 'bunds' can be constructed around the equipment to prevent oil leaking into the environment. During RIIO-ED1 all 33kV transformers and above and any bulk storage sites (in excess of 1,500 litres) will have an effective bund. This will require both new bunds to be established and for the refurbishment of existing bunds that are in poor condition.

Improving visual amenity

9.76 There are a number of National Parks and AONBs across the WPD geographical footprint containing iconic sites where the removal of WPD overhead lines would improve the visual amenity for both locals and tourists. During RIIO-ED1 WPD will continue to underground overhead lines, working with the National Parks and AONBs representatives to determine the lines that provide greatest amenity benefit.

WPD will underground 55km of overhead lines in National Parks and AONBs

Stakeholder views

9.77 The engagement process provided stakeholders with the opportunity to influence a range of different environmental activities.

9.78 Stakeholders were presented with different options for the replacement of leaking oil filled cables and SF_6 insulated switchgear. Whilst there was a spread of preferences, the majority favoured the removal of the worst 1% as this gave a balance between addressing the assets with the highest leak rates and value for money.

9.79 Proposals to underground overhead lines in National Parks and AONBs received a mixed response with initial engagement stages placing a high priority on increasing this activity. During further consultation on the Business Plan an alternative view was proposed that less should be done. 60% of stakeholders stated this should not be a high priority.

Outputs – Connections

9.80 Customers who require a new electricity supply need to obtain a new connection to the network. This includes all demand connections (customers who use electricity), generation connections (customers who generate electricity and may need to export it into the network) and unmetered connections (customers with equipment that does not have its own meter - such as street lighting) that are covered by the Guaranteed Standards of Performance.

9.81 The objective of connections outputs is to provide an excellent service for customers connecting to the network whilst facilitating competition in the connections market. During RIIO-ED1 we will:

Provide a faster and more efficient connections service

- Improve the overall time to deliver a connection by 20%.
- Provide excellent customer service so that customers rank WPD as the top performing DNO group in customer satisfaction surveys.
- Conduct surveys with distributed generation customers to gauge their satisfaction and identify improvements to the service provided.

Improve communication with customers

- Develop and enhance online connections processing and progress tracking.
- Ensure information provided in documentation and online is effective.

Enhance engagement with major connections customers

- Work with major customers to identify where processes can be improved and quickly implement changes.
- Host quarterly 'surgeries' for connection customers to better understand processes.

Guaranteed Standards of Performance (GSOPs)

- Target zero failures of the connection GSOPs.

Facilitation of competitive market

- Improve customer awareness of third party connection providers and carry out regular checks with customers that they understand the options available to them.
- Work with third party connection providers to extend the scope of contestable work to HV and reinforcement work.

Provide a faster and more efficient connections service

9.82 The overall time to deliver a connection is a combination of the time to provide a quotation (the time to quote) and, once the offer is accepted, the time taken to construct the connection. We will assess and refine our processes, incorporating feedback from customers, to improve the overall time by 20%. Whilst the Ofgem decision document states that the new overall time to deliver a connection will only apply to certain categories of connection (small developments of typically 1-4 properties), WPD will apply this measure across all market segments.

9.83 Customer satisfaction is important and we will improve interactions with customers so that customers rank WPD as the top performing DNO group. We will extend the surveys to distributed generation (DG) customers so that we can monitor the performance and ensure we deliver high levels of customer satisfaction.

Improve communication with customers

9.84 Customers seeking a connection require clear information on their options, the process for connection and what they need to do. This information is provided in leaflets, online via our website, by customers making telephone contact with contact centre staff or by direct contact with locally based planners. The amount of information required by customers differs depending on the complexity of the connection and the knowledge of the customer. It can range from simplified process explanations to provision of detailed network parameters.

9.85 The information provided in leaflets and online will be regularly reviewed and updated to ensure it reflects improvements to business processes and incorporates feedback from customers.

9.86 Some customers have indicated they prefer to carry out transactions and track progress online. The scope of online tracking will be enhanced and new facilities provided in response to customer feedback.

9.87 Where necessary, planners will visit customers on site to discuss requirements in more detail.

Enhance engagement with majorconnection customers

9.88 Major connection customers (generally large developers, DG customers and multiple site developers) have a wide range of requirements for their connections and the connection arrangements can be complicated. Whilst generic information is available, these customers usually require additional details and a more interactive communications process.

9.89 WPD will carry out dedicated engagement with these customers to understand where improvements can be made to information provision, communication processes and work delivery interaction.

WPD will improve processes as a result of dedicated engagement with major customers

9.90 We also propose to extend the use of local 'surgeries' where connection customers can attend events hosted at local offices to learn about the connections process, discuss issues and meet the WPD staff they interact with. We will do this ahead of the start of RIIO-ED1.

9.91 To keep major connections customers informed, we will publish an agreed plan of action and any changes resulting from the engagement.

Guaranteed Standards of Performance

9.92 The final proposals for DPCR5 introduced new standards to establish minimum levels of service and the level of compensation to customers where these are not met.

9.93 WPD targets zero failures against all the standards, but in the event of a failure will voluntarily double the value of payments to customers. This acts a strong incentive for the business to provide the necessary level of service.

Facilitation of competitive market

9.94 Providing choice for customers drives companies to improve service and become more efficient.

9.95 Prior to the introduction of competition for the provision of connections, customers could only request a connection from the incumbent DNO. Customers now have the choice of two alternatives: Independent Connection Providers (who construct the network and pass on ownership of that network to WPD) or Independent Distribution Network Operators (who construct the network and retain ownership and operation of that network). We will continue to promote competition and identify opportunities to inform customers that they have this choice and an annual survey will be used to gauge the level of customer awareness.

9.96 Whilst third parties can provide new connections, they cannot carry out all aspects of connections work. WPD has been actively assisting competition, developing new processes and systems to allow third parties to extend the scope of what they can do. We anticipate that this will soon include interconnection to, and reinforcement of, the existing HV network. Further extension will be considered in response to the requests from third party connection providers.

9.97 We will ensure that all improvements made to connections processes and timescales apply equally to the service provided to third party connection providers.

Stakeholder views

9.98 Whilst many customers are happy with the service that WPD provides and we currently have the highest satisfaction in the industry for our connections service, customers have also given us clear feedback that this is an area where we can still do better. In particular, some customers perceive the overall process to be slow and communication sometimes difficult. Initial stakeholder engagement supported this view with stakeholders asking for the process to be made quicker and clearer, and placing a high priority on these improvements.

9.99 When options were presented to stakeholders to improve or maintain our performance with respect to the overall time to connect, connections customers were in favour of improvements; 43% of business customers and 40% of developers/connections customers wanted improvements. The option to improve by 20% gained most support amongst these customers with a direct experience of applying for a connection, although there was little support to see costs increase to the customer for doing so. Other general stakeholders were firmly of the view that any possible cost increases should be borne by the connection customers only.

9.100 Whilst many connection stakeholders would like improvements to the overall time it takes to connect, this is not always the most critical requirement. Some major customers stress that the important aspect is to have a timely connection where work is coordinated with the development. This requires good communication and co-operation between the developers and WPD.

9.101 Stakeholders were also consulted on how communication should be improved. They overwhelmingly supported the introduction of a web based self-service system to make enquiries, submit applications, process payments and track the progress of projects online. Stakeholders dismissed the provision of a single local point of contact, suggesting that it would introduce an additional person in the chain, delaying communication between the customer and the appropriate WPD contact. They also showed little support for the introduction of a dedicated contact number for more knowledgeable first contact, preferring to be put through to the local team that would be doing the work.

Outputs – Customer satisfaction

9.103 The provision of excellent customer service for WPD's 7.8 million customers is a core business objective. During RIIO-ED1, we will:

Customer service
- Continue to be the number one performing DNO group across all elements of the Broad Measure of Customer Satisfaction.
- Maintain certification to the Customer Service Excellence standard.

Telephone response
- Respond to telephone calls quickly, answering them within 2 seconds.
- Ensure abandoned calls are less than 1%.
- Always provide customers with the option to talk to a WPD call taker.

Communication with customers
- Provide a restoration time for every outage.
- Call back all customers who have been in contact about a fault.
- Contact customers within two days of receiving a non-fault enquiry.
- Provide on demand messaging via text and social media for customers who want be kept informed by means other than the telephone.
- Develop 'self-service' options for customers to find information online.

Stakeholder engagement
- Continue to host a Customer Panel where the CEO will meet with WPD's expert stakeholders four times a year.
- Continue to host an annual round of 6 stakeholder workshops.
- Continue to produce a stakeholder report every year providing an update of actions taken as a result of stakeholder engagement.

Complaints
- Resolve at least 70% of complaints within one day.
- Continue to have a target of zero complaints where the Ombudsman has to get involved.

Guaranteed Standards of Performance (GSOPs) awareness
- Continue to send the 'Power for Life' publication to all 7.8 million customers which will include promotion of the GSOPs.

Customer service

9.104 WPD consistently achieves excellent levels of customer service that are reflected across all elements of the Broad Measure of Customer Satisfaction. During RIIO-ED1, we will continue to refine and improve the processes and practices for customer service to maintain industry leading performance.

WPD will continue to be the No1 DNO group for customer service

9.105 The Customer Service Excellence standard is a Government scheme which recognises organisations that provide effective and excellent customer service. WPD has been accredited to the standard since 1992 (when it was known as the Charter Mark) and we will continue to assess the service provided against this standard.

Telephone response

9.106 Allowing customers to speak to someone is an essential part of good customer service and we are proud of the telephone response that we already provide.

9.107 We will continue to operate highly efficient Contact Centres using the latest technology to provide automated messaging for power loss in addition to well trained staff to talk to customers who wish to speak to us in person. We will answer calls within two seconds and have the lowest number of abandoned calls.

Communication with customers

9.108 When supplies are interrupted, customers welcome good information about when they will be back on supply. WPD will provide a restoration time for every outage, using progress updates from field staff to provide best estimates.

9.109 All customers contacting WPD about a fault will receive a call back to provide progress updates or check that supplies are restored and gain feedback on the service provided. This will provide useful information for further service improvements.

9.110 Customers asking for action from us will be contacted by a local team member within two days of receiving the request.

9.111 Some customers want to be kept informed about what is happening on the network. We will provide messaging via text and social media to send information to customers who have asked to be kept informed. We will also enhance the 'self-service' capability of the WPD website to allow customers searching for network outage information to find it quickly and in an easy to use format.

Stakeholder engagement

9.112 Regular stakeholder engagement is used to improve day-to-day operations and inform business priorities. WPD has over 4,500 active stakeholder contacts, categorised into customer segments, allowing targeted engagement on specific issues. Engagement occurs throughout the business but there are specific events dedicated to stakeholder engagement.

9.113 Every quarter, WPD's CEO meets with an expert Customer Panel to shape our thinking and future priorities. In addition, there are at least six stakeholder workshops held every year where key themes and investment priorities are tested and discussed with a wider audience.

WPD's CEO to meet Customer Panel four times a year

9.114 These events provide very useful feedback and will continue during RIIO-ED1.

Complaints

9.115 Whilst WPD endeavours to get things right first time, sometimes things can go wrong. When complaints are received they are treated with urgency and with an aim to resolve the matter to the customer's satisfaction quickly. Local team managers are responsible for dealing with complaints, visiting customers where necessary to understand what can be done to put things right.

9.116 WPD will resolve at least 70% of complaints within one day and ensure that the response provided to all complaints result in the lowest number (across the industry) being investigated by the Ombudsman.

GSOPs awareness

9.117 GSOPs provide a means for individual customers to receive compensation payments when performance fails to meet the standards. They cover the provision of connections, supply interruptions and response to problems such as voltage complaints. WPD performs well across all categories and the number of failures is very low.

9.118 In the event of a failure WPD will voluntarily double the value of payments to customers. This will act a strong incentive for the business to provide the necessary level of service.

9.119 Every year, we will publicise the GSOPs in WPD's 'Power for Life' publication that is posted to all 7.8 million customers.

Stakeholder views

9.120 Traditionally customers have either written or called on the telephone, but advances in technology mean that there are more direct communication methods available online; via e-mail, text or social media. Part of the stakeholder engagement was used to explore which additional communication methods should be utilised in RIIO-ED1. Stakeholders suggested that many organisations, including local authorities, are using alternative technology and that multi-media communications should be available. They also stressed that this should be implemented quickly and at no extra cost to customers. WPD has therefore responded and will implement a number of changes during DPCR5 including the introduction of two way texting, online data systems and the use of social media.

9.121 Stakeholders have informed WPD that they believe that the values of Guaranteed Standard payments are too low to cover the impact of the failures. The payments were never intended to cover consequential loss and this position remains unchanged. However, since customers find that they have been inconvenienced when failures occur, WPD proposes to voluntarily double the value of the payments made.

Outputs – Social obligations

9.123 The objective of WPD's social obligation outputs is to improve the accuracy of information held about vulnerable customers and improve the services provided through partnership working. During RIIO-ED1, we will deliver the following social obligation related outputs:

Improving understanding of vulnerability

- Work with expert partners to improve understanding of the needs of vulnerable customers.
- Train staff to recognise the signs of vulnerability.

Improve the data held on the Priority Services Register

- Proactively contact vulnerable customers at least once every two years to check the details on the Priority Service Register.
- Improve the quality of Priority Services Register data by working with other agencies and sharing information.
- Co-ordinate meetings with suppliers to agree criteria for vulnerability.

Improve the services provided for vulnerable customers

- Raise awareness of the Priority Service Register.
- Make 10,000 crisis packs available.
- Contact all medically dependent customers every three hours during power cuts.
- Continue to provide practical support via the Royal Voluntary Service (RVS)and British Red Cross.
- Seek feedback from vulnerable customers to improve service.
- Develop mechanisms for sharing information with local resilience forums.

Address fuel poverty by supporting customers to access key information

- Build a database of regional agencies we can refer customers to for assistance.
- Work with partners to develop links to/from WPD's website.
- Develop joint information, awareness campaigns and co-ordinated assistance with partners.
- Provide bespoke training to WPD front line staff.
- Use data analysis to help identify localities with high concentration of vulnerable households.
- Develop local outreach services.

WPD's Vulnerable Customer Strategy

9.124 Since 2005 WPD's partnership approach to vulnerable customers has been recognised as best practice by Ofgem's Customer Service Reward and the Government's Customer Service Excellence accreditation.

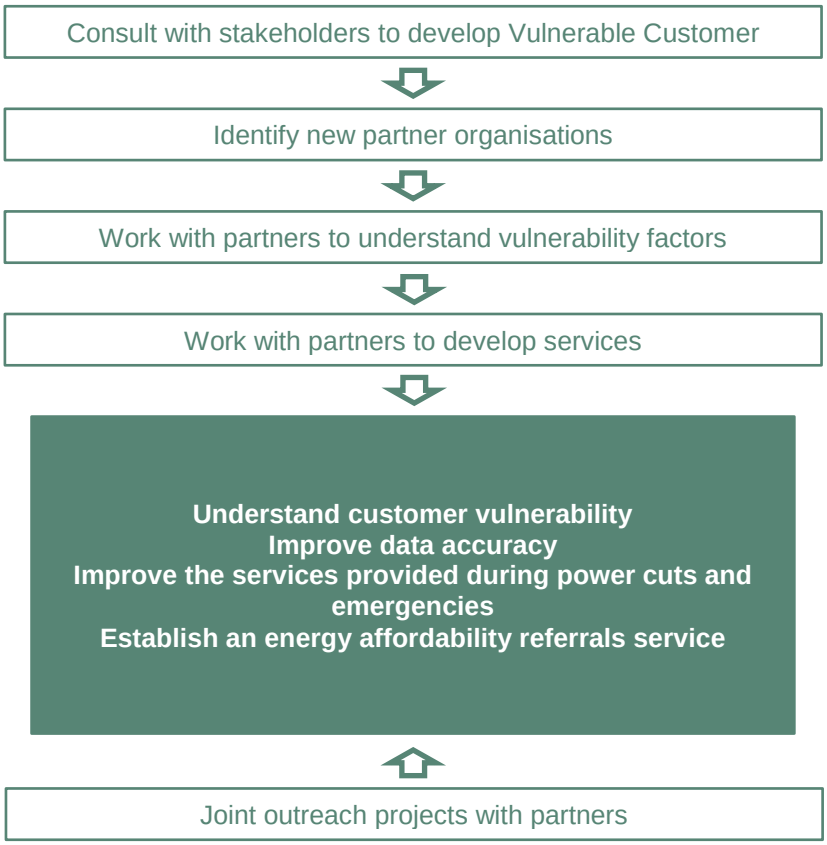
9.125 During this time, WPD's approach to service provision has been focused on customers on the Priority Services Register (PSR) who are registered as being dependent on electricity due to age, disability or chronic illness.

9.126 Going forward, WPD will focus on social obligations in relation to a broader group of customers who are defined as vulnerable for a range of reasons, including energy affordability. In order to respond to the needs of these customers, WPD has consulted stakeholders on new approaches to vulnerability.

9.127 Our Vulnerable Customer Strategy will achieve the following objectives;

- understand the nature of vulnerability and customer need;
- improve the accuracy of our records with respect to vulnerable customers;
- improve the services provided to vulnerable customers during power cuts and emergencies;
- refer customers to partners that can assist with energy affordability matters.

9.128 The following diagram shows the main elements of the WPD Vulnerable Customer Strategy:



Improving understanding of vulnerability

9.129 WPD will adopt the British Standard on Inclusive Service Provision (BS 18477:2010) to provide a framework for developing our understanding of vulnerable customers. This standard states: "*Consumer vulnerability is relative and dynamic, and a consumer's needs and abilities can change with time or circumstance*".

9.130 We will build a network of partners who can provide an insight into our understanding of vulnerability factors to help us to determine the needs of these customers and work with us on new initiatives.

9.131 It is important that appropriate staff are trained to recognise vulnerable customers so that they can provide the appropriate services.

9.132 We will work with partners to develop bespoke communication and listening skills training for front line Contact Centre staff to enable them to identify key warning signs of vulnerability. This will include recognising signs of disability, illness, age and fuel poverty.

Improve the data held on the Priority Services Register

9.133 WPD maintains a Priority Services Register (PSR) that records details about vulnerable customers so that additional support can be provided when the customers contact WPD or when their supply is interrupted. Approximately 715,000 customers are on the PSR across our four licenced areas which equates to almost 10% of our customer base. Over 165,000 customers are registered for medical dependency on power or for special communication needs.

9.134 Customers are added to the PSR mainly via data flows from suppliers. WPD will coordinate meetings with suppliers to agree criteria for vulnerability so that customers are treated appropriately.

9.135 Circumstances can change and therefore the details held on the PSR can become out of date. The main opportunity to check the accuracy of existing records is presently during a power cut and since these can be infrequent, inaccuracies in the PSR can result over time.

9.136 WPD will establish a dedicated team of people to proactively contact customers and check the details we hold about them. This is a process that will be repeated every two years to ensure that the register remains up-to-date and we can give the right support when required. This will be supplemented by sharing data with other service centred organisations that hold information about vulnerable customers, provided customers give their consent and data protection allows.

WPD will contact vulnerable customers every two years

Improve the services provided for vulnerable customers

9.137 Links have been established with many organisations such as the RVS and British Red Cross to improve the understanding of the needs of vulnerable customers. These partners work with WPD to improve the services that are provided and we will continue to work with them during RIIO-ED1.

9.138 Help will be provided for vulnerable customers during power cuts and where possible advice will be provided to enable them to be prepared should a power cut occur.

9.139 In addition, 10,000 'crisis packs' containing a blanket, torch and other useful items will be made available to agencies and WPD staff to hand out to vulnerable customers during power cuts.

9.140 We will build on existing relationships with local resilience forums to share information on support for vulnerable customers when extreme events, such as widespread flooding, occur.

Address fuel poverty by supporting customers to access key information

9.141 Some customers on low incomes cannot afford to use electricity to effectively heat their properties. There is growing concern that customers will suffer as economic growth remains low and austerity measures affect fuel poor customers further. Whilst WPD does not have a direct obligation to provide energy efficiency advice we are already working with the charity National Energy Action (NEA) to provide information on the causes of and solutions for fuel poverty.

9.142 We will seek to establish more partnerships to build a referral framework and provide links to websites and information.

9.143 Front line staff will receive bespoke training, developed with our partners to allow them to identify the key warning signs of fuel poverty and refer customers to appropriate organisations that can help.

Stakeholder views

9.144 Stakeholders state that WPD has a key responsibility to continue to support vulnerable people, by providing practical support during power cuts and more proactive preparation advice and information in advance of an interruption. Expanding our current support services and increasing the amount of information provided to customers, gained strong support.

9.145 Taking steps to improve the data held on the PSR was seen as a fundamental step to enable WPD to expand the support services offered to vulnerable customers. As well as working with energy suppliers and other utility providers to improve data-sharing, stakeholders would like WPD to take greater ownership for updating and cleansing the data on the PSR. Stakeholders strongly supported WPD's proposals to establish a team within our contact centre to proactively contact customers to update their records and gain a fuller understanding of their needs, including a commitment to contact PSR customers as a minimum once every two years.

9.146 Stakeholders supported WPD's proposals to contact known vulnerable customers every four hours during power cuts, but challenged WPD to shorten these timescale for customers with the most critical dependencies on electricity for medical reasons (e.g. heart and lung machine or kidney dialysis users), especially for power cuts occurring outside of daylight hours.

9.147 Stakeholders would like to see the continuation of partnership working and an increased number of trial initiatives and community-outreach projects, with the three-fold purpose of:

- making sure people are more prepared for the possibility of a power cut;
- improving and tailoring the support offered during power cuts;
- facilitating access to key information in order to combat the causes of fuel poverty and provide practical assistance to those customers in need.

9.148 The common consensus is that there is a role for WPD in helping to tackle fuel poverty and that we are uniquely placed to support customers through the types of interaction we have and the fact that we do not directly bill customers. Stakeholders stressed that WPD must not run the risk of duplicating the services already offered by specific support organisations and charities, and should not directly deliver energy efficiency measures. They stated that WPD should offer a referral service to help customers to access practical support and advice. The key actions for achieving this are the provision of specialist training to customer-facing staff to help them pick up on the warning signs of fuel poverty and building and maintaining a framework of regional support agencies that can handle referrals from WPD.

10 Expenditure

10.1 This section describes the forecast expenditure that is funded through DUoS. It includes:

- the core investment on the networks and business support activities that make this possible;
- other business costs such as business rates and licence fees.

10.2 More detailed discussion of our expenditure plans in included in the Supplementary Annex SA-05, Expenditure, and a description of how the costs were justified is included in Supplementary Annex SA-08, Business performance, efficiency and benchmarking.

10.3 Costs incurred on network related activities that are funded by third parties are excluded.

10.4 Summary expenditure is presented in tabular form (rounded to one decimal place). Descriptions for each investment area describe the main drivers of expenditure requirements.

Summary

10.5 In total £9.18bn will be required to be funded through DUoS. £6.25bn for core expenditure and £2.93bn on other costs.

10.6 The costs in the following sections are presented at 2012/13 prices. Core investment costs are shown net of any customer contributions, including future efficiency savings and excluding real price effects (RPEs) and pensions.

10.7 The cost of pensions and RPEs are shown separately as 'Other expenditure within the Price Control funded through DUoS'. A description of pension costs is included in Supplementary Annex SA-07 Financing the plan.

10.8 The elements of the core expenditure are shown in the table below:

Core expenditure funded through DUoS (£m)					
	West Midlands	East Midlands	South Wales	South West	Total
Reinforcement of the network	198.0	267.2	48.6	84.7	**598.5**
Non-load network investment	664.2	587.3	396.9	575.1	**2,223.5**
Network operating costs	355.0	370.9	194.1	304.9	**1,224.9**
Engineering management	288.6	290.8	147.9	214.5	**941.8**
Corporate activities	87.0	83.2	47.3	75.8	**293.3**
Workforce renewal	47.7	47.7	35.6	46.9	**177.9**
Vehicles, IT, property & engineering equipment	237.2	233.1	120.3	201.9	**792.5**
Total	**1,877.7**	**1,880.2**	**990.7**	**1,503.8**	**6,252.4**

10.9 Other expenditure within the price control funded through DUoS is shown in the following table:

Other expenditure within the price control funded through DUoS (£m)					
	West Midlands	East Midlands	South Wales	South West	Total
Real price effects	142.0	140.8	71.4	112.0	**466.2**
Smart metering	16.1	16.9	7.7	11.4	**52.1**
Rates	276.0	362.7	144.8	146.4	**929.9**
Licence fees	9.6	10.4	4.0	6.4	**30.4**
Normal pension contributions	84.7	84.5	62.3	98.8	**330.3**
Deficit pension contributions	165.7	163.3	172.9	281.3	**783.1**
Transmission exit charges	107.9	92.7	68.7	71.6	**340.9**
Carbon reduction commitments	0.8	0.8	0.8	0.8	**3.2**
Miscellaneous	-1.8	-0.1	-2.3	-0.5	**-4.7**
Total*	**801.0**	**872.0**	**530.3**	**728.2**	**2,931.4**

* Financing costs and tax is not included

10.10 The following pages provide a more detailed breakdown of the core expenditure for WPD as a whole and for each licence area.

WPD Total - Core costs funded through DUoS											
Costs excluding RPEs & pensions, including efficiency (£m at 2012/13 prices)	**Average per year in DPCR5**	**Average per year in RIIO-ED1**	**Spend profile in RIIO ED1**								**Total RIIO-ED1**
			2015/16	**2016/17**	**2017/18**	**2018/19**	**2019/20**	**2020/21**	**2021/22**	**2022/23**	
Customer Related Reinforcement	-7.5	6.5	6.0	5.9	6.2	6.6	6.7	6.7	6.8	7.1	52.0
General Network Reinforcement	53.4	43.4	69.9	64.6	36.6	46.8	36.9	31.8	35.4	25.5	347.5
Reinforcement for Low Carbon Technologies	0.0	24.9	4.7	4.7	9.3	18.3	27.3	36.2	45.0	53.6	199.0
TOTAL - Reinforcement of the Network	**45.9**	**74.8**	**80.6**	**75.2**	**52.1**	**71.7**	**70.9**	**74.7**	**87.2**	**86.2**	**598.5**
Asset Replacement	192.4	202.6	203.6	204.4	202.5	203.4	202.7	202.2	201.8	200.2	1620.8
Diversions	25.6	39.2	53.6	52.0	37.2	37.5	28.5	32.9	33.4	38.4	313.5
Quality of Supply (reducing power cuts)	12.6	3.7	5.1	5.1	5.0	4.9	4.9	4.9	0.0	0.0	29.9
Improving service for remote ("worst served") customers	0.3	0.4	0.0	1.6	1.6	0.0	0.0	0.0	0.0	0.0	3.2
Real Time Control Systems and Telecommunications	14.1	12.0	18.9	11.5	24.0	12.5	6.3	8.6	3.6	10.6	96.0
Protecting equipment from flooding risk	4.2	1.9	5.0	4.0	2.3	0.4	0.7	1.3	0.5	0.7	14.9
Enhancing site security, ESQCR and other legal requirements	18.4	11.7	15.7	14.9	14.7	9.9	9.8	9.7	9.6	9.4	93.7
Reducing oil and gas leaks from equipment	4.8	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	13.6
Undergrounding in National Parks and AONBs	1.1	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	8.0
Other Network Investment	9.9	3.7	8.3	9.4	3.0	3.4	2.4	1.4	1.4	0.6	29.9
TOTAL - Non-Load Network Investment	**283.4**	**277.9**	**312.9**	**305.6**	**293.0**	**274.7**	**258.0**	**263.7**	**253.0**	**262.6**	**2223.5**
Inspection, maintenance and routine tree cutting	75.0	48.4	49.7	49.3	48.8	48.3	47.9	48.1	47.6	47.2	386.9
Tree clearance to improve network resilience to severe weather	4.2	7.6	7.8	7.7	7.7	7.7	7.4	7.4	7.4	7.4	60.5
Responding to and repairing faults	92.0	88.9	93.5	92.2	90.7	89.3	87.9	86.8	85.9	85.0	711.3
Other network operating costs	7.9	8.3	8.5	8.5	8.4	8.3	8.2	8.2	8.1	8.0	66.2
TOTAL - Network Operating Costs	**179.1**	**153.1**	**159.5**	**157.7**	**155.6**	**153.6**	**151.4**	**150.5**	**149.0**	**147.6**	**1224.9**
Engineering management	**132.5**	**117.7**	**119.9**	**119.5**	**118.0**	**117.4**	**116.9**	**117.1**	**116.6**	**116.4**	**941.8**
Corporate activities	**67.1**	**36.7**	**38.0**	**37.8**	**37.1**	**36.7**	**36.4**	**36.1**	**35.8**	**35.4**	**293.3**
Workforce renewal	**20.3**	**22.2**	**21.5**	**22.0**	**22.4**	**22.4**	**22.4**	**22.4**	**22.4**	**22.4**	**177.9**
Vehicles, IT, Property & Engineering Equipment	**115.9**	**99.1**	**105.2**	**105.6**	**89.7**	**100.0**	**100.0**	**100.1**	**100.7**	**91.2**	**792.5**
TOTAL CORE COSTS	**844.2**	**781.5**	**837.6**	**823.4**	**767.9**	**776.5**	**756.0**	**764.6**	**764.7**	**761.8**	**6252.4**

West Midlands - Core costs funded through DUoS											
Costs excluding RPEs & pensions, including efficiency (£m at 2012/13 prices)	**Average per year in DPCR5**	**Average per year in RIIO-ED1**	**Spend profile in RIIO ED1**								**Total RIIO-ED1**
			2015/16	**2016/17**	**2017/18**	**2018/19**	**2019/20**	**2020/21**	**2021/22**	**2022/23**	
Customer Related Reinforcement	-2.7	2.3	2.10	2.10	2.20	2.30	2.30	2.30	2.40	2.40	18.1
General Network Reinforcement	26.2	15.6	18.40	19.00	16.40	17.60	16.90	11.50	12.10	12.90	124.8
Reinforcement for Low Carbon Technologies	0.0	6.9	1.30	1.30	2.57	5.07	7.55	10.01	12.46	14.87	55.1
TOTAL - Reinforcement of the Network	**23.5**	**24.8**	**21.80**	**22.4**	**21.2**	**25.0**	**26.8**	**23.8**	**27.0**	**30.2**	**198.0**
Asset Replacement	62.7	62.0	62.7	63.3	62.2	62.4	62.0	61.6	61.4	60.7	496.3
Diversions	9.4	10.8	9.6	8.8	8.5	9.2	9.5	13.9	13.3	13.3	86.1
Quality of Supply (reducing power cuts)	3.7	1.9	2.6	2.6	2.6	2.5	2.5	2.5	0.0	0.0	15.3
Improving service for remote ("worst served") customers	0.0	0.1	0.0	0.5	0.5	0.0	0.0	0.0	0.0	0.0	1.0
Real Time Control Systems and Telecommunications	5.0	3.1	5.7	3.9	6.8	1.2	1.6	1.9	0.8	2.5	24.4
Protecting equipment from flooding risk	0.6	0.2	0.0	0.1	0.2	0.1	0.2	0.4	0.1	0.1	1.2
Enhancing site security, ESQCR and other legal requirements	5.0	3.0	3.2	3.1	3.1	3.0	3.0	3.0	2.9	2.9	24.2
Reducing oil and gas leaks from equipment	1.3	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	4.0
Undergrounding in National Parks and AONBs	0.4	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	2.4
Other Network Investment	1.1	1.2	3.2	3.4	0.7	0.8	0.5	0.3	0.3	0.1	9.3
TOTAL - Non-Load Network Investment	**89.2**	**83.03**	**87.80**	**86.50**	**85.40**	**80.00**	**80.10**	**84.40**	**79.60**	**80.40**	**664.2**
Inspection, maintenance and routine tree cutting	25.9	13.7	14.1	14.0	13.8	13.7	13.6	13.7	13.5	13.4	109.8
Tree clearance to improve network resilience to severe weather	1.3	2.0	2.0	2.0	2.0	2.0	1.9	1.9	1.9	1.9	15.6
Responding to and repairing faults	28.6	26.3	27.7	27.3	26.8	26.4	25.9	25.6	25.3	25.0	210.0
Other network operating costs	**2.4**	2.5	2.5	2.5	2.5	2.5	2.4	2.4	2.4	2.4	19.6
TOTAL - Network Operating Costs	**58.2**	**44.4**	**46.30**	**45.80**	**45.10**	**44.60**	**43.80**	**43.60**	**43.10**	**42.70**	**355.0**
Engineering management	**44.0**	**36.1**	**36.80**	**36.7**	**36.2**	**35.9**	**35.9**	**35.8**	**35.7**	**35.6**	**288.6**
Corporate activities	**27.2**	**10.9**	**11.30**	**11.2**	**11.0**	**10.9**	**10.8**	**10.7**	**10.6**	**10.5**	**87.0**
Workforce renewal	**4.6**	**6.0**	**5.80**	**5.9**	**6.0**	**6.0**	**6.0**	**6.0**	**6.0**	**6.0**	**47.7**
Vehicles, IT, Property & Engineering Equipment	**36.5**	**29.7**	**31.90**	**31.1**	**25.0**	**28.0**	**31.0**	**32.3**	**31.0**	**26.9**	**237.2**
TOTAL CORE COSTS	**283.20**	**234.72**	**241.70**	**239.60**	**229.87**	**230.37**	**234.35**	**236.61**	**232.96**	**232.27**	**1877.7**

East Midlands - Core costs funded through DUoS											
Costs excluding RPEs & pensions, including efficiency (£m at 2012/13 prices)	**Average per year in DPCR5**	**Average per year in RIIO-ED1**	**Spend profile in RIIO ED1**								**Total RIIO-ED1**
			2015/16	**2016/17**	**2017/18**	**2018/19**	**2019/20**	**2020/21**	**2021/22**	**2022/23**	
Customer Related Reinforcement	-3.2	2.1	1.90	1.9	2.0	2.2	2.1	2.3	2.2	2.2	16.8
General Network Reinforcement	19.8	20.3	46.00	39.4	12.9	14.6	8.5	11.7	19.6	10.0	162.7
Reinforcement for Low Carbon Technologies	0.0	11.0	2.06	2.1	4.1	8.1	12.0	15.9	19.8	23.6	87.7
TOTAL - Reinforcement of the Network	**16.6**	**33.4**	**49.96**	**43.4**	**19.0**	**24.9**	**22.6**	**29.9**	**41.6**	**35.8**	**267.2**
Asset Replacement	53.9	52.2	52.60	52.4	52.1	52.0	51.8	52.4	52.3	52.1	417.7
Diversions	9.0	10.5	13.30	12.9	12.6	12.4	8.3	8.2	8.3	8.3	84.3
Quality of Supply (reducing power cuts)	3.7	1.1	1.50	1.5	1.4	1.4	1.4	1.4	0.0	0.0	8.6
Improving service for remote ("worst served") customers	0.0	0.0	0.00	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.2
Real Time Control Systems and Telecommunications	5.7	3.2	5.90	4.0	6.9	1.3	1.9	2.0	0.8	2.6	25.4
Protecting equipment from flooding risk	1.5	0.6	1.30	1.7	0.9	0.1	0.2	0.4	0.2	0.2	5.0
Enhancing site security, ESQCR and other legal requirements	3.9	3.2	3.30	3.3	3.2	3.2	3.1	3.1	3.1	3.0	25.3
Reducing oil and gas leaks from equipment	1.7	0.6	0.60	0.6	0.6	0.6	0.6	0.6	0.6	0.6	4.8
Undergrounding in National Parks and AONBs	0.4	0.1	0.10	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.8
Other Network Investment	7.7	1.9	4.80	5.3	1.3	1.4	1.0	0.6	0.6	0.2	15.2
TOTAL - Non-Load Network Investment	**87.5**	**73.4**	**83.40**	**81.9**	**79.2**	**72.5**	**68.4**	**68.8**	**66.0**	**67.1**	**587.3**
Inspection, maintenance and routine tree cutting	21.2	11.4	11.70	11.60	11.50	11.40	11.30	11.40	11.30	11.20	91.40
Tree clearance to improve network resilience to severe weather	0.7	1.8	1.80	1.8	1.8	1.8	1.7	1.7	1.7	1.7	14.0
Responding to and repairing faults	30.4	30.3	31.70	31.3	30.8	30.4	30.0	29.6	29.3	29.0	242.1
Other network operating costs	**2.7**	2.9	3.00	3.0	3.0	2.9	2.9	2.9	2.9	2.8	23.4
TOTAL - Network Operating Costs	**55.0**	**46.4**	**48.20**	**47.7**	**47.1**	**46.5**	**45.9**	**45.6**	**45.2**	**44.7**	**370.9**
Engineering management	**44.1**	**36.4**	**37.40**	**37.1**	**36.5**	**36.2**	**36.1**	**35.9**	**35.9**	**35.7**	**290.8**
Corporate activities	**23.4**	**10.4**	**10.90**	**10.80**	**10.5**	**10.4**	**10.3**	**10.2**	**10.1**	**10.0**	**83.2**
Workforce renewal	**4.9**	**6.0**	**5.80**	**5.9**	**6.0**	**6.0**	**6.0**	**6.0**	**6.0**	**6.0**	**47.7**
Vehicles, IT, Property & Engineering Equipment	**36.4**	**29.1**	**29.80**	**29.3**	**26.0**	**28.6**	**30.1**	**30.1**	**31.8**	**27.4**	**233.1**
TOTAL CORE COSTS	**267.9**	**235.0**	**265.5**	**256.1**	**224.3**	**225.1**	**219.4**	**226.5**	**236.6**	**226.7**	**1880.2**

South Wales - Core costs funded through DUoS											
Costs excluding RPEs & pensions, including efficiency (£m at 2012/13 prices)	**Average per year in DPCR5**	**Average per year in RIIO-ED1**	**Spend profile in RIIO ED1**								**Total RIIO-ED1**
			2015/16	**2016/17**	**2017/18**	**2018/19**	**2019/20**	**2020/21**	**2021/22**	**2022/23**	
Customer Related Reinforcement	-0.5	1.1	1.0	0.9	1.1	1.0	1.2	1.1	1.1	1.3	8.7
General Network Reinforcement	3.6	3.6	2.3	2.3	2.8	7.4	5.8	5.1	1.7	1.2	28.6
Reinforcement for Low Carbon Technologies	0.0	1.4	0.3	0.3	0.5	1.0	1.5	2.1	2.6	3.0	11.3
TOTAL - Reinforcement of the Network	**3.1**	**6.1**	**3.6**	**3.5**	**4.4**	**9.4**	**8.5**	**8.3**	**5.4**	**5.5**	**48.6**
Asset Replacement	30.9	35.0	34.1	34.9	34.6	35.9	35.5	34.9	35.2	34.9	280.0
Diversions	3.0	8.3	17.4	17.2	8.8	8.7	3.5	3.5	3.6	3.7	66.4
Quality of Supply (reducing power cuts)	2.4	0.4	0.5	0.5	0.5	0.5	0.5	0.5	0.0	0.0	3.0
Improving service for remote ("worst served") customers	0.2	0.1	0.0	0.5	0.5	0.0	0.0	0.0	0.0	0.0	1.0
Real Time Control Systems and Telecommunications	1.2	2.9	3.6	2.0	5.5	5.0	1.2	2.1	0.9	2.6	22.9
Protecting equipment from flooding risk	1.3	1.0	3.6	2.1	1.1	0.1	0.2	0.1	0.1	0.3	7.6
Enhancing site security, ESQCR and other legal requirements	3.3	1.3	1.4	1.3	1.3	1.3	1.3	1.2	1.2	1.2	10.2
Reducing oil and gas leaks from equipment	0.4	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	2.4
Undergrounding in National Parks and AONBs	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	1.6
Other Network Investment	0.9	0.2	0.1	0.2	0.3	0.4	0.3	0.2	0.2	0.1	1.8
TOTAL - Non-Load Network Investment	**43.7**	**49.6**	**61.2**	**59.2**	**53.1**	**52.4**	**43.0**	**43.0**	**41.7**	**43.3**	**396.9**
Inspection, maintenance and routine tree cutting	12.6	9.9	10.2	10.1	10.0	9.9	9.8	9.8	9.7	9.6	79.1
Tree clearance to improve network resilience to severe weather	1.0	1.6	1.7	1.6	1.6	1.6	1.6	1.6	1.6	1.6	12.9
Responding to and repairing faults	11.6	11.6	12.3	12.1	11.9	11.7	11.5	11.3	11.2	11.1	93.1
Other network operating costs	**1.1**	1.1	1.2	1.2	1.1	1.1	1.1	1.1	1.1	1.1	9.0
TOTAL - Network Operating Costs	**26.3**	**24.3**	**25.4**	**25.0**	**24.6**	**24.3**	**24.0**	**23.8**	**23.6**	**23.4**	**194.1**
Engineering management	**18.8**	**18.5**	**18.8**	**18.9**	**18.4**	**18.6**	**18.3**	**18.4**	**18.3**	**18.2**	**147.9**
Corporate activities	**6.4**	**5.9**	**6.1**	**6.1**	**6.0**	**5.9**	**5.90**	**5.8**	**5.8**	**5.7**	**47.3**
Workforce renewal	**4.4**	**4.5**	**4.2**	**4.4**	**4.5**	**4.5**	**4.5**	**4.5**	**4.5**	**4.5**	**35.6**
Vehicles, IT, Property & Engineering Equipment	**17.0**	**15.0**	**15.5**	**16.6**	**14.60**	**17.0**	**14.9**	**14.3**	**13.9**	**13.5**	**120.3**
TOTAL CORE COSTS	**119.7**	**123.8**	**134.8**	**133.7**	**125.6**	**132.1**	**119.1**	**118.1**	**113.2**	**114.1**	**990.7**

South West - Core costs funded through DUoS											
Costs excluding RPEs & pensions, including efficiency (£m at 2012/13 prices)	**Average per year in DPCR5**	**Average per year in RIIO-ED1**	**Spend profile in RIIO ED1**								**Total RIIO-ED1**
			2015/16	**2016/17**	**2017/18**	**2018/19**	**2019/20**	**2020/21**	**2021/22**	**2022/23**	
Customer Related Reinforcement	-1.1	1.1	1.0	1.0	0.9	1.1	1.1	1.0	1.1	1.2	8.4
General Network Reinforcement	3.8	3.9	3.2	3.9	4.5	7.2	5.7	3.5	2.0	1.4	31.4
Reinforcement for Low Carbon Technologies	0.0	5.6	1.1	1.1	2.1	4.1	6.2	8.2	10.1	12.1	44.9
TOTAL - Reinforcement of the Network	**2.7**	**10.6**	**5.3**	**6.0**	**7.5**	**12.4**	**13.0**	**12.7**	**13.2**	**14.7**	**84.7**
Asset Replacement	44.9	53.4	54.2	53.8	53.6	53.1	53.4	53.3	52.9	52.5	426.8
Diversions	4.2	9.6	13.3	13.1	7.3	7.2	7.2	7.3	8.2	13.1	76.7
Quality of Supply (reducing power cuts)	2.8	0.4	0.5	0.5	0.5	0.5	0.5	0.5	0.0	0.0	3.0
Improving service for remote ("worst served") customers	0.1	0.1	0.0	0.5	0.5	0.0	0.0	0.0	0.0	0.0	1.0
Real Time Control Systems and Telecommunications	2.2	2.9	3.7	1.6	4.8	5.0	1.6	2.6	1.1	2.9	23.3
Protecting equipment from flooding risk	0.8	0.1	0.1	0.1	0.1	0.1	0.1	0.4	0.1	0.1	1.1
Enhancing site security, ESQCR and other legal requirements	6.2	4.3	7.8	7.2	7.1	2.4	2.4	2.4	2.4	2.3	34.0
Reducing oil and gas leaks from equipment	1.4	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	2.4
Undergrounding in National Parks and AONBs	0.2	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	3.2
Other Network Investment	0.2	0.5	0.2	0.5	0.7	0.8	0.6	0.3	0.3	0.2	3.6
TOTAL - Non-Load Network Investment	**63.0**	**71.9**	**80.5**	**78.0**	**75.3**	**69.8**	**66.5**	**67.5**	**65.7**	**71.8**	**575.1**
Inspection, maintenance and routine tree cutting	15.3	13.3	13.7	13.6	13.5	13.3	13.2	13.2	13.1	13.0	106.6
Tree clearance to improve network resilience to severe weather	1.2	2.3	2.3	2.3	2.3	2.3	2.2	2.2	2.2	2.2	18.0
Responding to and repairing faults	21.4	20.8	21.8	21.5	21.2	20.8	20.5	20.3	20.1	19.9	166.1
Other network operating costs	**1.7**	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.7	1.7	14.2
TOTAL - Network Operating Costs	**39.6**	**38.1**	**39.6**	**39.2**	**38.8**	**38.2**	**37.7**	**37.5**	**37.1**	**36.8**	**304.9**
Engineering management	**25.6**	**26.8**	**26.9**	**26.8**	**26.9**	**26.7**	**26.6**	**27.0**	**26.7**	**26.9**	**214.5**
Corporate activities	**10.1**	**9.5**	**9.7**	**9.7**	**9.6**	**9.5**	**9.4**	**9.4**	**9.3**	**9.2**	**75.8**
Workforce renewal	**6.4**	**5.9**	**5.7**	**5.8**	**5.9**	**5.9**	**5.9**	**5.9**	**5.9**	**5.9**	**46.9**
Vehicles, IT, Property & Engineering Equipment	**26.0**	**25.2**	**28.0**	**28.6**	**24.1**	**26.4**	**24.0**	**23.4**	**24.0**	**23.4**	**201.9**
TOTAL CORE COSTS	**173.4**	**188.0**	**195.7**	**194.1**	**188.1**	**188.9**	**183.1**	**183.4**	**181.9**	**188.7**	**1503.8**

Customer specific reinforcement

10.11 Customers who require an electricity supply to domestic or business properties or wish to export the power from a distributed generator, need to obtain a connection to our network.

10.12 Connection costs are subdivided into two categories that are treated differently. Firstly, the assets installed exclusively for the connection are called 'sole user' assets and since the customer funds these they are treated as being outside the price control. Secondly, in some cases there is a requirement to increase the capacity of the existing network to enable the new connection to be made without reducing the security of the network. This customer specific reinforcement is part funded by the customer and part funded through DUoS income and is therefore assessed under the price control process.

10.13 The expenditure described in this section relates to customer specific reinforcement.

Connection volumes

10.14 Data collected by Oxford Economics on housing stock projections by local authorities has been used to inform our forecast of future volumes of connections.

10.15 Although the projections show relatively consistent growth across all four areas, we have reduced the growth rates for most markets segments up to 2017 to represent slow recovery from recession.

10.16 WPD forecasts assume that the most buoyant market will be medium sized housing developments that generate cash flow quickly for developers. There will be some growth in larger housing schemes as market confidence returns, but this is assumed to be at half the rate of the Oxford Economics data up to 2017. Commercial and industrial developments will continue but volumes will be flat until 2017.

10.17 It is anticipated that distributed generation (DG) will continue to grow, influenced by the availability of financial incentives such as the Feed-in-Tariff. The only exception is onshore wind generation where volumes are predicted to fall away as the number of suitable locations reduces.

Market share changes

10.18 Third party connection providers are most active in market segments where there are larger domestic housing estates, commercial developments or distributed generators. This means that third parties carry out fewer projects, but provide a large proportion of connections to properties. It is anticipated that third parties will continue to grow their market share in the majority of market segments, but WPD expects to retain market share in West Midlands and gain back some market share in East Midlands for large schemes, as a consequence of lower prices that are available because of efficiency savings resulting from the takeover by WPD.

10.19 As an example, within the forecast for the market segment for low voltage connections with high voltage work (LVHV) the following market share changes have been assumed.

Proportion of LVHV demand connection projects carried out by third parties (2012 to 2023)				
Market Segment	West Midlands	East Midlands	South Wales	South West
LVHV	Held at 15%	Reduction from 25% to 20%	Increase from 1% to 10%	Increase from 1% to 12%

Impact of low carbon technology

10.20 As customers adopt more LCTs and the associated load growth uses up existing network capacity, more connection projects will require the existing network to be reinforced. The cost forecasts assume that the percentage of projects requiring reinforcement grows by 0.25% per annum for low voltage connections with only low voltage work and 0.5% per annum for low voltage connections requiring high voltage work. It is assumed that there is no impact for higher voltage connections.

Extending the scope of contestable works

10.21 The promotion of competition in connections has led to customers having a choice for the provision of certain parts of a connection. WPD has been working with third party providers to extend the scope of what third parties can do and will continue to develop processes to allow further expansion of contestable works. This will include allowing third parties to work on the existing network to complete final connections and the customer specific reinforcement. It has been assumed that by the end of RIIO-ED1 the majority of reinforcement work at LV and HV will be contestable and third parties will have the opportunity to carry out the reinforcement in addition to installing assets specifically for the new connections.

Customer specific reinforcement expenditure forecast

10.22 The costs of customer specific reinforcement are subdivided into two main components:

- customer funded reinforcement (where the customer pays for their proportion of any additional capacity provided upstream of the connection);
- DUoS funded reinforcement (where WPD receives an allowance through the price control mechanism to cover the costs of the remaining proportion of upstream reinforcement).

Customer specific reinforcement in RIIO-ED1 (£m)					
	West Midlands	East Midlands	South Wales	South West	Total
Customer funded reinforcement	10.4	12.0	7.2	7.9	37.5
DUoS funded reinforcement	18.1	16.9	8.6	8.4	52.0

General network reinforcement

Introduction

10.23 The statutory requirements for the amount of capacity that must be provided to meet demand are driven by our Licence (requiring compliance with a National Standard on Security of Supply – P2/6) and the Electricity Supply, Quality and Continuity Regulations (ESQCR) that encompass requirements on adequacy of equipment, voltage levels, disturbing loads etc. Although temporary relief (derogations) from P2/6 can be applied for, our business processes are designed to avoid the need for these wherever possible.

10.24 The following sections provide an overview of the expenditure in these areas both under our 'best view' of the future and some alternative scenarios developed by the Department of Environment and Climate Change (DECC) that have been regionalised by the research company EA Technology.

Drivers

10.25 The UK targets for reducing carbon dioxide emissions require a reduction of 80% by 2050. This target will be met through the decarbonisation of heating and transport, improvements in energy efficiency and producing electricity from renewable sources. The Government has set out, in its Carbon Plan, potential pathways (scenarios) to put the UK on track to halve greenhouse gas emissions, on 1990 levels, by the mid-2020s and on a path towards the 80% reduction by 2050. The impact of this on our networks is significant.

10.26 The known drivers of changes to the demand on the network and hence load related investment are:

- the impact of energy efficiency improvements and demand side response (enabled by the roll out of smart meters);
- the number of new connections (generally around 1% per annum);
- the potential impact of customers installing LCTs;
- the continuing growth in larger scale generation (generally solar, wind, biomass and waste incineration but the potential for Combined Heat and Power).

Impact of low carbon technologies

10.27 We have used a model called 'Transform', developed by EA Technology for the DECC/Ofgem led Smart Grid Forum, to forecast the level of expenditure required to accommodate LCTs.

10.28 DECC has produced national scenarios of the uptake of LCTs necessary to meet the Carbon Plan. EA Technology has regionalised these scenarios to determine the volumes in each distribution licence area. The EA Technology scenarios assume that installations of heat pumps and electric vehicles will group together 'cluster' in the same manner as the adoption of solar panels.

10.29 WPD's best view case is based on the results of work commission by WPD and undertaken with the CSE in Bristol. This work has derived the likely volume of LCTs and provided a more detailed view of the way LCTs will cluster on the network and drive investment. This data has been used within the Transform model to determine the level of investment.

10.30 The following tables compare the volumes of different LCTs in the best view case against the EA Technology regionalised DECC forecasts.

CSE – 'On our wires project'

CSE have developed a Housing Assessment Model that analyses housing stock at individual property level, using data on the size of property, built form and wall type (solid or cavity).

From this, CSE have assessed the order in which we can expect groups of like property types to install heat pumps and PV.

Electric vehicle potential uptake has been assessed by CSE using socio-demographic groupings, urban/ not urban locations together with location in local authority areas which already have some electric vehicles.

Cumulative number of retro fit domestic heat pumps at the end of RIIO-ED1				
	WPD 'Best View' based on CSE data	**Regionalised DECC LOW case**	**Regionalised DECC MEDIUM case**	**Regionalised DECC HIGH case**
West Midlands	53,683	39,403	105,300	100,579
East Midlands	50,708	47,136	127,152	121,426
South Wales	19,492	78,596	158,996	152,895
South West	72,162	27,074	71,647	68,454

Cumulative kW of retro fit PV installations at the end of RIIO-ED1				
	WPD 'Best View' based on CSE data	**Regionalised DECC LOW case**	**Regionalised DECC MEDIUM case**	**Regionalised DECC HIGH case**
West Midlands	135,909	461,626	713,530	962,973
East Midlands	191,506	496,172	774,841	1,050,616
South Wales	54,234	198,600	312,245	424,968
South West	225,281	409,957	588,801	766,876

Cumulative number of electric vehicles charged at existing premises at the end of RIIO-ED1				
	WPD 'Best View' based on CSE data	**Regionalised DECC LOW case**	**Regionalised DECC MEDIUM case**	**Regionalised DECC HIGH case**
West Midlands	66,761	62,411	181,772	277,613
East Midlands	77,023	68,622	199,863	305,241
South Wales	28,887	21,316	62,084	94,818
South West	45,014	46,691	135,988	207,689

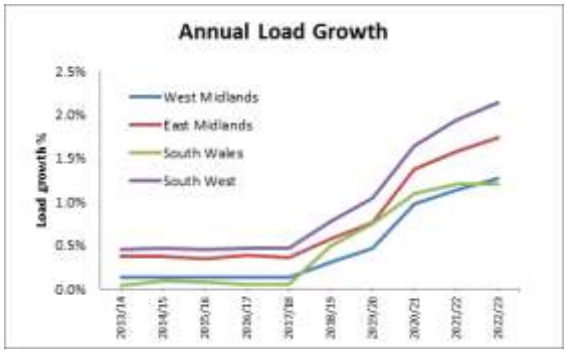
10.31 Where the LCTs will be connected and how close together the connections are has a major impact on the network. The 'clustering' assumption used in the Transform model is therefore important as the resulting investment need is very sensitive to this assumption. Knowledge of

this sensitivity was a key driver to undertaking the detailed analysis with CSE. The results of the CSE work indicate that clustering will be very high.

10.32 There is significant uncertainty around the take up of LCTs. The uncertainty section of our plan contains further details of the overall load related reopener that we require to protect both shareholders and customers from either a significantly higher or lower level of investment in this area.

Forecasting overall load growth and expenditure

10.33 The Transform model has been used to derive annual load growth rates. The chart shows that the rate of load growth increases steadily during the RIIO-ED1 period.



10.34 This load growth incorporates LCTs in new properties, the retro-fitting of LCTs and energy efficiency as shown in the tables below:

West Midlands	Annual Load Growth %									
	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
Energy Efficiency	-0.59%	-0.59%	-0.59%	-0.60%	-0.60%	-0.60%	-0.61%	-0.28%	-0.28%	-0.28%
New Build with LCTs	0.57%	0.57%	0.57%	0.57%	0.57%	0.62%	0.66%	0.69%	0.74%	0.78%
Retro Fit LCTs	0.15%	0.15%	0.15%	0.16%	0.16%	0.30%	0.42%	0.58%	0.70%	0.81%
Combined Growth	**0.13%**	**0.14%**	**0.13%**	**0.13%**	**0.14%**	**0.31%**	**0.47%**	**0.98%**	**1.14%**	**1.28%**

East Midlands	Annual Load Growth %									
	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
Energy Efficiency	-0.69%	-0.69%	-0.70%	-0.70%	-0.71%	-0.71%	-0.72%	-0.33%	-0.33%	-0.33%
New Build with LCTs	0.85%	0.85%	0.84%	0.84%	0.84%	0.90%	0.97%	1.00%	1.08%	1.13%
Retro Fit LCTs	0.21%	0.21%	0.21%	0.21%	0.22%	0.35%	0.48%	0.70%	0.82%	0.93%
Combined Growth	**0.37%**	**0.37%**	**0.34%**	**0.39%**	**0.36%**	**0.57%**	**0.76%**	**1.38%**	**1.58%**	**1.73%**

South Wales	Annual Load Growth %									
	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
Energy Efficiency	-0.68%	-0.68%	-0.69%	-0.69%	-0.70%	-0.70%	-0.71%	-0.35%	-0.35%	-0.35%
New Build with LCTs	0.59%	0.62%	0.61%	0.59%	0.58%	0.88%	1.02%	0.93%	0.99%	0.96%
Retro Fit LCTs	0.12%	0.13%	0.13%	0.13%	0.14%	0.27%	0.37%	0.46%	0.51%	0.54%
Combined Growth	**0.04%**	**0.09%**	**0.07%**	**0.05%**	**0.05%**	**0.50%**	**0.75%**	**1.09%**	**1.20%**	**1.20%**

South West	Annual Load Growth %									
	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
Energy Efficiency	-0.62%	-0.62%	-0.60%	-0.60%	-0.61%	-0.61%	-0.61%	-0.29%	-0.29%	-0.29%
New Build with LCTs	0.87%	0.88%	0.88%	0.88%	0.88%	0.94%	1.00%	1.06%	1.14%	1.20%
Retro Fit LCTs	0.20%	0.21%	0.21%	0.21%	0.22%	0.47%	0.68%	0.90%	1.12%	1.28%
Combined Growth	**0.45%**	**0.46%**	**0.46%**	**0.46%**	**0.46%**	**0.77%**	**1.05%**	**1.65%**	**1.94%**	**2.14%**

Note that individual growth rates do not summate to give precise combined rate because of interaction of these within the Transform modelling.

10.35 The elements of load growth and their inputs have been cross-checked against other sources. For example the levels of energy efficiency have been checked against The Carbon Plan, and new housing additions against Oxford Economics dwelling stock forecasts and each regions recent historic connection rates.

10.36 The Transform model has been used to generate secondary network requirements and provide the underlying growth rates at the primary network level. Therefore consistent growth forecasts

have been applied across all voltage levels. The primary network requirements have been further adjusted for significant localised impacts of known developments.

10.37 The generic networks and typical loading characteristics within the Transform model make it inappropriate for the identification of specific EHV network requirements. As such, only the LV and HV elements have been taken from this model, with EHV requirements identified from detailed network analysis. The requirements identified have been adjusted to account for the use of smart solutions at EHV.

Primary network reinforcement requirements

10.38 As described above, investment in the EHV network has been separately assessed to take account of the changes in demand from the growth in connection of LCTs, new connections, generation, and the impact of energy efficiency and expected demand side response.

10.39 This results in expected reinforcement investment at EHV as follows:

EHV and 132kV reinforcement expenditure (£m)					
	West Midlands	East Midlands	South Wales	South West	WPD Total
DPCR5 Annual Average	20.0	14.7	1.9	2.0	38.6
RIIO-ED1 Annual Average	10.5	13.6	2.1	1.8	28.1
RIIO-ED1 Total (8 years)	**83.9**	**109.2**	**17.1**	**14.3**	**224.5**

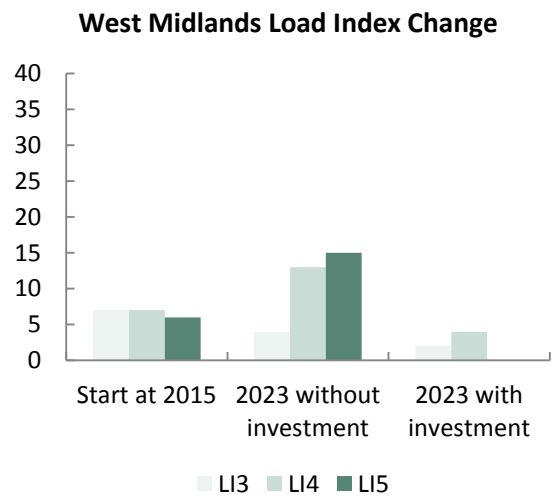
10.40 The difference in the amount of investment between our four licenced areas is partly due to the differing sizes of the networks and also due to the forecast starting loads on the networks (as highlighted by the differing starting Load Indices (LIs) – see below) and the higher volumes of specific development areas within the two Midlands areas.

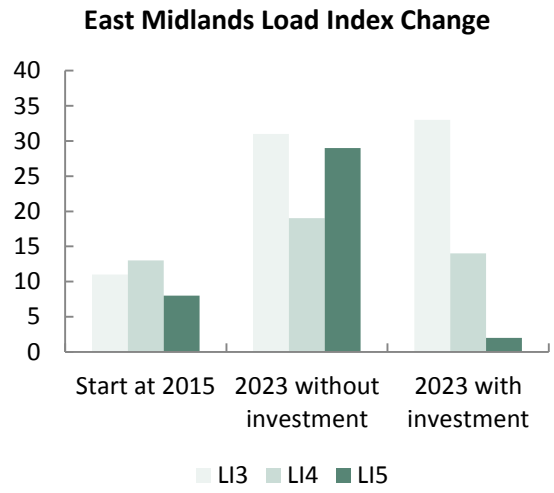
10.41 Load Indices are a measure introduced in DPCR5 to provide an indication of the level of primary substation loading risk within the following general definitions:

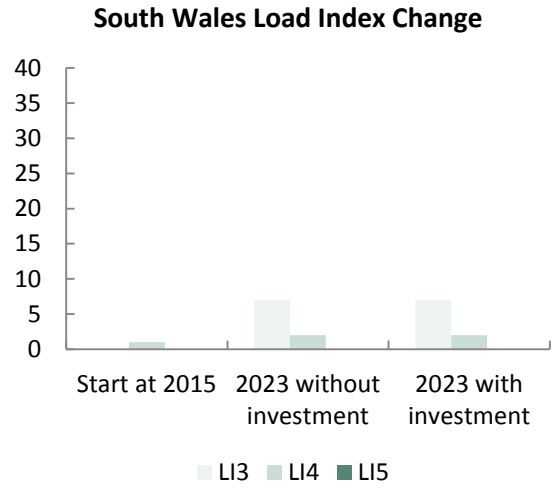
LI rank	Definition
LI1	Significant spare capacity
LI2	Adequate spare capacity
LI3	Highly utilised
LI4	Fully utilised, mitigation requires consideration
LI5	Fully utilised, mitigation required

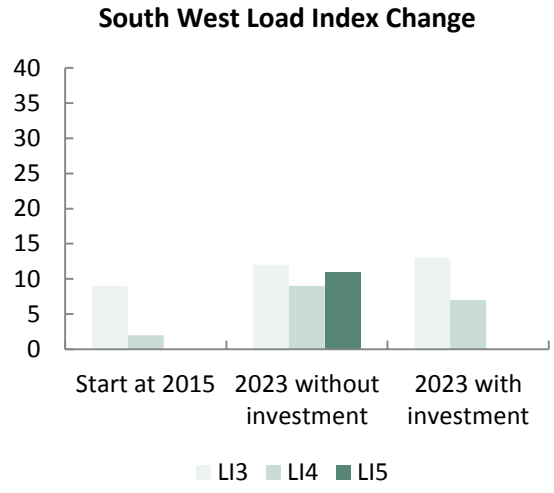
10.42 Using consistent LI thresholds, in line with guidance from Ofgem, the starting LIs and expected movement during the RIIO-ED1 period is as follows:

Load Index changes at EHV and 132kV substations over the RIIO-ED1 period									
	Start at 2015			2023 without investment			2023 with investment		
	LI3	LI4	LI5	LI3	LI4	LI5	LI3	LI4	LI5
West Midlands	7	7	6	4	13	15	2	4	0
East Midlands	11	13	8	31	19	29	33	14	2
South Wales	0	1	0	7	2	0	7	2	0
South West	9	2	0	12	9	11	13	7	0









Secondary network reinforcement requirements

10.43 Historically, investment in the reinforcement of HV and LV networks has been low as they were generally built with sufficient capacity to accommodate the changing use of electricity. The main driver of reinforcement investment at these voltage levels during RIIO-ED1 and beyond is the expected growth in LCTs being 'retro fitted' in existing properties. A detailed assessment of the output from the Transform model together with assessment of the data provided as part of the CSE work and underlying trends has been used to derive our forecasts.

10.44 This results in expected reinforcement expenditure at LV and HV for traditional and LCT related reinforcement as follows:

Total LV reinforcement expenditure (£m)					
	West Midlands	East Midlands	South Wales	South West	WPD Total
DPCR5 Annual Average	0.7	0.8	0.4	0.5	2.4
RIIO-ED1 Annual Average	6.1	9.8	1.4	4.6	21.9
RIIO-ED1 Total (8 years)	**49.1**	**78.3**	**11.5**	**36.4**	**175.4**

Total HV reinforcement expenditure (£m)					
	West Midlands	East Midlands	South Wales	South West	WPD Total
DPCR5 Annual Average	2.9	3.3	1.1	1.1	8.4
RIIO-ED1 Annual Average	4.2	5.3	1.3	2.6	13.4
RIIO-ED1 Total (8 years)	**33.3**	**42.4**	**10.7**	**20.6**	**107.0**

10.45 We have also used the Transform model to assess the alternative levels of expenditure needed for LCT related reinforcement to deliver the different DECC Carbon Plan scenarios as regionalised by EA Technology. Comparison of the results, for LV and HV networks, is shown in the table below:

LV & HV LCT related reinforcement expenditure over the RIIO-ED1 period Comparison of WPD Best View and DECC scenarios (£m)					
	WPD 'Best View' Forecast	Scenario 1 – high emissions abatement in heat provision	Scenario 2 – high emission abatement in transport	Scenario 3 – high electrification of heat and transport provision	Scenario 4 – International Carbon Credit purchases needed to meet targets
West Midlands	55.1	68.7	63.1	75.1	4.7
East Midlands	87.7	186.2	113.3	140.3	5.8
South Wales	11.3	91.2	92.5	90.0	13.5
South West	44.9	34.0	40.3	44.4	2.0
Total	**199.0**	**380.0**	**309.1**	**349.8**	**26.0**

(Note: the DECC forecasts are based on the clustering pattern currently seen from the uptake of small scale PV whereas the WPD Best View is based on a more clustered approach following the work undertaken by CSE. If the DECC forecast were to use the higher CSE clustering then the investment levels would be much higher)

10.46 The Transform model uses smart solutions for reinforcement wherever they are a lower cost than 'conventional' solutions which generally add additional assets or replace them with higher capacity ones.

10.47 The Uncertainty section describes how both customers and shareholders are protected from significant errors in the assumptions about the volume or cost of reinforcement needed over the RIIO-ED1 period.

10.48 We will further develop the CSE data together with other information we have on system loads, including the data that will become available via smart meters to develop an LCT hotspot indicator for our network designers.

Fault level capability

10.49 Certain faults that occur on the network can allow very high current to flow until the network is switched off automatically by circuit breakers. Although the network is designed to withstand a certain level of fault current, the number of generators and large motors connected to the network can cause the fault current to exceed the rating of the circuit breakers. This introduces a risk of catastrophic failure when they operate.

10.50 WPD has a duty of care to its employees and members of the public to ensure that they are not at risk of injury due to the failure of the company's assets.

10.51 The situation can change depending on what is connected to the network and we therefore undertake an annual fault level survey to identify the locations and situations where the current fault level potentially exceeds 95% of the switchgear rating.

10.52 Solutions are generated to eliminate the risk to safety and restore optimal running arrangements, with the main approach being the replacement of the switchgear for higher rated equipment.

10.53 The forecast expenditure to maintain our fault level capability during the RIIO-ED1 period is as follows:

Fault level capability expenditure (£m)					
	West Midlands	East Midlands	South Wales	South West	WPD Total
DPCR5 Annual Average	2.5	0.4	0.2	0.2	3.3
RIIO-ED1 Annual Average	1.5	2.5	0.1	0.6	4.6
RIIO-ED1 Total (8 years)	**11.7**	**19.9**	**0.8**	**4.8**	**37.1**

10.54 The difference between the underlying forecast in South West and South Wales and the two Midlands areas is due to a combination of there being a large number of large power stations located in the Midlands which generally raise fault levels and the anticipated impact of growth in combined heat and power plants in the large urban areas.

10.55 Our LCNF FlexDGrid project is seeking to develop better ways of assessing fault level by exploring the potential benefits of enhanced fault level assessment, real-time management of fault level and fault level mitigation techniques.

Asset replacement

10.56 The existing network has developed over many years with a large proportion being installed during the 1950s and 1960s. It contains many assets from different manufacturers that are designed to an evolving range of standards.

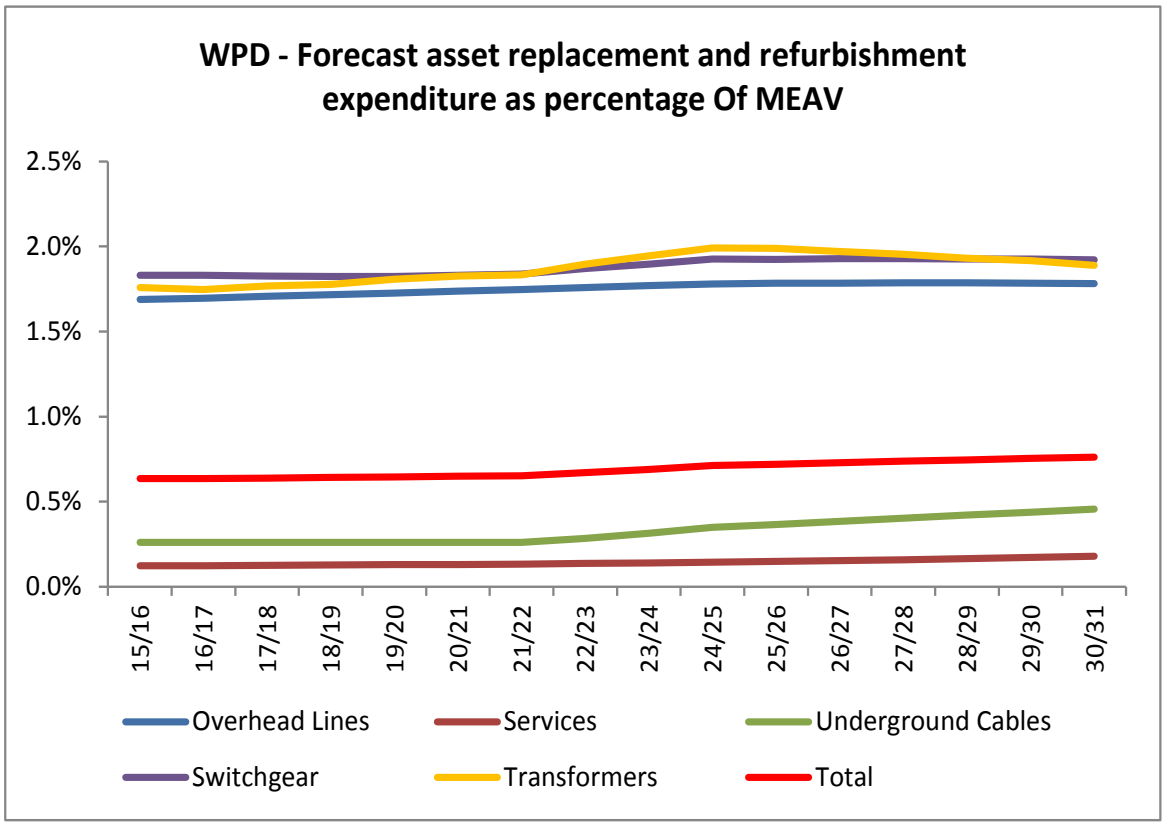
10.57 Network assets are subject to slow but progressive deterioration, influenced by atmospheric conditions, the construction of the assets, material ageing and the duty they are expected to perform. Defects can also arise that limit their operational capability. The replacement of assets in poorest condition counteracts the effect of deterioration of the whole asset base and WPD replaces around 0.6% of the entire asset base each year.

10.58 The chart below shows the asset replacement and refurbishment expenditure as a percentage of the modern equivalent asset value (MEAV) of the whole population.

10.59 Approximately 2% of overhead lines, switchgear and transformers (which have an asset life in the order of 50 to 60 years) will be replaced or refurbished each year during RIIO-ED1.

10.60 0.2% of underground cables and 0.1% or services (which have asset lives in the order of 100 years) will be replaced or refurbished each year during RIIO-ED1.

10.61 From the start of RIIO-ED2 there is a progressive increase in underground cable replacement as more underground cable reaches the end of its life. Even so, the rate of replacement at the end of RIIO-ED2 will be equivalent to a life of 200 years because the most of the underground cable would not have reached the end of its life by 2031.



Replacement forecasting process

10.62 The volume of asset replacement activity is forecast using two techniques: (1) age based survivor modelling to provide long term projections and (2) condition based risk management (CBRM) that refines the requirements in the shorter term. The replacement forecast is derived by consideration of the outputs of both of these analyses.

Survivor modelling

10.63 Since 2000 the industry and Ofgem have used survivor modelling to forecast future replacement volumes. Survivor modelling is a well-established statistical technique that uses the preposition that the older the asset, the greater likelihood that it is in poorer condition and hence the higher probability that the asset will need to be replaced.

10.64 It works by applying a life expectancy distribution to the age profile of the remaining (surviving) assets to determine how many assets require to be replaced. It is especially useful for providing a longer term view of how future requirements will change in relation to current activity.

10.65 Survivor modelling predicts that for the majority of asset categories replacement volumes will level off by the end of RIIO-ED1, except for cables where there will be an increased requirement compared to the very low current volumes of replacement.

Condition based risk management

10.66 Condition based risk management (CBRM) is an asset management approach that evaluates the risk associated with failure of assets due to their condition. It can be used to determine when the condition of an asset has deteriorated to a point that the risk associated with failure is no longer acceptable allowing a forecast of the timely replacement of assets to be developed.

10.67 CBRM uses asset health models, which make use of condition information. This condition information is collected during inspection and maintenance of assets. Condition information is used in combination with other asset specific information, such as age, location and defect history, to define a health value for each asset. This health value is used to determine the probability of failure associated with the condition of each asset. Asset degradation assumptions within the CBRM model predict how the health value will change over time. The speed of degradation is determined by a number of different factors including the original construction of the asset the age of the asset and its environment. The probability of failure of an asset increases as the asset's health degrades.

10.68 The consequence of failure of each asset is different. It is determined by the impact on failure upon customer supply, cost of repair and the asset's location which affects safety and environmental factors. Each asset within the CBRM model has been assessed and assigned a consequence score. This allows assets to be grouped into different consequence bands.

10.69 The risk associated with failure of assets is evaluated by combining the consequences of failure with the probability of failure relating to asset health.

10.70 The output from the CBRM models has been used to undertake cost benefit analysis that compares the cost of replacement against the benefit of removing future risk. This analysis has been undertaken for different levels of consequence of failure, across each asset type in order to determine the point at which replacement delivers optimal benefit for each level of consequence. These replacement trigger points are translated into equivalent trigger health values. Assets with higher consequences of failure are replaced before those with lower consequence of failure.

10.71 The CBRM model applies degradation assumptions to individual assets and those reaching the appropriate trigger value for replacement within the RIIO-ED1 period are identified. This provides a forecast of asset replacement requirements for the RIIO-ED1 period.

10.72 CBRM, combined with cost benefit analysis, provides a more sophisticated assessment of replacement requirements and has enabled WPD to optimise every part of the asset replacement programme.

Replacement and refurbishment activity

Cables

10.73 The majority of underground cables continue to provide a reliable service, but there are certain specific problems that lead to replacement.

10.74 Consac cable is a low voltage cable that is used to distribute power to homes and businesses and was installed during the 1970s in West Midlands and South West. Consac is an aluminium cable that is prone to faults where water ingress causes it to corrode. This corrosion can cause repeat failures on the same piece of network that creates a nuisance for customers. It is expected that volumes of replacement will remain broadly flat during RIIO-ED1.

10.75 Although other, older, types of low voltage paper-insulated cable provide a good service there are areas of the network where repeat faults occur due to their deterioration, historic overloading or ground disturbance. They are more prone to faults in wet ground conditions where water ingress can lead to intermittent interruptions that are difficult to locate. It is expected that volumes of replacement will remain broadly flat during RIIO-ED1.

10.76 Fluid filled cables, containing insulating oil, pose an environmental risk when leaks occur. Although damage can normally be repaired, cables with deteriorated sheaths are prone to regular leaks and are replaced. Following stakeholder consultation, WPD has decided to replace the 1% of cables that have the highest leak rates.

Overhead lines

10.77 Most of the overhead network is built on wooden poles that have a finite life. WPD places a high priority on the replacement of poor condition wooden poles in order to remove weak points and to reduce safety risks and the likelihood of failure. Overhead lines are inspected every seven years and poles found in poor condition are removed from the network within a year of being identified.

10.78 Overhead towers (pylons) are prone to rusting that affects the tower steelwork. Rusting is particularly aggressive near coastal regions. Routine tower painting prevents the most corrosion and in many instances towers can be refurbished by changing the sections of corroded steelwork. Where the corrosion is widespread or affects the main legs or cross arms the replacement of the whole tower is undertaken if necessary to prevent failure.

10.79 Overhead line conductor is susceptible to vibration and movement caused by the wind. This can lead to wear, especially at the points where it is supported. Corrosion also occurs where aggressive atmospheric conditions exist such as salty wet air near the coast.

10.80 Vibration and movement can also affect the fittings used to support the conductor. Components can wear, especially when corrosion causes parts that need to move to seize up.

Switchgear

10.81 Switchgear replacement programmes have been in place for a number of years and are targeted at equipment that is in poor condition, has defective components or is of a type that has been involved in an incident leading to an operational restriction.

10.82 Switchgear failure can cause significant risk of injury to staff and damage to premises and there is a national system, administered by the Electricity Networks Association for reporting defects and dangerous situations. This allows sharing of knowledge so that companies can respond to issues found across the industry. This is especially important when catastrophic failures are caused by the design of equipment or failure of a critical component. In these circumstances the whole population of the equipment or component have to be replaced.

Transformers

10.83 Ground mounted distribution transformers are robust items of plant that have limited moving parts. Therefore the main problems encountered with ground mounted transformers result from rust and from the degradation of insulation caused by excessive loads or moisture ingress. Transformers will be replaced based upon condition assessments and oil test results.

10.84 The failure of higher voltage, larger transformers (supplying thousands of customers) can have a significant impact on network security. The failure of these transformers is usually caused by a combination of the demand placed upon the transformers, the effect of moisture ingress and the atmospheric corrosion of steelwork and seals. Oil testing is used to assess the internal condition and transformers are changed where tests suggest evidence of electrical discharge or significant insulation degradation.

Replacement and refurbishment expenditure

Total asset replacement expenditure (£m)					
	West Midlands	East Midlands	South Wales	South West	WPD Total
DPCR5 Annual Average	51.9	46.7	25.8	37.4	161.8
RIIO-ED1 Annual Average	50.7	42.4	29.7	44.8	167.6
RIIO-ED1 Total (8 years)	406.0	338.9	237.5	358.3	1,340.6

Total asset refurbishment expenditure (£m)					
	West Midlands	East Midlands	South Wales	South West	WPD Total
DPCR5 Annual Average	4.7	2.7	2.8	3.5	13.7
RIIO-ED1 Annual Average	3.5	3.1	2.4	3.2	12.1
RIIO-ED1 Total (8 years)	28.0	24.4	19.1	25.3	96.8

Summary volumes

Volumes of assets to be replaced in RIIO-ED1		
Asset Type	**Volume**	**Percentage of Population Removed (Average per Annum)**
Low voltage underground cable	1,197	0.2%
High voltage underground cables	675	0.2%
132kV, 66kV & 33kV underground cable	268	0.8%
Overhead line conductor (all voltages)	11,683	1.6%
Poles (all voltages)	263,656	2.4%
Towers	92	0.1%
Low voltage switchgear	12,729	1.3%
HV pole mounted switchgear	6,333	1.3%
HV ground mounted switchgear	14,655	1.9%
132kV, 66kV & 33kV switchgear	3,962	2.8%
HV pole mounted transformers	16,290	1.6%
HV ground mounted transformers	5,998	1.3%
132kV, 66kV & 33kV transformers	387	1.9%
Low voltage services	194,898	0.3%

Buildings and civil structures

10.85 It is important that substation buildings, sites and fences remain in good condition and secure in order to protect network assets and provide a safe working environment for staff. Substations will be refurbished where defects are found.

10.86 Cable bridges are used to cross waterways, especially in the Midlands where there is an extensive network of canals in Birmingham and the Black Country. Many of these structures are constructed from lattice steelwork, with external cladding and they can carry several cables. Where necessary steelwork will be replaced or refurbished to ensure they remain secure.

Civil works expenditure (£m)					
	West Midlands	East Midlands	South Wales	South West	WPD Total
DPCR5 Annual Average	6.0	4.6	2.3	3.9	16.7
RIIO-ED1 Annual Average	7.8	6.8	2.9	5.4	22.9
RIIO-ED1 Total (8 years)	**62.4**	**54.4**	**23.5**	**43.2**	**183.5**

Diversions and conversion of wayleaves to easements

10.87 WPD needs agreements with property owners when assets are installed on private land. Wayleave agreements are used in most cases because they are cheaper than easements or other legal arrangements. Wayleaves are licences that pay landowners an annual rental, but they have the drawback that they can be terminated at the request of the landowner. Easements are permanent rights of way in perpetuity.

Diversions due to wayleave terminations

10.88 Diversions are needed when landowners request that assets are moved. This may be because of the construction of a house extension or to enable the development of land. Diversions are also needed when large infrastructure upgrades take place such as the proposed electrification of the Paddington to Swansea rail line.

Conversion of wayleaves to easements and injurious affections

10.89 In some cases, diversions can be very expensive and so WPD negotiates to keep the existing routes. When a permanent right of way is required, WPD will negotiate a compensation payment in exchange for the conversion of a wayleave to an easement.

10.90 Although WPD aims to minimise expenditure, the value of compensation claims can be very high. Where necessary we use statutory powers to establish a reasonable settlement.

10.91 Over the last 10 years, a number of compensation agents have established themselves, specialising in injurious affection compensation due to overhead electricity lines affecting property prices. Landowners or their agents submit a wayleave termination together with an offer to negotiate a permanent easement. Each claim is rigorously challenged but the settlement of cases across the industry has inevitably established a “going rate” for injurious affection payments.

10.92 The expenditure forecast and activity volumes for diversions and the conversion of wayleaves to easements reflect historic trends that we expect to continue.

Summary expenditure

Diversions and conversion of wayleaves to easements (£m)					
	West Midlands	East Midlands	South Wales	South West	WPD Total
DPCR5 Annual Average	9.4	9.0	3.0	4.2	25.7
RIIO-ED1 Annual Average	10.8	10.5	8.3	9.6	38.9
RIIO-ED1 Total (8 years)	**86.1**	**84.3**	**66.4**	**76.7**	**313.5**

Quality of supply

10.93 WPD has the best track record of any DNO for improving network performance.

10.94 Although stakeholders have indicated that reliability performance is good, they have required that performance should remain the same or get better.

10.95 The proposed investment programme will increase the number of automated devices on the network. Increasing the amount of automation will enable computer controlled reconfiguration of the network when a fault occurs that will, in turn, reduce the number of customer affected by faults will speed up the restoration of supplies.

Quality of supply expenditure (£m)					
	West Midlands	East Midlands	South Wales	South West	WPD Total
DPCR5 Annual Average	3.7	3.7	2.4	2.8	12.5
RIIO-ED1 Annual Average	1.9	1.1	0.4	0.4	3.7
RIIO-ED1 Total (8 years)	**15.3**	**8.6**	**2.9**	**2.9**	**29.7**

Worst served customers

10.96 There is a small number of customers that experience high numbers of faults. These customers are generally located on the end of long circuits or on remote parts of the network, with limited alternative networks to provide supplies when faults occur.

10.97 Stakeholders have indicated that they support investment on worst served customers provided it yields an improvement of service for those customers. During RIIO-ED1 WPD will reduce the number of worst served customers by 20% from 20,000 to 16,000.

10.98 The investment will provide additional protection equipment to prevent faults affecting worst served customers. Where low cost solutions can be found, network reconfiguration and interconnection will also be carried out to enable supplies to be re-routed quickly when faults occur.

Worst served customer expenditure (£m)					
	West Midlands	East Midlands	South Wales	South West	WPD Total
DPCR5 Annual Average	0.0	0.0	0.2	0.1	0.3
RIIO-ED1 Annual Average	0.1	0.0	0.1	0.1	0.4
RIIO-ED1 Total (8 years)	**1.0**	**0.2**	**1.0**	**1.0**	**3.1**

Operational IT&T (Real time control systems and telecommunications)

10.99 WPD uses a dedicated communication infrastructure to monitor the loads flowing through the electricity network, understand its operational state and remotely control devices. This operational IT&T system consists of three elements:

- devices installed at substations that collect information locally and link to the communications network;
- communication infrastructure that carries the data between the substations and central control rooms;
- control centre hardware that collates the information and allows engineers to control the network in real-time.

10.100 The proposed expenditure will maintain the integrity of the systems, whilst incorporating necessary network expansion and improving reliability and security.

Substation devices

10.101 The electronic devices used to connect remote sites to the communications network are collectively known as Remote Terminal Units (RTUs). They have a life expectancy of around 15 years. An extensive replacement programme across West Midlands and East Midlands was completed in 2012 and so no further expenditure will be required until RIIO-ED2 in these areas. The replacement of RTUs in the South West and South Wales will be carried out over a five year period between 2014 and 2018, with the programme being completed by the third year of RIIO-ED1.

Communications infrastructure and Cyber security

10.102 WPD has developed its own internally managed telecommunications infrastructure for operational data communication. This approach is cost effective, reliable and more resilient when compared to third party providers.

10.103 The infrastructure comprises scanning radio that transmits data from radio transmitters located remotely on a range of network assets to base-stations located at major substations. Microwave and fibre optic communications then transfers the data between the base-stations and our control centres.

10.104 Within West Midlands and East Midlands, mobile phone GPRS technology is currently used to communicate with remote devices. GPRS communication does not provide sufficient reliability and is not fully secure, with the potential for third party interference.

10.105 GPRS devices will reach the end of their life through the RIIO-ED1 period and at this point they will be replaced with our standard scanning radio network to create a more secure common platform across the whole of the WPD network.

10.106 In addition many of the existing scanning radio system transmit data on unlicenced channels. Other users can broadcast on the same frequencies and this can cause interference leading to failures in the communication of data. Where this occurs licenced solutions will be installed to provide exclusive use of channels.

10.107 We will further enhance security by applying additional data signal encryption in order to limit the potential for third party interference in our network.

Control centre hardware and software

10.108 Due to its strategic importance, the hardware used for the WPD control system is upgraded every five years to take advantage of technological developments in processing speed and capability. It is anticipated that the next generation of hardware will allow continuous calculation of network parameters such as dynamic load flows and fault levels, which will set the foundation for smarter network operational control.

10.109 Software is regularly updated to take advantage of improvements in functionality. These advances are predominantly driven by WPD and each extension to functionality is subject to revised licencing charges. The cost forecasts are in line with previous developments carried out over the last 10 years.

Foundation for smart grids

10.110 In the general network reinforcement section of this document we refer to using the Transform model to assist in understanding the investment needs driven by the expected growth in LCTs. As part of its output, this model assesses the need for enabler technologies that support the development of a smart grid, such as data communication and analysis systems.

10.111 The majority of communication technologies that the Transform model identifies are local monitoring and control systems. The costs of these local control systems are included in the load related expenditure.

10.112 The communication between these local control schemes and central control centres will require additional communications infrastructure that is forecast to cost around £5m over the RIIO-ED1 period.

Expenditure summary

Operational IT&T expenditure (£m)					
	West Midlands	East Midlands	South Wales	South West	WPD Total
DPCR5 Annual Average	5.0	5.7	1.2	2.2	14.1
RIIO-ED1 Annual Average	3.0	3.2	2.9	2.9	12.0
RIIO-ED1 Total (8 years)	**24.3**	**25.4**	**22.9**	**23.4**	**95.9**

BT 21st Century (BT 21CN)

10.113 WPD rents a number of telecommunication circuits from BT which are used for protection and SCADA. Dedicated circuits have been used to provide fast fault clearance times to maintain the stability of the transmission system, distribution networks and connected generators.

10.114 BT is in the process of converting its existing network to an internet protocol system known as BT 21st Century Network (BT 21CN). Since the communication path for each transmission of data is not predetermined, there could be delays in delivering the signals that may cause electricity distribution network protection systems to function incorrectly.

10.115 WPD plans to replace all telecommunication circuits affected by BT 21CN with circuits owned and operated by WPD's own telecommunication company, Surf Telecom. Three generic solutions have been proposed using fibre optic, microwave and UHF radio. It is proposed that all work will be completed in South Wales and South West by the end of DPCR5, with work on 75 protection and 200 SCADA circuits in West Midlands and East Midlands being carried out during RIIO-ED1.

BT 21CN expenditure (£m)					
	West Midlands	East Midlands	South Wales	South West	WPD Total
DPCR5 Annual Average	1.1	2.1	0.8	0.2	4.2
RIIO-ED1 Annual Average	0.7	1.1	-	-	1.8
RIIO-ED1 Total (8 years)	**5.9**	**8.8**	**-**	**-**	**14.7**

Black Start

10.116 Although extremely rare, a number of blackouts across the world over the last decade (in the USA, Europe and across India) have highlighted that very widespread supply interruptions (blackouts) can occur. Blackouts can be triggered by a coincidence of circumstances that as a result of standard network running arrangements, cause disconnections of customers to cascade as each alternative network reacts to the situation. Recovery from the blackout - a 'Black Start' - can take a number of days as generation stations return online and network loads are balanced with the output of generation.

10.117 The electricity industry has developed a standard that requires major substations to have the resilience to remain operational for 72 hours. The main consideration in meeting this standard is the length of time that control and protection batteries will last.

10.118 WPD will make all substation battery systems at major substations resilient to 72 hours. This will be achieved by increasing the capacity of batteries used for control and installing load disconnection schemes to manage the drain on batteries used for tripping of switchgear and protection.

10.119 In addition, telecommunications are essential to the organisation and coordination of the resources needed for successful restoration of supplies. WPD therefore proposes to carry out a range of works (such as installation of generation to improve the backup power supplies at key telecommunications sites to 72 hours resilience). This additional work only applies to the West Midlands and East Midlands businesses.

Black Start expenditure (£m)					
	West Midlands	East Midlands	South Wales	South West	WPD Total
DPCR5 Annual Average	-	-	0.1	-	0.1
RIIO-ED1 Annual Average	0.4	0.8	0.2	0.4	1.9
RIIO-ED1 Total (8 years)	**3.3**	**6.4**	**1.6**	**3.5**	**14.8**

Protecting equipment from flooding risk

10.120 Widespread flooding across the UK in 2007 affected network assets and interrupted electricity supplies to thousands of customers in Gloucestershire and Yorkshire. These interruptions highlighted the potential vulnerability of electricity substations to flooding. Following a Government review and the publication of the Pitt Report, a programme of flood defences was instigated.

10.121 Climate change predictions suggest that flooding could become a more regular occurrence.

10.122 WPD has been working with the Environment Agency to identify the substations at greatest risk and by the end of DPCR5 an additional 120 substations will have been protected. Stakeholders have indicated that investment in flood defences is a high priority and consequently during RIIO-ED1 the WPD programme will be extended to a further 75 sites, protecting customers from the risk of power cuts due to flooding.

10.123 Investment will be used to build protective walls around vulnerable equipment.

Flood defence expenditure (£m)					
	West Midlands	East Midlands	South Wales	South West	WPD Total
DPCR5 Annual Average	0.6	1.5	1.3	0.8	4.2
RIIO-ED1 Annual Average	0.1	0.6	0.9	0.1	1.8
RIIO-ED1 Total (8 years)	**1.1**	**4.9**	**7.5**	**1.1**	**14.6**

Critical National Infrastructure Security

10.124 WPD works with the security services and the Centre for the Protection of the National Infrastructure (CPNI) to take even more stringent security measures at sites that are key to the UK. The CPNI assessments consider the number of customers connected to a specific site, its criticality to the network in general or its role in supporting key installations or customers. When a site is defined as being part of the CPNI list, additional security works are undertaken to increase the protection of the site.

10.125 The measures include the installation of enhanced and electrified fences, alarm systems and CCTV systems. Expenditure expectations are forecast to be £5m with costs being recovered once work is completed.

Substation security

10.126 WPD has legal obligations to operate its distribution networks safely and reliably. In addition to the protection of the general public from dangers of electricity and the reduction of the risk of personal injury to staff there is also a heightened requirement to ensure sites and assets are secure to prevent third party trespassing, vandalism and theft.

10.127 Although it is virtually impossible to prevent access by a determined thief, improved deterrent measures are required to deter unauthorised access and to make it more difficult.

10.128 At larger substations intruder alarms and security specification doors will be installed. CCTV will be added to higher risk sites and electric fences will be added to very high risk sites.

10.129 At distribution substations innovative tagging and identification systems will be installed allowing stolen equipment to be more readily traced to deter theft.

132kV & EHV site security expenditure (£m)					
	West Midlands	East Midlands	South Wales	South West	WPD Total
DPCR5 Annual Average	1.6	1.0	1.6	1.0	5.2
RIIO-ED1 Annual Average	0.8	1.4	-	-	2.2
RIIO-ED1 Total (8 years)	**6.3**	**10.8**	**-**	**-**	**17.1**

Distribution substation security expenditure (£m)					
	West Midlands	East Midlands	South Wales	South West	WPD Total
DPCR5 Annual Average	0.2	0.2	0.0	0.0	0.4
RIIO-ED1 Annual Average	0.3	0.2	0.1	0.1	0.7
RIIO-ED1 Total (8 years)	**2.3**	**1.4**	**0.7**	**0.7**	**5.1**

Overhead line clearance to ground

10.130 The ESQCR specifies ground clearance requirements for overhead lines that span across roads. This is to ensure that vehicles passing under the lines have sufficient clearance without the risk of snagging the lines.

10.131 Advances in line height measurements techniques now allow staff to measure the height of road crossings from the side of the road. These new instruments have identified that around 20% of road crossings, mainly overhead services, are non-compliant with clearance requirements.

10.132 Overhead lines that do not meet the requirements will be rebuilt to increase the height across roads. This will require taller poles and overhead line re-conductoring.

10.133 The work to correct any shortcomings will carry on throughout DPCR5, but there will be a need to continue into RIIO-ED1. The following table shows the costs specifically for this activity. These costs are included in the overall legal and safety costs.

Legal and safety – overhead line clearance to ground expenditure (£m)					
	West Midlands	East Midlands	South Wales	South West	WPD Total
DPCR5 Annual Average	0.7	0.6	0.5	1.0	2.8
RIIO-ED1 Annual Average	1.8	1.4	1.2	2.3	6.7
RIIO-ED1 Total (8 years)	**14.2**	**11.6**	**9.3**	**18.4**	**53.5**

Total legal and safety expenditure

10.134 In addition to ground clearance and security work there are a range of lower cost investments proposed for safety and legal reasons including dealing with asbestos and installing fire protection. The total expenditure is shown below:

Legal and safety expenditure (£m)					
	West Midlands	East Midlands	South Wales	South West	WPD Total
DPCR5 Annual Average	3.0	2.6	2.1	2.1	9.8
RIIO-ED1 Annual Average	3.0	3.2	1.3	2.5	9.9
RIIO-ED1 Total (8 years)	**24.2**	**25.3**	**10.2**	**19.9**	**79.6**

Compliance with ESQCR Regulation 18

10.135 Regulation 18 of the Electricity Safety, Quality and Continuity Regulations (ESQCR) 2002 specifically deals with the clearance of overhead lines to structures. New overhead lines are designed to be clear of buildings and other obstacles to reduce the risk of inadvertent contact. Where existing lines are close to buildings, the regulations require that lines are modified to remove the risk.

10.136 WPD has identified the locations where work is required and the majority of the programme will be completed in DPCR5, but there will be part of the programme in the South West that will continue into RIIO-ED1.

ESQCR horizontal clearance expenditure (£m)					
	West Midlands	East Midlands	South Wales	South West	WPD Total
DPCR5 Annual Average	2.0	1.3	1.1	4.1	8.5
RIIO-ED1 Annual Average	-	-	-	1.8	1.8
RIIO-ED1 Total (8 years)	**-**	**-**	**-**	**14.1**	**14.1**

Metal theft remedial actions

10.137 Significant increases in the prices of commodities such as copper and aluminium have resulted in increased incidence of theft, especially theft of copper low voltage overhead lines and earthing conductors located within primary and distribution substations.

10.138 WPD has been proactively working with police forces to assist in crime prevention. We have provided guidance to improve the identification of recovered stolen materials and facilitated meetings with neighbouring forces to ensure that intelligence is shared across police area boundaries. Although this has led to a number of arrests and prosecutions, theft continues to be a problem.

10.139 In addition to safety risks the consequences of theft are the need for remedial works to replace the stolen assets, repairs to damaged fences and doors, interruptions to supply and inconvenience for customers.

10.140 The costs for metal theft remedial actions are included within the totals for Trouble call.

Reducing technical losses

10.141 An electricity network uses energy to facilitate the delivery of power to customers. Some of this energy is fixed and is related to the network (mainly transformers) being energised. The remainder is variable and related to the level of electrical load which is flowing through cables and wires causing a heating effect. The summation of this energy is referred to as technical losses.

10.142 Another reason for electricity losses is where there is no meter or supplier at the final connection to record the usage. There are situations where a connection has been made to our system without authority. The energy used in these connections is not metered and does not feature in volumes that suppliers register. As a result it is shown as a loss on our network. This is known as theft in conveyance or illegal abstraction

Improved understanding of losses

10.143 We plan to improve our understanding of losses by using the established highly monitored network in South Wales which supported the Low Carbon Network Fund (LCNF) LV Templates project. This network can measure the power supplied into this network at HV and also measure the power delivered from the LV substations. The losses in this section of network will be due to technical losses, as most illegal abstraction occurs beyond this point on the LV network. We will investigate ways of extrapolating this data to provide reliable loss baselines for different network types.

Addressing losses in transformers

10.144 To reduce the variable losses in a transformer the resistance of the wires needs to be decreased, which can be done by increasing the cross sectional area of the wires or using materials with a lower resistance. To reduce the fixed losses the efficiency of the magnetism needs to be improved, which can be done by using materials with better magnetic properties.

10.145 The additional costs of low loss transformers have long pay-back periods which normally make them uneconomic.

10.146 New legislation is anticipated to be passed in the EU during the RIIO-ED1 for the mandatory installation of low loss transformers. Although the implementation of this law is not expected for some time, the impact would be in the order of £5m per annum based on manufacturers' estimates and current price difference between "normal" and low-loss transformers.

10.147 WPD believe that any obligation arising before the end of RIIO-ED1 will be minimal and we will absorb the higher costs through efficiency improvements elsewhere.

10.148 In the meantime WPD will adopt a selective programme of oversizing transformers where we identify coincident LCT clustering that requires re-sizing of the transformer at a later date. Data from the CSE informs us that 7% of the network will be subject to LCT hotspots and to deal with these we will install 109 oversize transformers at an incremental cost of £0.1m per annum.

Addressing losses in cables

10.149 To reduce the variable losses in a cable the cross sectional area of the conductors needs to be increased. Once a cable is laid and the ground is reinstated, there is very little chance to make alterations to the cable. We will take the opportunity whilst installing cable to consider whether a larger size will provide a loss reduction. Data from the CSE informs us that 7% of the network will be subject to LCT hotspots and consequently we will use larger cable in these situations. This will equate to 75km per annum being installed with a higher rating and lower losses. The incremental cost will be £0.3m per annum.

Demand side management (DSM)

10.150 Assets working at their maximum capacity will lead to significantly more losses than those with a reduced loading. The scale of variable losses can therefore be reduced by simply reducing the demand on the network or by reconfiguring networks to transfer loads from highly loaded circuits to lower loaded circuits. In our LCNF projects we are developing methods to monitor and automatically reconfigure networks. Where these networks can be meshed (operated in parallel) and loads transferred it will be possible to reduce the overall losses.

Imbalance and power factor

10.151 We will look to develop new ways of addressing loading imbalance and improvement to power factor. We are already developing a project with a solar generation customer that will use the customer's inverter equipment to alter the phase angle of the generated power. It will also use local storage to set the generated power per phase to reduce overall network imbalance.

Theft in conveyance

10.152 Theft of electricity from our network adds to the level of recorded losses, but is difficult to detect exactly where it is occurring.

10.153 We plan to use the "addresspoint" standard to produce a list of premises which do not have an electricity supply registered to them. By starting from the assumption that all premises in the UK have an electricity supply, we can use this list to establish a subset of premises without a registered supply and which would require a physical inspection. This desktop analysis will make the targeting of potential theft a much more efficient system.

Expenditure

10.154 We propose to cover the cost of the larger size assets through efficiency savings. We therefore have not requested any specific allowances for this activity.

Environmental

Reducing oil leaks from equipment

10.155 The design of very high voltage underground cables has evolved over many years and our new cables use a solid plastic insulation. Old designs of 33kV and higher voltage cables used insulation oil inside the cable. Although these cables are normally very reliable, the oil may leak out if they are damaged. The oil is biodegradable in the long-term, but leaks can cause immediate environmental damage to land and water courses.

10.156 The cables are monitored to allow quick response should a leak arise but traditional methods of leak location can be slow and expensive.

10.157 WPD has helped in the development of a technique to help pinpoint leaks more quickly, thereby reducing the amount of oil lost in the environment before a cable is repaired. We have been trialling a new technique called PFT tagging. PFT tagging adds a tiny amount of tracer to the fluid in the cable and if a leak occurs the tracer can be detected. Identifying the source of the tracer locates a leak quickly and to within a few meters, reducing both the amount fluid leaking into the environment and extent of excavation. The programme of tagging will be extended to all cables that have a history of leaks.

10.158 In addition, the asset replacement programme will replace the 1% of cables that have the highest leak rates, especially where the leaks are due to the deterioration of the cables.

Reducing SF6 gas leaks from equipment

10.159 Sulphur Hexafluoride (SF_6) is a gas which is used throughout the industry as an insulation medium in switchgear. It has very good electrical properties and has allowed switchgear to be designed into smaller packages thereby reducing the amount of materials used in the production of switchgear and reducing the physical space needed to build a substation. Although SF_6 has excellent insulating properties it is a potent greenhouse gas. There is no suitable replacement for this gas and it remains in widespread use in the electricity industry.

10.160 Over half of stakeholders indicated that the reduction of SF_6 leaks should be a high priority and supported replacing the 1% of switchgear with highest leak rates. The cost of doing so is included in the table below.

Total environmental expenditure

10.161 In addition to reducing leaks from equipment we will carry out work to deal with noisy equipment and in a limited number of instances we will underground overhead lines to improve visual amenity in areas *outside* AONBs and National Parks. The total environmental expenditure is shown below:

Environmental expenditure (£m)					
	West Midlands	East Midlands	South Wales	South West	WPD Total
DPCR5 Annual Average	1.3	1.7	0.4	1.4	4.9
RIIO-ED1 Annual Average	0.5	0.6	0.3	0.3	1.6
RIIO-ED1 Total (8 years)	**4.1**	**4.6**	**2.1**	**2.3**	**13.2**

Undergrounding in National Parks and AONBs

10.162 WPD's geographic area includes a large number of National Parks and AONBs. The distributed nature of the network means that overhead lines are installed within these areas, sometimes near iconic sites. There are locations, especially at popular tourist sites, where the removal of selective overhead lines can enhance visual amenity.

10.163 Stakeholders suggested that the programme of undergrounding should be increased. We will therefore replace 55km of overhead line with underground cable during RIIO-ED1. We will continue to work collaboratively with National Park and AONB representatives to identify the areas that would benefit greatest from the undergrounding of overhead lines.

10.164 The unit costs used within the forecasts shown in the table below are lower than DPCR5 unit costs so as to drive the selection of projects that provide visual amenity improvements for less expenditure:

Undergrounding in National Parks and AONBs expenditure (£m)					
	West Midlands	East Midlands	South Wales	South West	WPD Total
DPCR5 Annual Average	0.4	0.4	0.1	0.2	1.2
RIIO-ED1 Annual Average	0.3	0.1	0.2	0.4	1.0
RIIO-ED1 Total (8 years)	**2.3**	**0.9**	**1.4**	**3.0**	**7.7**

Inspection and maintenance

10.165 The equipment used in the network normally has a long working life and many assets are operational for over 40 years. To ensure the assets remain in a good condition for the whole of their lifetime, inspection and maintenance is used to preserve their condition.

10.166 WPD's approach to inspection and maintenance is to use periodic inspections to determine the condition of assets. The inspection regime is determined by manufacturers' guidance, national policy, and local awareness e.g. the asset is close to the sea. The results of the inspections inform reactive maintenance, as well as triggering enhanced inspections and/or assessment of asset health for asset replacement considerations if appropriate. Routine maintenance is scheduled to anticipate and limit the impact of degradation.

10.167 The annual costs of the existing inspection and maintenance programmes have reduced as a result of business efficiencies and are expected to remain broadly the same for each year of RIIO-ED1 as shown in the table below:

Inspection and maintenance expenditure (£m)					
	West Midlands	East Midlands	South Wales	South West	WPD Total
DPCR5 Annual Average	12.8	12.0	5.7	6.5	37.0
RIIO-ED1 Annual Average	8.0	7.2	4.1	5.4	24.8
RIIO-ED1 Total (8 years)	**64.2**	**57.6**	**33.0**	**43.5**	**198.4**

10.168 The inspection of service positions and the identification of defects are currently undertaken by suppliers when they carry out meter readings. The move to smart meters will mean that every service position will be assessed during RIIO-ED1 resulting in the removal of defective service equipment. Once the rollout of smart meters is complete, suppliers will rely on remote reading capability and inspect service positions less frequently. We will be developing an understanding of the impact of these changes to determine whether a service position inspection programme is required in RIIO-ED2.

Tree cutting - routine

10.169 Overhead lines are susceptible to damage from growing trees, falling trees and windborne vegetation. Climbable trees near overhead lines also pose a danger to the public where physical contact with conductors is possible. Tree clearance is therefore carried out to reduce the risk of injury to the public and to prevent damage causing interruptions to supply.

10.170 Routine clearance is carried out to maintain distances specified within Industry Standard ENA TS 43-8 (that specifies a minimum of 3 metre clearance for climbable trees and 0.8 metres for all others). The majority of tree cutting is a cyclical activity that clears sufficient distance from trees to maintain minimum clearance distances between cuts. Tree cutting remains the most practical and cost effective option compared to the alternatives of replacing open wire LV lines with Aerial Bundled Covered (ABC) conductor, diverting lines (assuming alternative routes can be obtained) or undergrounding.

10.171 There are backlogs of clearance in West Midlands and East Midlands that will be removed by the end of DPCR5. Consequently the expenditure in RIIO-ED1 will reduce once the programme is solely based upon routine 5-yearly tree clearance cycles.

10.172 Routine tree cutting costs are shown in the table below:

Routine tree clearance expenditure (£m)					
	West Midlands	East Midlands	South Wales	South West	WPD Total
DPCR5 Annual Average	13.1	9.3	7.0	9.2	38.6
RIIO-ED1 Annual Average	5.7	4.2	5.7	7.9	23.5
RIIO-ED1 Total (8 years)	**45.5**	**33.6**	**46.0**	**63.2**	**188.2**

Tree cutting - improving network resilience to severe weather

10.173 During the stormy weather in October 2002 tree related network damage caused some customers in the UK to be without power for up to five days. Following the storm the Government changed the legislation to ensure that DNOs did more to prevent supply interruptions caused by trees. The legal changes required DNOs to operate progressive resilience tree cutting and felling programmes to improve network performance in abnormal weather conditions.

10.174 The Government's Regulatory Impact Assessment assumed that clearance should be applied on a modest yet progressive basis, clearing 0.8% of the higher voltage networks per annum resulting in 20% being resilient after 25 years (by 2034).

10.175 Stakeholders have taken the view that this programme should be advanced and therefore WPD will deliver the programme within 20 years, increasing the volume from 500km to 700km per annum. The costs of the accelerated programme are shown in the table below:

Resilience tree clearance expenditure (£m)					
	West Midlands	East Midlands	South Wales	South West	WPD Total
DPCR5 Annual Average	1.3	0.7	1.0	0.8	3.8
RIIO-ED1 Annual Average	2.0	1.8	1.6	2.3	7.6
RIIO-ED1 Total (8 years)	**15.6**	**14.0**	**12.9**	**18.1**	**60.6**

Responding to and repairing faults (Trouble call)

10.176 "Trouble call" includes the activities of responding to reported issues and resolving faults. Trouble call includes incidents that cause customers to go off supply (and are incentivised under the Interruptions Incentive Scheme (IIS)). It also includes occurrences not incentivised (ONIs) where customers are not off supply, such as reports of flashing requiring investigation, call outs to reports of potential break-ins to substations, falling trees that might be near our equipment or gates and/or access doors being damaged. Both IIS and ONI type faults require some form of urgent response.

10.177 When faults happen the priority is the restoration of supply so that customers experience minimal inconvenience. Where appropriate, generators and temporary arrangements are provided to restore supplies when a quick repair is not possible.

10.178 The extensive nature of the network means that there are around 50,000 incidents each year affecting customer supplies and a further 80,000 ONIs where some form of site visit is required. The costs of this response and the associated repairs to the network are shown below.

Responding to and repairing faults expenditure (£m)					
	West Midlands	East Midlands	South Wales	South West	WPD Total
DPCR5 Annual Average	28.6	30.4	11.6	21.4	91.9
RIIO-ED1 Annual Average	24.7	28.7	10.8	19.5	83.7
RIIO-ED1 Total (8 years)	**197.3**	**229.5**	**86.7**	**155.8**	**669.4**

Substation electricity, remote generation and dismantlement

10.179 WPD has contracts in place for the purchase of unmetered electricity consumed at substations. Forecasts assume that expenditure will continue in line with DPCR5 levels; approximately £6m per annum across the group.

10.180 There are two locations within WPD where the provision of permanent standby generation is needed to provide security of supply to remote networks. In the South West the generation provides security of supply support to the Isles of Scilly and in South Wales it provides security at Tregaron where there is limited 11kV interconnection.

10.181 Very occasionally network assets are dismantled, permanently removed and no alternative assets are installed. This happens where there is no longer a need for an electricity supply or where the progressive development of the network renders other parts of the network unnecessary. Expenditure within this category is low within South West and South Wales at around £1m per year, but within the East Midlands and West Midlands, where there is more change of land usage, cost are approximately £1m per annum.

10.182 The total costs across all three areas are shown in the table below:

Substation electricity, remote generation and dismantlement expenditure (£m)					
	West Midlands	East Midlands	South Wales	South West	WPD Total
DPCR5 Annual Average	2.4	2.7	1.1	1.7	7.9
RIIO-ED1 Annual Average	2.5	2.9	1.1	1.8	8.3
RIIO-ED1 Total (8 years)	**19.6**	**23.5**	**9.0**	**14.1**	**66.2**

Smart meters

Introduction

10.183 Smart electricity and gas meters are due to be installed in all homes in a supplier led mass rollout planned to commence towards the end of 2015 and finish during 2020.

10.184 Although the smart meter programme is being managed by the Government in liaison with the main electricity Suppliers, DNOs will play a key part in its successful delivery.

10.185 The accelerated nature of the rollout programme (approximately four times quicker than the current meter replacement programme) means that there will be an increase in the number of issues reported about DNO owned service equipment. WPD will be required to rectify these issues to ensure that the rollout programme is not delayed.

10.186 Smart meters are expected to provide benefits for WPD with improved business efficiency and customer service. This will require the development of new business processes and systems to support the smart meter environment and utilise the additional facilities and data that will be made available.

10.187 The transfer of data and instructions to and from the meter will be managed by a separate central Data and Communications Company (DCC), who will charge users such as WPD for the services provided.

Benefits for WPD

10.188 The smart meter programme has the potential to provide data to enhance existing core business activities such as fault management, network planning and asset management. There are also potential benefits which can lead to future applications that will help the deployment of low carbon technologies and move to actively managed networks.

10.189 Detailed benefit analysis has been completed for smart metering in conjunction with the ENA. It is expected that over RIIO-ED1 the total gross benefit that WPD would expect to see from smart metering would be in the region of £9m to £12m, with £7.5m relating to benefits associated with applying smart metering to existing business functions.

Fault management

10.190 Smart metering will provide a number of functions to support fault restoration and reporting activities. On the occurrence of a supply interruption,' last gasp' functionality will allow a message to be sent notifying WPD of a loss of supply. This will provide a level of visibility down to the individual premise level that has not been available before. It will also be possible to remotely confirm which customers are on or off supply, aiding efficient supply restoration.

Network planning

10.191 Smart metering will increase the data available about the low voltage network providing two major benefits:

- more detailed information about network loading and voltage, that will allow better prioritisation of reinforcement work;
- better information when designing for new connections, potentially reducing the time to connect as well as the cost of connection.

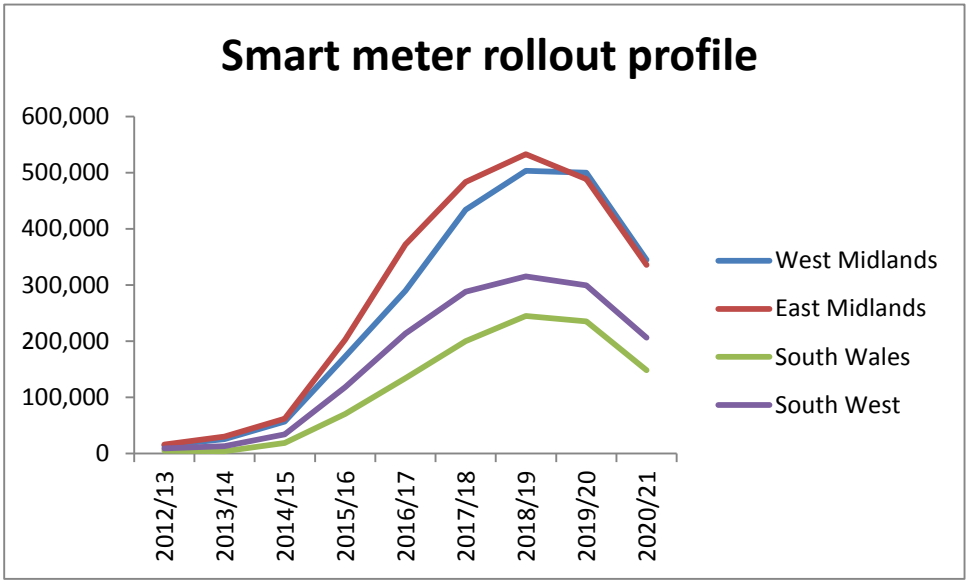
Future applications

10.192 Smart metering functionality has the potential to support more sophisticated future network operations such as load shifting and scheduling, application of variable tariffs and other demand side management techniques. It will also help to support a more active network management approach compared with the more passive approach applied today.

Rectification of service position issues

10.193 The installation programme for smart meters is being controlled by suppliers in liaison with their meter installers. Although in the majority of cases the meter operators will be able to proceed with the meter change, there will be situations where DNOs will need to carry out remedial work to service equipment to allow the installation of a smart meter to proceed.

10.194 The accelerated nature of the rollout programme means that there will be an increase in the number of defects reported. Whilst the programme is on average four times quicker than the current meter replacement rate, the timing of the rollout leads to a peak workload during 2018 and 2019 as illustrated in the following graph derived from supplier data in January 2013:



10.195 The actual number of defects is unknown, but for the purposes of forecasting work volumes and resource requirements it has been assumed that remedial work will be required for 2% of smart meter installations. Over the rollout programme this equates to 148,000 service issues in total. It is assumed that 4,500 would have been identified under business as usual and so there will be an additional 143,500 service issue to resolve. The rectification costs are shown in the table below:

Smart meter related cutout change expenditure in RIIO-ED1 (£m)					
	West Midlands	East Midlands	South Wales	South West	WPD Total
Cutout changes	**8.4**	**9.1**	**3.9**	**5.4**	**26.8**

10.196 At the peak of installation it is estimated that 30,000 visits will occur per annum based upon a service issue rate of 2%. This will require the equivalent of 60 staff to be deployed into this activity.

DCC charging arrangements

10.197 A new regulated organisation called the Data and Communications Company will manage the systems for communications between the meters and users of smart meter services. The DCC will be responsible for all end to end communications from the meters at customer properties to users' processing centres.

10.198 In order to fund and support the operation of the national smart meter infrastructure the DCC will levy charges for use of their network. These charges will cover the full end to end process covering the costs of three discrete elements:

- the communication network from the smart meters to the DCC - provided by the Communication Service Provider (CSP);
- internal DCC processing provided by the Data Service Provider (DSP);
- the communication network from the DCC to user's processing centres.

10.199 As at July 2013 an indication of the Communication Service Provider (CSP) element of the charges has been published. This service is to be levied in two distinct categories. Firstly "Fixed" costs based upon the number of meters and secondly, "Variable" costs based upon the number of transactions processed per period by the user. These charges are:

- Fixed cost of £0.20 per electricity meter enrolled per year;
- Variable cost (£ per transaction sent/received) varying from £0.002 to £0.20.

10.200 These charges are under review and are likely to change following contract award in August 2013. Further information is also awaited on the cost of all other elements of the DCC service.

10.201 The following table summarises the DCC fees and costs:

Smart meter related DCC expenditure in RIIO-ED1 (£m)					
	West Midlands	East Midlands	South Wales	South West	WPD Total
DCC licence fee	**2.4**	**2.4**	**1.2**	**2.0**	**8.0**
DCC fixed transaction costs	**5.4**	**5.7**	**2.6**	**3.9**	**17.6**
DCC variable costs	**1.0**	**1.1**	**0.5**	**0.6**	**3.2**

Development of WPD smart meter IT systems

10.202 WPD systems for communicating with the DCC and storing smart meter data will be developed by 2015. Additional systems will need to be developed during RIIO-ED1 for the migration of supplier registration processing away from DNO systems to the DCC and for the ability to carry out load management. The cost of these new systems is shown below:

Smart meter IT related expenditure in RIIO-ED1 (£m)					
	West Midlands	East Midlands	South Wales	South West	WPD Total
IT systems	**2.2**	**2.2**	**1.1**	**1.8**	**7.3**

Closely associated indirects (engineering management)

10.203 The expenditure on physically carrying out the work could not go ahead without the support of other 'indirect' activities such as planning, project management, system records, stores and transport. Many of the costs have reduced from DPCR5 levels as a result of efficiency savings following acquisition of the Midlands businesses.

Network design and engineering

10.204 Network Design and Engineering activity includes high level planning and detailed project design up to the point of project approval. These costs are forecast to flex in line with work volumes as shown in the table below:

Network design and engineering expenditure (£m)					
	West Midlands	East Midlands	South Wales	South West	WPD Total
DPCR5 Annual Average	5.4	5.5	2.6	3.3	16.8
RIIO-ED1 Annual Average	4.4	4.3	2.1	3.0	13.8
RIIO-ED1 Total (8 years)	**34.9**	**34.3**	**16.5**	**24.3**	**110.0**

Project management

10.205 Project Management follows on from project approval and relates to the activity of managing the delivery of network projects including work preparation, managing construction of the work and updating all records. Again the costs will flex in line with work volumes as shown in the table below:

Project management expenditure (£m)					
	West Midlands	East Midlands	South Wales	South West	WPD Total
DPCR5 Annual Average	5.6	5.9	3.0	4.3	18.8
RIIO-ED1 Annual Average	6.4	6.2	3.1	4.9	20.6
RIIO-ED1 Total (8 years)	**51.5**	**49.5**	**24.6**	**39.4**	**165.0**

System mapping

10.206 System Mapping is the activity of updating network geographical records. Although the volume of record updating will change as a consequence of network investment many of the costs, such as payment of Ordnance Survey licence fees are fixed, so it is forecast that costs will remain flat with any increases in volumes being managed through efficiency savings as shown in the table below:

System mapping expenditure (£m)					
	West Midlands	East Midlands	South Wales	South West	WPD Total
DPCR5 Annual Average	1.6	1.5	0.7	1.1	4.9
RIIO-ED1 Annual Average	1.4	1.4	0.7	1.2	4.8
RIIO-ED1 Total (8 years)	**11.4**	**11.6**	**5.7**	**9.4**	**38.0**

Engineering management and clerical support

10.207 Engineering management and clerical support (EMCS) relates to a wide range of office based activities of managing or assisting employees undertaking direct activities, but not directly involved with either planning projects or project managing. EMCS includes engineering managers, work programmers, resource planners and clerical staff. Some slight increases will be incurred to reflect increases in wayleave payments where an additional £56m will be required over the RIIO-ED1 period. EMCS costs are shown in the table below:

Engineering management and clerical support expenditure (£m)					
	West Midlands	East Midlands	South Wales	South West	WPD Total
DPCR5 Annual Average	20.9	20.8	7.9	10.3	59.9
RIIO-ED1 Annual Average	15.3	15.8	8.1	10.7	50.0
RIIO-ED1 Total (8 years)	**122.7**	**126.5**	**64.8**	**85.8**	**399.7**

Control centre

10.208 Control centre activities include the real time operational control and monitoring of the network, outage planning and dispatching resources in response to network faults and safety issues. The number of control rooms will be reduced from three to two and this consolidation will take place during 2013. There will then be two control centres, one serving the Midlands and once serving the South West and South Wales. No further changes are proposed during RIIO-ED1 and therefore once the new structure is established costs will remain fixed and are shown in the table below:

Control centre expenditure (£m)					
	West Midlands	East Midlands	South Wales	South West	WPD Total
DPCR5 Annual Average	4.4	4.4	2.2	3.1	14.1
RIIO-ED1 Annual Average	4.0	4.2	2.3	3.3	13.8
RIIO-ED1 Total (8 years)	**32.2**	**33.2**	**18.2**	**26.4**	**110.0**

Contact centre (call centre)

10.209 It is important for WPD's 7.8 million customers to have the means to contact the company easily. The WPD contact centres manage the main incoming telephone lines used by customers, taking the initial calls, recording details, providing information and forwarding customers on to the relevant parts of the organisation. There are no anticipated future savings from smart meters providing outage information, because staff will continue to contact customers to confirm that they are off supply. There will be an additional cost of around £0.5m per annum for the provision of additional social obligation services, such as a dedicated team for the validation of Priority Services Register data. Contact centre costs are shown in the table below:

Contactcentre expenditure (£m)					
	West Midlands	East Midlands	South Wales	South West	WPD Total
DPCR5 Annual Average	1.4	1.4	0.7	1.1	4.6
RIIO-ED1 Annual Average	1.4	1.4	0.7	1.1	4.5
RIIO-ED1 Total (8 years)	**10.9**	**10.9**	**5.5**	**9.0**	**36.3**

Stores

10.210 The WPD network investment programme requires a large throughput of materials that are held in local satellite stores supplied from two central warehouses. Supporting the stores activity are storekeepers, stock checkers and delivery drivers. Cost forecasts are assumed to be flat taking account of the savings achieved following the acquisition of the West Midlands and East Midlands businesses.

Stores expenditure (£m)					
	West Midlands	East Midlands	South Wales	South West	WPD Total
DPCR5 Annual Average	3.9	4.0	1.3	1.9	11.0
RIIO-ED1 Annual Average	2.6	2.5	1.3	2.1	8.5
RIIO-ED1 Total (8 years)	**20.5**	**20.4**	**10.3**	**16.8**	**68.0**

Network policy

10.211 Network policy relates to the development and review of environmental, technical and engineering policies that dictate what is done and the procedures to follow in doing so. During RIIO-ED1 new policies will be needed to reflect the learning of the LCNF and Network Innovation Competition. It is anticipated that the research work and trails will provide the majority of the development of the details and therefore the impact on the Policy Team resources will be limited. It is therefore forecast that current levels of expenditure will continue, as shown in the table below:

Network policy expenditure (£m)					
	West Midlands	East Midlands	South Wales	South West	WPD Total
DPCR5 Annual Average	0.9	0.8	0.3	0.4	2.4
RIIO-ED1 Annual Average	0.6	0.6	0.3	0.5	1.8
RIIO-ED1 Total (8 years)	**4.4**	**4.5**	**2.2**	**3.6**	**14.8**

Operational training (workforce renewal)

Introduction

10.212 Working and operating on the electricity network requires a strong awareness of potential dangers. Staff need to be trained and competent to undertake the required activities following prescribed procedures.

10.213 In addition to the specific training received when staff first join WPD, the introduction of new equipment or revised procedures requires that we also provide regular updates and refresher training to our staff.

10.214 As staff change roles their responsibilities change and additional operational and upskill training may be required to allow them to fulfill a wider range of responsibilities.

10.215 The costs of attending training courses and the provision of trainers, course material and training centres are therefore dependent upon the level of recruitment and the need for refresher and upskill training.

Drivers of workforce renewal

10.216 We need to be able to forecast the workforce renewal requirements and training needs to ensure that we have the correct level of resource and expertise in future years.

10.217 Workforce renewal is required to replace staff who retire or staff that leave the employment of WPD for other reasons (commonly referred to as 'natural wastage'). It includes the upskill training of existing operational staff for more complex roles.

10.218 In addition we need to constantly review our forward work programmes to ensure we are prepared for major changes in the type or volumes of work we are required to undertake.

10.219 WPD continually assesses a forward plan for recruitment and training to ensure that staff resource numbers are appropriate for the roles that the business requires.

10.220 Early action is taken so that the business has the required number and mix of resources to deliver its plans now and into the future.

Current workforce renewal

10.221 WPD currently recruits on average 190 new engineering staff per year to ensure that we have the required resources needed in DPCR5. The staff are normally recruited as apprentices (100 per annum), students/graduates (10 per annum) or as new skills trainees (80 per annum).

10.222 In addition we undertake upskill training for around 80 staff per year.

Planning for RIIO-ED1

10.223 WPD staff resource planning looks through both RIIO-ED1 and into the early years of RIIO-ED2 (in particular 2023/24/25). This is to ensure that we recruit sufficient numbers of new staff through RIIO-ED1 and train them such that we have the right number and mix of craft and technical skills for RIIO-ED1 and into the early years of RIIO-ED2.

10.224 In addition to specific changes in workload volumes (which are discussed later) there are two key sources of data that are regularly reviewed in respect of workforce numbers:

- the forward age profile of staff across our business and the skill sets that they possess (allowing the future anticipated number of retirees to be assessed);
- the long run average number of staff that have left WPD through natural wastage with any forward adjustment for significant known events e.g. an "Olympic Park" type development. (At this stage we do not anticipate any major change in our natural wastage numbers going forward and the line is therefore flat throughout RIIO-ED1).

10.225 These requirements are combined to establish the staff resource requirement and are used to feed into our recruitment and training plans.

10.226 In total we need to recruit and train 210 staff per annum (1,680 staff through the RIIO-ED1 period) to allow us to maintain our current DPCR5 staff numbers. As we currently recruit and train 190 staff per year in DPCR5 this represents a small additional replacement need of 20 staff per year (or 160 staff through the RIIO-ED1 period).

10.227 To meet this additional need through RIIO-ED1 and into RIIO-ED2 we plan to increase our recruitment of apprentices from 100 to 120 per annum.

10.228 In addition to these apprentices we will also continue to recruit and train a further 80 new skills trainees each year to replace the average number of people who leave the business through natural wastage.

10.229 Through DPCR5 we have provided upskill training to an average of 80 staff per year (predominantly training craft staff to technician or technician to specialist/team manager roles). This number will remain constant throughout RIIO-ED1.

10.230 Our graduate recruitment will continue at the same rate as that in DPCR5 at around 10 per annum.

10.231 All of these staff will be trained in the skills sets as appropriate for replacing those who have left or who are forecast to leave WPD.

Workload volumes for the WPD 'Best View' scenario

10.232 The analysis of asset replacement, general network reinforcement and LCT reinforcement required during RIIO-ED1 combined with the relatively small impact of smart metering results in a resource demand that remains broadly in line with our existing requirements for delivery of our work programme for DPCR5.

10.233 With respect to phasing of work, whilst towards the latter years of RIIO-ED1 the LCT workload shows some increase this coincides with the completion of the ESQCR works required to ensure horizontal safety clearances to buildings.

10.234 This ESQCR work will be completed in WPD South Wales and in both the WPD Midlands licence areas in 2015 and in WPD South West in 2018. Resources that become available from the ESQCR works can be readily deployed to meet increased LCT workload or other programmes as appropriate with minor geographical adjustments made to replace staff following retirements or natural wastage as necessary to meet specific work demands.

10.235 It should also be noted that the level of upskill training also remains broadly flat through RIIO-ED1 and in line with the DPCR5 period.

Impact on training facilities

10.236 WPD owns and operates two main training centres, in Taunton and Tipton, supported by a number of satellite training facilities.

10.237 We currently employ 32 full time trainers. In addition to undertaking new starter training these staff also conduct refresher training, course development, audits and other training activity.

10.238 Under the WPD best view scenario no changes are required to these facilities or trainer numbers.

Summary

10.239 We have detailed the need to increase our annual recruitment from 190 staff per annum to 210 representing an increase of 160 in total over the 8 years of RIIO-ED1. Further details are contained within the Supplementary Annex (SA-05) Expenditure.

Operational training expenditure (£m)					
	West Midlands	East Midlands	South Wales	South West	WPD Total
DPCR5 Annual Average	4.6	4.9	4.4	6.4	20.3
RIIO-ED1 Annual Average	6.0	6.0	4.4	5.9	22.2
RIIO-ED1 Total (8 years)	**47.8**	**47.7**	**35.3**	**46.8**	**177.5**

Business support costs (corporate activities)

10.240 Corporate activities (also referred to as business support indirects) include a number of central functions provided for all licence areas. Corporate costs are generally allocated broadly on the basis of network scale on a 30:30:15:25 ratio between West Midlands, East Midlands, South Wales and South West respectively.

Human resources and non-operational training

10.241 Expenditure on the human resources function includes development of HR policy and procedures, employee relations, payroll management, and the costs for non-operational training include the preparation and provision of non-engineering training courses. There are no major changes to expenditure and demonstrated in the table below:

Human resources and non-operational training expenditure (£m)					
	West Midlands	East Midlands	South Wales	South West	WPD Total
DPCR5 Annual Average	1.4	1.2	0.6	0.8	3.9
RIIO-ED1 Annual Average	0.8	0.8	0.4	0.6	2.6
RIIO-ED1 Total (8 years)	**6.1**	**6.2**	**3.6**	**5.0**	**20.9**

Finance and regulation

10.242 Finance and regulation expenditure covers a wide range of activities including the statutory, regulatory and internal management of cost, procurement, insurance, taxation and auditing activities. Although the scale of regulatory reporting has grown, WPD has implemented data analysis software (Hyperion) to make the extraction of data and population of reporting templates less labour intensive, faster and more auditable. This means that as the burden of regulatory reporting increases, the impact on resource requirements is minimised.

10.243 Ofgem is proposing to change licence conditions for illegal abstractions of electricity, introducing a new obligation for DNOs to investigate where a supplier is not registered at a property. When this is implemented, WPD will incur additional costs but these are not expected to be material.

10.244 Finance and regulation expenditure is shown in the table below:

Finance and regulation expenditure (£m)					
	West Midlands	East Midlands	South Wales	South West	WPD Total
DPCR5 Annual Average	7.4	6.7	4.4	7.0	25.5
RIIO-ED1 Annual Average	7.9	7.2	4.5	7.2	26.8
RIIO-ED1 Total (8 years)	**62.9**	**57.9**	**35.7**	**57.9**	**214.4**

CEO and corporate communications

10.245 The costs classed under CEO include the cost of directors, board meeting costs, corporate communications, community awareness, legal services and company secretarial. WPD will continue to raise awareness of its activities through an annual publication sent to all customers supported by a month long TV campaign. Additional activities will be carried out for communication of services for vulnerable customers and will cost an extra £0.5m per annum.

CEO and corporate communications expenditure (£m)					
	West Midlands	East Midlands	South Wales	South West	WPD Total
DPCR5 Annual Average	2.0	2.2	1.3	2.2	7.7
RIIO-ED1 Annual Average	2.3	2.4	1.0	1.6	7.2
RIIO-ED1 Total (8 years)	**18.0**	**19.0**	**8.0**	**12.9**	**57.9**

Vehicles, IT, property and engineering equipment

10.246 Non-operational capital relates to expenditure on new and replacement assets that are not network assets. During RIIO-ED1, WPD will refurbish some existing offices and purchase new operational vehicles, tools and IT systems.

Vehicle leases, maintenance and servicing

10.247 Historically in the West Midlands and East Midlands vehicles have been leased and maintenance has been contracted out to third parties, but in South Wales and South West vehicles have been purchased and maintained with in-house facilities, providing a dedicated, faster and more cost effective service. Vehicles in the Midlands will be progressively replaced with purchased items as the leases expire; this means that there will be a migration of costs from vehicle leases to vehicle purchase during RIIO-ED1.

Vehicle leases, maintenance and servicing expenditure (£m)					
	West Midlands	East Midlands	South Wales	South West	WPD Total
DPCR5 Annual Average	9.6	8.9	3.9	6.1	28.6
RIIO-ED1 Annual Average	4.3	3.3	2.2	3.7	13.4
RIIO-ED1 Total (8 years)	**34.1**	**26.2**	**17.2**	**29.9**	**107.5**

Vehicle purchases

10.248 During DPCR5 and RIIO-ED1 vehicles in the Midlands will be progressively replaced with purchased items as the leases expire; this means that there will be a migration of costs from vehicle leases to vehicle purchase during RIIO-ED1.

10.249 The decision to purchase rather than lease vehicles was taken because purchasing is justified by the cost benefit analysis (included at Supplementary Annex SA-05 Expenditure).

10.250 The table below shows the cost of vehicle purchases:

Vehicle purchase expenditure (£m)					
	West Midlands	East Midlands	South Wales	South West	WPD Total
DPCR5 Annual Average	4.4	3.9	1.2	2.1	11.7
RIIO-ED1 Annual Average	3.8	2.9	1.9	3.3	11.9
RIIO-ED1 Total (8 years)	**30.3**	**23.3**	**15.2**	**26.3**	**95.2**

Running costs for existing IT and telecoms

10.251 WPD's business support costs for IT and telecoms cover costs of system maintenance and administration, software licence fees and communication costs. Although savings have been made as part of the acquisition of the Midlands businesses, IT systems continually evolve and technological developments enhance system capability. There will be on-going costs for software licences and our forecast assumes that these costs will rise as more flexible mobile working arrangements are implemented and use of business intelligence tools increases.

Existing IT and telecoms expenditure (£m)					
	West Midlands	East Midlands	South Wales	South West	WPD Total
DPCR5 Annual Average	11.2	10.7	5.2	8.2	35.3
RIIO-ED1 Annual Average	9.9	9.9	5.0	8.2	32.9
RIIO-ED1 Total (8 years)	**78.9**	**78.9**	**39.8**	**65.4**	**263.0**

Capital purchase of IT&T

10.252 Reliable computer and telecoms infrastructure is critical in order to allow staff to carry out their duties. During RIIO-ED1 we will be making improvements to both IT and telecoms systems.

10.253 The evolution of computer systems brings improvements in functionality and faster processing of data. Servers, computers and printers are refreshed every 4-5 years to ensure devices remain reliable and take advantage of developments in technology.

10.254 The introduction of more mobile working throughout the company will lead to increased use of laptops and handheld devices for data collection and management of work.

10.255 The data communications network will be updated to meet the demand for an increasingly resilient, reliable, high bandwidth, low latency network to meet business needs for high volumes of data traffic - driven by smart metering, smart grids, mapping data, scanned images, graphics, pictures and video.

10.256 Modern telephony networks are predominantly operated using internet protocols allowing data and voice calls to use the same network. The system used in the South Wales and South West uses an older digital exchange and will therefore be converted to internet protocol in RIIO-ED1.

10.257 The implementation of in-house developed systems will only be considered when 'off the shelf' solutions are not available to meet business needs or where WPD can gain business advantage by building a tailor-made system. This approach allows systems to be quickly updated with additional functionality to cater for new outputs, measures and performance indicators.

IT & telecoms non-operational capital expenditure (£m)					
	West Midlands	East Midlands	South Wales	South West	WPD Total
DPCR5 Annual Average	2.8	2.6	1.9	3.1	10.4
RIIO-ED1 Annual Average	4.2	4.2	2.1	3.5	14.1
RIIO-ED1 Total (8 years)	**33.9**	**33.9**	**17.1**	**27.8**	**112.6**

Property management and maintenance

10.258 There are 59 non-operational properties throughout the region that are used to provide office space and parking for local teams. Having established more depots in the Midlands, there are no plans to significantly change the portfolio of property and therefore costs for rent, security, routine maintenance and cleaning are forecast in line with current levels of expenditure.

Property management and maintenance expenditure (£m)					
	West Midlands	East Midlands	South Wales	South West	WPD Total
DPCR5 Annual Average	4.8	5.6	2.1	3.4	15.8
RIIO-ED1 Annual Average	4.2	5.6	2.0	3.5	15.3
RIIO-ED1 Total (8 years)	**33.6**	**44.6**	**16.2**	**28.0**	**122.3**

Purchase and refurbishment of non-operational property

10.259 Non-operational property costs relate to premises used by people (e.g. depots and offices). There are no plans to purchase any new properties, but £2m per annum will be spent on improvements and refurbishments to buildings that have not been refurbished for over 10 years. The majority of expenditure will be in the South West where most of the older unrefurbished properties are.

Non-operational property expenditure (£m)					
	West Midlands	East Midlands	South Wales	South West	WPD Total
DPCR5 Annual Average	0.9	1.2	1.0	1.1	4.3
RIIO-ED1 Annual Average	0.4	0.4	0.3	0.7	1.8
RIIO-ED1 Total (8 years)	**3.4**	**3.3**	**2.3**	**5.4**	**14.3**

Tools and equipment

10.260 Craft and engineering staff require equipment to work on the network assets. The amount of tools and equipment used for work on the network varies in proportion to direct network costs and so the costs have been rolled forward in proportion to the changes in the work programme as shown in the table below:

Tools and equipment expenditure (£m)					
	West Midlands	East Midlands	South Wales	South West	WPD Total
DPCR5 Annual Average	2.8	3.3	1.7	2.0	9.8
RIIO-ED1 Annual Average	2.9	2.9	1.6	2.4	9.7
RIIO-ED1 Total (8 years)	**22.9**	**22.9**	**12.6**	**19.0**	**77.4**

Transmission exit charges

10.261 The WPD network is connected to the National Grid at Transmission Exit Points. National Grid provides infrastructure at these exit points to allow power to flow from the transmission system to the distribution network. National Grid recovers the cost of providing the exit points through annual charges.

10.262 The charges include the costs for new assets when additional capacity is requested by WPD The costs of replacing existing assets is determined by National Grid's replacement programme and are charged to WPD over a forty year period.

10.263 Where additional capacity is required, WPD's preference is to reinforce the distribution network as it is usually cheaper. Inevitably there are circumstances where it is necessary to request additional capacity from National Grid. WPD works closely with National Grid at Joint Technical Planning Meetings to determine which approach to reinforcement is the most economical.

10.264 Even though National Grid provide a quotation for the proposed work, the eventual charges are determined by the actual costs of the work. This means that if additional costs are incurred they are passed through to the charges levied on WPD. Hence there is little opportunity to influence the costs once projects are under way.

10.265 During RIIO-ED1 there will be limited requirement for new or reinforced transmission exit charges and this will add only £0.4m per annum to charges. The majority of costs cover previous requirements and National Grid's replacement programme. The following expenditure relates to pass through costs.

Transmission exit charges – pass through costs (£m)					
	West Midlands	East Midlands	South Wales	South West	WPD Total
DPCR5 Annual Average	9.8	7.1	5.1	6.5	28.5
RIIO-ED1 Annual Average	13.5	11.6	8.6	9.0	42.7
RIIO-ED1 Total (8 years)	**107.9**	**92.7**	**68.7**	**71.6**	**340.9**

Business rates

10.266 Rates are a tax on the occupation of property. They are based on the rental value of the property set by the Valuation Office, an executive agency of the Inland Revenue. Rates are calculated by rateable value multiplied by the uniform business rate, which is set by Central Government.

10.267 We have assumed that the next revaluation to set rateable values will take effect in England and Wales on 1 April 2017, and that rates will increase in line with projected RAV increases. We have also assumed that the same transitional relief mechanism (that only exists in England) will apply as for the 2010 revaluation i.e. first year cap of 12.5% increase, second year 17.5% and third year 20%.

10.268 The net impact of the assumptions above is to increase business rates by 17%. The total costs for the RIIO-ED1 period are broken down by DNO as follows:

Business rates (£m)					
	West Midlands	East Midlands	South Wales	South West	WPD Total
DPCR5 Annual Average	28.1	35.6	16.3	19.1	99.1
RIIO-ED1 Annual Average	34.5	45.3	18.1	18.3	116.2
RIIO-ED1 Total (8 years)	**276.0**	**362.7**	**144.8**	**146.4**	**929.9**

10.269 As was the case in previous revaluations WPD will do its best to engage with Valuation Office so as to ensure that business rate charges made on the four WPD DNOs are minimised.

Ofgem licence costs

10.270 Ofgem licence fees are calculated for the year ahead based upon an estimate of Ofgem's net costs plus an amount for Consumer Focus and Consumer Direct/The Office of Fair Trading. These are allocated across licence holders in proportion to the number of customers.

10.271 Fees are assumed to remain at the same level as in DPCR5. In 2012/13 licences fees for the four WPD licence areas were £3.8m.

Pensions

10.272 Pension costs are excluded from the various categories of costs in other parts of this plan because pension recovery rates can vary and so distort cost comparisons between years.

Background

10.273 There are two types of pension scheme:

- Final Salary Schemes that provide a pension to employees based on their salary at the time they retire (or leave employment if that is earlier) and their years of service;
- Defined Contribution Schemes that provide a pension that depends on how much was paid into the scheme by the employee and employer.

10.274 Final salary schemes need to be funded on the basis of estimates of the value of investments held by the scheme (the assets) and the projected pension costs (the liabilities). Both the assets and liabilities vary over time and full valuations are carried out every three years. If the assets are worth more than the estimate of the liabilities, there is a surplus. If the assets are worth less than the liabilities, there is a deficit.

10.275 When there is a deficit, companies have a legal obligation to pay in enough money over time to ensure that the deficit is eliminated. The period over which the deficit is eliminated is the deficit recovery period and is assumed to be over 10 years from 1st April 2014.

10.276 By their nature, defined contribution schemes can have neither a surplus nor a deficit.

10.277 Pensions matters are overseen by the Pensions Regulator who ensures that companies meet their obligations to the pensions schemes under both the pension scheme trust deeds and the Pensions Act.

WPD pension schemes

10.278 WPD operates two final salary schemes, the WPD Electricity Supply Pension Scheme (WPD ESPS) for employees and former employees of South West and South Wales; and the CN Electricity Supply Pension Scheme (CN ESPS) for employees and former employees of East Midlands and West Midlands.

10.279 Both of WPD's final salary schemes are closed to new members, but 72.5% of current employees are included within the final salary schemes.

10.280 WPD also operates a defined contribution (DC) scheme the Western Power Pension Scheme (WPPS) for employees that joined WPD after the final salary schemes were closed to new members. 27.5% of current employees are members of the DC scheme.

Defined contribution scheme pension costs

10.281 Under Ofgem's pension funding principles that were reaffirmed in 2012, costs related to defined contribution schemes receive a separate allowance. The defined contribution pension costs included in our plan are set out below:

Defined contribution scheme pension expenditure (£m)					
	West Midlands	East Midlands	South Wales	South West	WPD Total
DPCR5 Annual Average	0.7	0.8	0.2	0.4	2.1
RIIO-ED1 Annual Average	2.1	2.1	0.7	1.0	5.9
RIIO-ED1 Total (8 years)	**16.9**	**16.9**	**5.2**	**8.3**	**47.3**

Final salary schemes – ongoing costs

10.282 Employees accrue pension rights as they work, and they contribute to the costs of funding those pensions by paying a percentage of their salaries into the scheme.

10.283 WPD also helps fund the pension scheme. Following a valuation in 2011, for staff in the Midlands we currently pay an average standard contribution rate (SCR) of 22.4% of employees' salaries into the CN ESPS, while for South West and South Wales we pay an SCR of 24% of salaries into the WPD ESPS. These percentages (which exclude administrative costs and Pension Protection Fund levy costs) are in line with those paid by other DNOs and are less than those paid by GDNs as demonstrated by the table below:

Employer SCR (% of pay as at 31 March 2010) (Source GAD Report for Ofgem dated 16 May 2012)	
Scotia Gas Networks	43%
Scottish Hydro	42%
Northern Gas Networks	34%
National Grid Gas	32%
Electricity North West	29%
Central Networks East and West (pre 2011)	**28%**
Northern Power Grid	27%
UK Power Networks	26%
Scottish and Southern (Southern)	26%
SP Manweb	25%
Scottish Power	24%
National Grid Electricity	24%
WPD South West and South Wales	**24%**

10.284 The projected ongoing pension costs from April 2015 onwards are included in our plan are set out below:

Ongoing final salary pension expenditure (£m)					
	West Midlands	East Midlands	South Wales	South West	WPD Total
DPCR5 Annual Average	10.4	9.8	7.4	11.9	39.5
RIIO-ED1 Annual Average	8.5	8.5	7.1	11.3	35.4
RIIO-ED1 Total (8 years)	**67.8**	**67.6**	**57.1**	**90.5**	**283.0**

Final salary schemes – deficit contributions

10.285 Both the CN ESPS and the WPD ESPS are anticipated to have deficits at the next valuation date (31 March 2013).

10.286 The amount of deficit contributions needed changes with the value of the deficit and is determined in negotiation with the pension schemes' trustees every three years. The deficit changes with movements in financial markets, the level of contributions, membership changes and other assumptions (e.g. future interest rates) made by the actuaries when they estimate future cost of paying the pensions. During RIIO-ED1 valuations will take place based on the values as at 31 March 2016, 2019 and 2022.

10.287 Both the CN ESPS and the WPD ESPS include pensioners and former employees not yet drawing a pension that worked for parts of the wider WPD business outside of the main distribution business. Therefore, not all the pension deficit relates to the DNOs. Ofgem has therefore undertaken to provide an allowance only for an estimated 76.4% (for WPD ESPS) and 80.1% (for CN ESPS) of the revalued 2010 deficit provided that the deficit costs are determined as not being inefficient. Whether or not such costs are efficient will be determined by Ofgem on the basis of an independent reasonableness review to be commissioned by Ofgem.

10.288 In their restated pension principles, Ofgem have undertaken to give companies an allowance to pay the regulated 'distribution' portion of the deficits at 31 March 2010. No specific allowance is available for any deficit that is created after 31 March 2010 although the costs of any such incremental deficit relating to regulated activities will be allowed as part of overall employment costs. However, because of investment market changes, and changes in estimates of how long pensions are due to be paid, the March 2010 deficit is revalued from time to time.

10.289 Our forecast of pension costs for the defined benefit schemes is based on the most recent actuarial valuations (WPD Group 31st March 2010 and Central Networks Group 30th June 2011), projected forward to 31st December 2012 based on market conditions (including the latest mortality statistics) as at 31st January 2013.

10.290 The projected deficits based on independent actuaries' estimates for our two schemes at 31st December 2012 are:

- WPD Group £893m (of which £881m is 31 March 2010 deficit)
- Central Networks Group £577m (of which £570m is 31 March 2010 deficit).

10.291 After the submission of WPD's Business Plan in June 2013, Ofgem applied an adjustment to the RIIO-ED1 Pension Deficit Repair Allowance included in our plan. The effect of this was to reduce the Pensions Deficit Repair Allowance for the RIIO-ED1 period by a total of approximately £117m across all four WPD DNOs. The intention of this adjustment was to reflect not only the provisional DPCR5 adjustments but also certain other adjustments proposed by Ofgem and agreed in August 2013 on the basis that they would be subject to the 2013 valuation and pension review originally intended to be conducted by Ofgem prior to the commencement of the RIIO-ED1 price control.

10.292 It should be noted that any differences between this adjusted forecast and the allowances based on the outcome of the actual 2013 triennial valuations, subject to Ofgem's reasonableness review, will be taken into account through the Annual Iteration Process as set out in the RIIO-ED1 Strategy Decision Documents. This provides an opportunity for Pensions Deficit Repair Allowances to be reset for the years 2016/17 onwards.

10.293 The pension deficit allowances included in our plan relating to the deficits referred to above are set out in the table below:

Pension deficit repair expenditure funded through DUoS (£m)					
	West Midlands	East Midlands	South Wales	South West	WPD Total
DPCR5 Annual Average	19.4	17.9	13.2	23.4	73.9
RIIO-ED1 Annual Average	19.6	19.2	22.2	35.9	96.9
RIIO-ED1 Total (8 years)	**156.8**	**153.9**	**178.0**	**287.6**	**776.3**
Legacy Adjustments	8.9	9.4	-5.1	-6.3	6.9
RIIO-ED1 Total (8 years) inc. Legacy	**165.7**	**163.3**	**172.9**	**281.3**	**783.1**

Real price effects

10.294 WPD has engaged First Economics to assess real price effects (i.e. above inflation costs) and the findings are shown in the table below:

Real price effects (%)						
	2013/14	**2014/15**	**2015/16**	**2016/17**	**2017/18**	**2018/19 to 2022/23**
Labour – general	(0.6)	0.2	0.7	0.5	0.2	0.9
Labour – specialist	0.7	1.5	2.0	1.8	1.5	2.1
Materials – general/civils	0.7	1.7	1.3	1.0	0.8	1.1
Materials – electrical	0.2	2.2	1.8	1.5	1.3	1.6
Plant and equipment	0.2	1.2	0.8	0.5	0.3	0.6
IT	(2.1)	(2.1)	(2.5)	(2.8)	(3.0)	(2.7)
Property rentals	(0.6)	0.2	0.7	0.5	0.2	0.9

10.295 The forecast has been derived from a number of data sources including the Office for National Statistics and the Office for Budget Responsibility.

10.296 The forecasts costs for specific activities in the Business Plan have not included the effects of these above inflation costs. Their impact is accounted separately and offset, in part, by efficiency savings.

Regional drivers

10.297 WPD operates across a wide geographic area including large cities like Birmingham and Bristol, Cardiff and Nottingham and sparsely populated rural areas in Lincolnshire, Cornwall and South Wales.

10.298 Each location has its unique challenges but does not necessitate any specific locational or regional adjustments.

10.299 The only location where we agree there should be an allowance for regional effects is inner London.

Efficiency improvements

10.300 We have sought to identify the scope for year on year efficiency improvements. We have considered efficiency improvements in three component parts, they are:

- efficiency catch up, which relates to the opportunity for an inefficient DNO to improve its efficiency to a level consistent with the most efficient DNO;
- merger efficiencies, which relate to the cost saving delivered as a consequence of merger and acquisition activity;
- frontier efficiency shift, which relates to the on-going efficiency improvements that can be delivered by a DNO already operating at the efficiency frontier.

10.301 WPD has been identified as one of the most efficient DNOs. Therefore there is negligible scope associated with catch up efficiency.

10.302 The synergy and efficiency savings that have been delivered following WPD's acquisition of the West and East Midlands DNOs have been identified in this Business Plan. Therefore, there is no further scope for additional merger efficiencies.

10.303 However, our review of available information indicates that there is scope for year on year improvements available to WPD as a frontier performing DNO. Our Business Plan assumes that efficiency savings of 1% per year will be achieved for controllable cost elements of labour, materials and contractor costs.

Business efficiency improvement (%)								
	2015/16	**2016/17**	**2017/18**	**2018/19**	**2019/20**	**2020/21**	**2021/22**	**2022/23**
Labour	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Materials	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Contractors	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0

10.304 This 1% per year efficiency saving does not relate to any specific initiatives. However, the generic initiatives that we seek to exploit include:

- improvements to business processes;
- improvements to operational working practices;
- new innovative techniques developed as part of LCNF projects;
- learning from other DNOs, utilities and large asset based organisations;
- reductions in the cost of procured goods and services;
- continued use of in-house resource to undertake core activities;
- design of the right engineering solutions to network problems (i.e. no 'gold plating').

10.305 A copy of the First Economics report is available at http://www.westernpower.co.uk/docs/About-us/Stakeholder-information/Our-future-business-plan/Supporting-Expenditure-information/First-Economics-RPE-forecast.aspx

Traffic Management Act – impact of Permit Schemes

10.306 Legislation requires WPD to inform Highways Authorities about work that will affect public roads. This helps the authorities to manage the road network and where possible co-ordinate work with other utilities to minimise disruption to traffic and the effect on economic growth.

10.307 There are three different types of notification scheme in operation:

- Notices describe the work location, when the work will take place and how long it will take. They are the main method for notification and do not require any payment. Unless the Highways Authority objects, the work can go ahead as notified.

- Permits are similar to Notices, with the main differences being that the Highways Authority will grant permission or refuse permission based upon assessment of the submitted permit and that charges can be levied. The Department for Transport is actively encouraging Highway Authorities to implement Permit Schemes, specifically for strategic traffic routes.

- Lane Rental is a scheme where Highway Authorities charge a daily fee for access to work in the highway. These can only be implemented once an Authority has operated a Permit Scheme for at least two years. Consequently only a limited number of authorities have currently either implemented or are seeking to implement a Lane Rental scheme. However, over the RIIO-ED1 period it is envisaged that more authorities will implement them and that there could be a significant impact on costs.

10.308 Although there are currently four Permit Schemes operating within the WPD area, consultation with all the Highways Authorities has identified that several of them (particularly in West Midlands and East Midlands) will be seeking to develop permit schemes some of which are at advanced stages of implementation.

10.309 The introduction of these schemes will lead to costs that WPD cannot avoid, but the impact is not certain because the timing and scale of each scheme is determined by individual Highways Authorities. Additional annual costs have been forecast by considering the amount of work carried out on traffic sensitive roads and the typical costs of permits for different activities. These costs are normally incorporated within direct work activities but they are shown separately below to illustrate their impact on the business.

Licence area	Permit fee annual cost (£m)
West Midlands	0.37
East Midlands	0.45
South Wales	0.12*
South West	0.14

* South Wales permit costs would not be incurred until half way through RIIO-ED1, once the Welsh Assembly had determined their strategy.

10.310 The timing of Lane Rental schemes is unknown, but should they be introduced, WPD will incur additional multi-million pound costs each year. Due to the great uncertainty, WPD has not proposed any cost allowances in RIIO-ED1, but will require a price control re-opener mechanism to be in place should the introduction of Lane Rental schemes have a material impact on expenditure.

10.311 The costs indicated in this section have been incorporated into the costs of direct activities.

11 Uncertainty

11.1 The proposals in this Business Plan have been derived by using the most up-to-date information that is available and therefore represents WPD's best view. Although we are best placed to manage the risk of delivery of our plan, there are some areas of uncertainty which need additional mechanisms due to the external nature of the uncertainty and its potential impact.

11.2 In assessing the need for uncertainty mechanisms we consider:

- the reason for introducing each one;
- the appropriate mechanism;
- the value and impact on customers and other stakeholders;
- whether the proposed mechanism works with other aspects of the plan.

11.3 We also consider whether there are any drawbacks in terms of :

- undermining efficient delivery;
- price volatility;
- unintended consequences;
- complexity;
- resource cost to manage (both internal and at Ofgem).

11.4 The areas of uncertainty that meet these criteria are:

- load related expenditure (including uptake of low carbon technology);
- potential introduction of Lane Rental charges for works in the street;
- impact of the smart meter rollout;
- CNI security;
- innovation rollout.

Load related expenditure

11.5 The external drivers of investment due to changes in the demand on our network are:

- General economic conditions which has a significant influence on new connections;
- Customer behaviour in terms of energy efficiency and their usage in response to overall prices and tariffs introduced by suppliers;
- Rate of adoption of LCTs;
- Connection of DG which is heavily influenced by support mechanisms and planning policy.

11.6 The UK targets for reducing carbon dioxide emissions require a reduction of 80% by 2050. This target will be met through the decarbonisation of heating and transport, improvements in energy efficiency and producing electricity from renewable sources. A number of low carbon technologies - such as electric vehicles, solar panels, wind farms and heat pumps - place new requirements on the network.

11.7 As part of its Carbon Plan, DECC has set out 4 illustrative scenarios all of which would meet the Government's carbon targets. These national scenarios, all of which require a significant adoption of LCTs, have been summarised by DECC as follows:

Scenario 1	**High emissions abatement in low carbon heat**
• Medium levels of fuel efficiency • High levels of low carbon heat • High levels of solid wall insulation	High level of emissions reductions from uptake of low carbon heat in buildings and industry (8 million installations) with significant emission reductions from transport (60g CO_2/km) and significant thermal insulation of buildings (5 million solid wall insulation).
Scenario 2	**High emissions abatement in transport**
• High levels of fuel efficiency • Medium levels of low carbon heat • High levels of solid wall insulation	High level of emissions reductions from transport (50g CO_2/km), with comparatively lower reductions from low carbon heat (7 million installations) and significant thermal insulation of buildings (5 million solid wall insulation).
Scenario 3	**High electrification of heat and transport**
• High levels of fuel efficiency • High levels of low carbon heat • Low levels of solid wall insulation	This reflects a future where there is high electrification in heat and transport, with significant uptake of EVs and heat pumps (as in scenario 1 and scenario 2) and lower comparative levels of insulation (2.5 million).
Scenario 4	**Credit purchase**
• Low levels of fuel efficiency • Low levels of low carbon heat • Medium levels of solid wall insulation	Reflects a future where more than one key technology under-delivers, and carbon credits are purchased. It assumes 1.6 million low carbon heat installations, medium levels of insulation (4.5 million) and fuel efficiency of 70g CO_2/km.

11.8 Although DECC has produced a number of scenarios for meeting the target, there is considerable uncertainty about the uptake of low carbon technology, how installations will cluster and the resultant impact on the network.

11.9 The rate of growth will be dependent on many factors such as development of these technologies by manufacturers, rate of fall of prices, relative cost of different fuels, availability of subsidies, building regulations and consumer attitudes.

11.10 Our expenditure forecasts are based upon pragmatic assumptions informed by data provided by the CSE. We have proposed to use information from more advanced monitoring of the network and data from smart meters to identify LCT hotspots so that reinforcement work can be targeted at the parts of the network where it is required. Tracking expenditure against forecasts will determine whether there is significant variance.

11.11 The need for network reinforcement is dependent on widespread changes in demand driven by general economic conditions and the specific location of the development of new load or generation connections. This is in addition to the effect of LCTs.

11.12 Assumptions about the amount of load growth are used to forecast which parts of the network will require reinforcement, but actual load growth can differ.

11.13 Ofgem recognises that there is significant uncertainty over the investment required to accommodate new and changing patterns of energy use.

11.14 The load-related reopener mechanism introduced for DPCR5 will continue into RIIO-ED1, but with an expanded scope that additionally includes fault level reinforcement and secondary network connections.

11.15 The re-opener will operate around a 20% dead band, where efficient costs incurred above the deadband can be funded through additional allowances.

11.16 There will be two windows in 2017 and 2020 where DNOs have the opportunity to demonstrate that incurred efficient costs are more than 20% higher than the combined allowances for load related work. At the end of RIIO-ED1 there will not be an opportunity to recover additional costs, even if they exceed the threshold at that point.

11.17 WPD is satisfied that the proposal by Ofgem provides the right approach to the level of uncertainty and we require no further mechanism.

High value projects

11.18 Sometimes there is a need to carry out extensive work to resolve an issue. This can result in multi-million pound projects. They can be required to accommodate additional demand, which can be as a result of new connection activity.

11.19 The move to an eight year price control period means that these high-value projects could arise once allowances have been decided.

11.20 We do not expect to have many projects falling within this category and the availability of a reopener adequately covers any future requirements that may arise.

Transmission Connection Point charges

11.21 The WPD network is connected to the National Grid at Transmission Connection Points (also referred to as Transmission Exit Points). National Grid provides infrastructure at these exit points to allow power to flow between the transmission system and distribution network.

11.22 Even though National Grid provides a quotation for the proposed work, the eventual charges are determined by the actual costs of the work. This means that if additional costs are incurred they are included in the charges levied on WPD. There is little opportunity to influence the costs once projects are under way.

11.23 Ofgem proposes to treat part of transmission connection charges as pass through costs. This will apply to assets installed prior to 2015 and any new work resulting from National Grid's assets replacement programme.

11.24 The proposed regulatory framework provides a balanced approach to managing cost uncertainty and, by excluding DNO instigated work, places a responsibility on DNOs to identify the most efficient mechanism for providing the additional capacity required at transmission connection points.

11.25 We are satisfied that approach by Ofgem is sufficient and we do not require any additional uncertainty mechanism.

Street works

11.26 Legislation requires WPD to inform Highways Authorities about work that will affect public roads. Most Highways Authorities currently operate a Notice process which does not incur fees, but the Department for Transport is encouraging them to implement Permit schemes for traffic sensitive strategic roads that will introduce new charges. In addition Highways Authorities have the option of implementing Lane Rental schemes where utilities pay a daily charge for working in the road.

11.27 We have assumed that Highway Authorities will adopt Permits schemes, but only apply these to traffic sensitive roads. This will introduce an additional cost of £1m per annum across WPD. This approach balances the additional costs where Highways Authorities choose to apply Permit fees to all roads against situations where Notice schemes remain in place.

11.28 Ofgem proposes to have one reopener window in 2019 where additional costs for the full period will be considered. It will cover additional costs associated with Permit Schemes and Lane Rentals, including system set up costs, but these will need to exceed a materiality threshold for the reopener to apply.

11.29 WPD actively engages with over 60 local authorities to keep informed of changes to requirements across the company. Since local authorities apply to the Department for Transport to introduce schemes, there is sufficient time to understand the impact of changes. This means that one reopener at the mid-point of RIIO-ED1 will be adequate.

Enhanced physical site security

11.30 DECC are responsible for assessing the items of our network which are a part of the Critical National Infrastructure (CNI). The assessment undertaken considers the number of customers connected to a specific site, its criticality to the network in general or its role in supporting key installations or customers. When a site is defined as being part of this list, additional security works are undertaken to increase the protection of the site.

11.31 Where additional costs exceed a materiality threshold, DNOs can apply for a reopener in 2019. Cost below the threshold can be logged up and Ofgem will consider them as part of RIIO-ED2 allowances.

11.32 The proposals made by Ofgem provide recovery of all efficiently incurred costs. WPD does not require any additional mechanisms.

Smart meter rollout and DCC fixed costs

11.33 The roll out of smart meters to domestic customers between the end of 2014 and 2020 has uncertainty in all three main impact areas:

- remedial work at the metering point;
- charges from the Data and Communications Company for the provision of data from smart meters;
- development of in-house systems for the receipt and storage of data, the potential for the DCC to start handling the change of supplier registration process and proactive load management system.

11.34 The volume and cost of the remedial work included within the Business Plan assumes that 2% of installations will require remedial action to allow the meter operator to install a smart meter. The National Skill Academy has provided forecasts that suggest 4% of installations will require a visit to enable a smart meter to be connected and therefore costs from remedial work could double. Due to the uncertainty of the actual volumes of remedial work it is proposed that a volume driver is required to adjust allowances once the work is completed.

11.35 Provisional charges for DCC services, published by DECC in January 2013, suggest that costs for WPD would be approximately £100m over the RIIO-ED1 period. These charges have been reviewed by DECC and figures shared in April 2013 suggest that the costs will be reduced to around £29m. These costs may change again once DECC completes the procurement process to establish the DCC provider.

11.36 The in-house data systems for communication with the DCC and for the storage of smart meter data will be completed by the end of 2015, however the design baseline for these systems is yet to be defined. In addition, systems may also be required to enable the DCC to carry out the Change of Supplier Registration Service (a process currently carried out within DNO systems) and there will be a need for systems to carry out load management once the roll out of smart meters near completion. The exact nature of these systems is undefined and therefore there is uncertainty about the costs.

11.37 The proposed regulatory framework has two mechanisms; a volume driver for the volume of remedial work required and a pass through for the DCC and system costs.

11.38 Suppliers will be installing smart meters at around four times the rate of routine meter changes. This will identify higher volumes than normal for remedial actions required at service positions. The exact impact is uncertain and the use of a volume driver to adjust allowances is appropriate.

11.39 DECC has determined that full fixed costs for the DNOs will be levied from the start of the smart meter rollout. Costs will be incurred at a time when there will be insufficient coverage to gain benefits. During the rollout programme, allowances are required for these costs and the use of a pass through approach is acceptable.

11.40 Since the specification of the IT and communication systems that DNOs will require to make use of the data are not fully defined the costs are uncertain. Since the specifications will be determined by DECC and the DCC the requirement is outside of the control of DNOs and a pass through mechanism for the costs is acceptable.

Innovation rollout

11.41 WPD is carrying out the highest number of Low Carbon Network Fund projects of all DNOs. The rollout of some of these solutions may be directed to providing longer term benefits. This may require investment ahead of the benefits being delivered. Without additional funding these projects may not be able to go ahead.

11.42 Ofgem has proposed an innovation rollout mechanism that can be used for costs associated with the implementation of proven low carbon or environmental innovations.

11.43 Where the benefits of innovation will materialise in the long term, an application can be made for additional funding should the cost of the rollout exceed a materiality threshold. Costs below the threshold will not be funded, but will be subject to the efficiency incentive.

11.44 There will be two windows, in 2017 and 2019, where DNOs can apply for additional funding and application can be made ahead of expenditure being incurred.

11.45 The proposals made by Ofgem provide two opportunities to request additional funding. WPD does not require any additional mechanisms.

RPI Indexation

11.46 Ofgem proposes to use the Retail Prices Index (RPI) to adjust allowances for economy-wide inflation/deflation.

11.47 This principle is established within regulatory mechanisms and we do not propose any changes to it.

Cost of debt

11.48 Prior to the introduction of the RIIO framework for price controls, the cost of debt was determined at the start of a price control and fixed for the whole period. The move to longer price control periods has led Ofgem to implement a methodology that varies the costs of debt in line with a published index.

11.49 Ofgem proposes to set the real cost of debt using the a 10 year simple trailing average of the iBoxx GBP Non-Financials indices of 10+ years maturity, with credit ratings of broad A and broad BBB, less the implied 10 year gilt inflation break evens published by the Bank of England. The costs of debt will be updated each year.

11.50 The proposals made by Ofgem provide an adequate mechanism for calculating a real cost of debt and we do not propose any changes or any additional mechanisms.

Business rates

11.51 Business rates are periodically revaluated and the next revaluation is due in 2017. It is anticipated that they will increase significantly, but the actual amounts will be determined by the Valuation Office, an executive agency of the Inland Revenue.

11.52 Ofgem proposes to allow business rates to be pass through provided that DNOs can demonstrate they have made efforts to minimise the valuations.

11.53 Charges are mostly outside of the influence of WPD and it is appropriate for them to be treated as pass through costs.

Corporation tax

11.54 The Government sets corporation tax in response to economic conditions and other financial objectives. The changes are outside of the control of WPD and can occur at any time.

11.55 Ofgem proposes to have annual adjustment mechanism where revenues are adjusted if the impact of a tax change exceeds a materiality threshold. This introduces a dead band, of plus or minus one per cent in the rate of mainstream corporation tax, where revenues are not altered if the impact of the tax change does not breach the threshold. Within the dead band DNOs benefit from tax reduction and incur additional costs when taxes increase. Adjustments can increase or decrease revenues and the use of the dead-band shares the impact of tax changes between DNOs and customers.

11.56 Ofgem's proposals cater for any changes. WPD does not require any additional mechanisms.

Established pension deficit repair

11.57 Final salary pension schemes need to be funded on the basis of estimates of the value of investments held by the scheme (the assets) and the projected pension costs (the liabilities). Both the assets and liabilities vary over time and full valuations are carried out every three years. If the assets are worth more than the estimate of the liabilities, there is a surplus. If the assets are worth less than the liabilities, there is a deficit.

11.58 In their restated pension principles, Ofgem have undertaken to give companies an allowance to pay the regulated 'Distribution' portion of the deficits at 31 March 2010. No specific allowance is available for any deficit that is created after 31 March 2010 although the costs of any such incremental deficit relating to regulated activities will be allowed as part of overall employment costs.

11.59 Ofgem proposes to have three re-opener windows (in 2016, 2019 and 2022) that coincide with triennial actuarial revaluations. These will be used to assess costs and adjust allowances to reflect economic and efficiently incurred deficit. WPD does not require any additional mechanisms.

Ofgem licence fees

11.60 Ofgem funds its activities by charging licence fees. These charges are dependent upon the costs incurred by Ofgem and are outside the control of DNOs. Whilst there is significant development and change in energy provision, there is uncertainty about the scale of Ofgem's activities and it is difficult to determine an appropriate ex-ante allowance.

11.61 Ofgem proposes to allow Ofgem licence fees to be treated as pass through and WPD believe that this is appropriate.

12 Financing the Business Plan

12.1 The expenditure requirements during RIIO-ED1 will mean that WPD will have to raise £1.74bn of new debt as well as re-financing £850m debt as it falls due for repayment. In addition shareholders will re-invest £874m to maintain gearing at 65% (debt to RAV value).

12.2 In deriving these values we have made a number of assumptions about the cost of debt, cost of equity and other financing parameters.

Cost of equity - 6.4%

12.3 The lengthening of the price control period from five years in DPCR5 to eight years in RIIO-ED1 increases forecasting risk for WPD's shareholder. Forecasting the level of costs is less certain for eight years and this uncertainty is compounded by investment requirement uncertainty (for example for the range of scenarios for LCTs). However, Ofgem have indicated that they intend to put in sufficient cost re-opener mechanisms in RIIO-ED1 to off-set the increased forecasting risk.

12.4 Our cost of equity assumption is in line with the value specified in the Ofgem's Decision to fast track Western Power Distribution document, namely 6.4%.

Cost of debt - 2.6%

12.5 Ofgem has determined that under RIIO-ED1 the cost of debt will be calculated from a 10 year rolling average of real rates that will be determined from the arithmetical average of the iBoxx A-rated and BBB-rated non-financial indices less the implied 10-year gilt inflation break evens published daily by the Bank of England. We estimate that the average cost of debt allowance over RIIO-ED1 will be 2.3% and we have used this figure in testing the financeability of the plan.

12.6 To enable comparability between DNOs Business Plans Ofgem have indicated that we should use the value specified in the Ofgem's Decision to fast track Western Power Distribution document, namely 2.6%. We have utilised this figure within each year of the RIIO-ED1 finance plan to produce the forecast figures.

RIIO-ED1 Cost of Debt Forecast								
	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
Rate used in Financing Plan	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6

Gearing - 65%

12.7 We have assumed that gearing remains at the same level as DPCR5 – 65%.

Vanilla WACC – 3.9%

12.8 The value of Vanilla WACC is derived from the cost of equity, cost of debt and gearing assumptions above.

Capitalisation rate - 80% of totex (total core costs)

12.9 In DPCR5, costs other than business support and non-operational capex were treated as 85% 'slow pot' (i.e. capitalised into the RAV) and 15% 'fast pot', with business support and non-operational capex treated separately as 100% fast pot.

12.10 To avoid any remaining boundary issues in cost classification, we have included business support and non-operational capex in the total pot of costs (totex). Our modelling indicates that treating 80% of totex as slow pot produce the same capitalisation treatment in DPCR5.

Asset lives transitional arrangements

12.11 The RIIO-ED1 proposals indicate a 45 year life on assets acquired after 1st April 2015 with the possibility of a transitional arrangement in RIIO-ED1.

12.12 In RIIO-T1, the price control for transmission companies, transitional arrangements are in place whereby SHETL, SPTL and NGET respectively have 16, 8 and 8 year transitional periods on new assets, with all three having a gradual increase in asset lives from 20 to 45 years. The cash flow and credit ratios of our four DNOs show significant deterioration during RIIO-ED1 unless a transitional arrangement is put in place.

12.13 We have adopted the NGET transitional arrangement which has a linear increase in asset lives from 20 to 45 years within one price control period.

Asset life applied to assets acquired in each year of RIIO-ED1								
2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	Average
23.1	26.3	29.4	32.5	35.6	38.8	41.9	45.0	34.1

12.14 This equates to an average asset life for new assets (i.e. slow pot additions to RAV) in RIIO-ED1 of just over 34 years, which we have rounded up to 35 years. We require this transitional arrangement in order to ensure we achieve credit ratios that will maintain a minimum credit agency rating of BBB/Baa2 for our four DNOs.

12.15 We have employed NERA to assess our cash flow risk. Their Monte Carlo modelling concludes that a capitalisation totex rate of 80%, transitional asset lives of 35 years (which is broadly equivalent to our proposed linear transition) and cost of equity of 6.7% give credit ratios for the RIIO-ED1 period that look consistent with a solid investment grade rating for all WPD entities. A higher capitalisation rate (85%) or a longer asset life assumption for new assets (i.e. immediately moving to 45 years) has a significantly negative impact on our credit ratios.

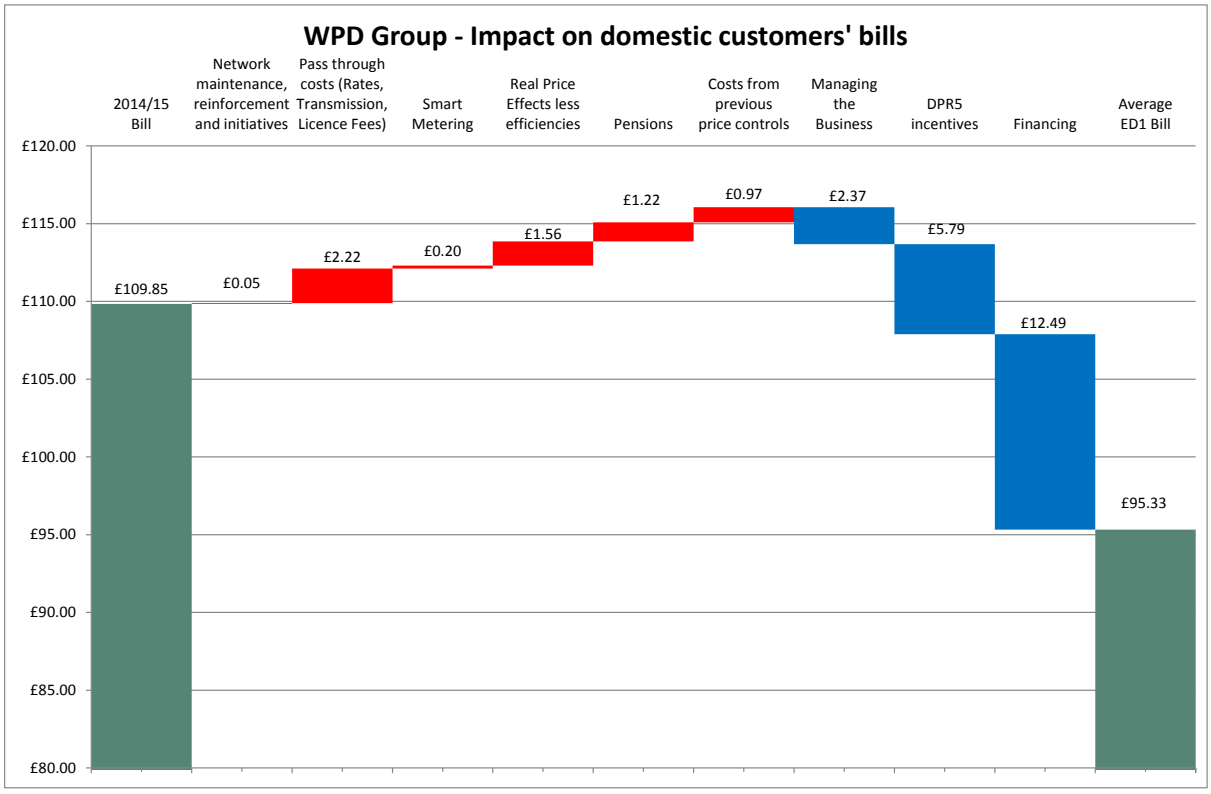
13 Impact on customers' bills and WPD's revenue request for RIIO-ED1

Impact on customers' bills

13.1 Within this Business Plan we set out detailed forecasts for the costs of carrying out the plan and the financing costs we incur to enable us to do so.

13.2 Over RIIO-ED1 our charges reduce by an average of 13.2% before inflation.

13.3 The change in bills is driven by a number of key areas of expenditure. This is shown for domestic customers in the chart below for our four DNOs combined:



13.4 For our four DNOs the detailed impact on both domestic and business customers' bills is shown below:

How this will impact domestic customer bills

In 2012/13 prices

WPD West Midlands	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
Percentage change in distribution costs	n/a	-10.2%	0.9%	-5.4%	1.0%	1.0%	1.0%	1.0%	1.0%
Annual change in £'s	n/a	-£10.29	£0.81	-£4.97	£0.88	£0.87	£0.88	£0.89	£0.89
Total distribution charge	£101.17	£90.88	£91.69	£86.72	£87.60	£88.47	£89.35	£90.24	£91.13

WPD East Midlands	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
Percentage change in distribution costs	n/a	-8.2%	0.9%	-4.1%	1.0%	1.0%	1.0%	1.0%	1.0%
Annual change in £'s	n/a	-£7.26	£0.74	-£3.34	£0.78	£0.78	£0.80	£0.81	£0.81
Total distribution charge	£88.11	£80.85	£81.59	£78.25	£79.03	£79.81	£80.61	£81.42	£82.23

WPD South Wales	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
Percentage change in distribution costs	n/a	-22.7%	0.9%	-1.2%	1.0%	1.0%	1.0%	1.0%	1.0%
Annual change in £'s	n/a	-£28.73	£0.89	-£1.19	£1.01	£0.97	£0.99	£0.98	£1.02
Total distribution charge	£126.28	£97.55	£98.44	£97.25	£98.26	£99.23	£100.22	£101.20	£102.22

WPD South West	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
Percentage change in distribution costs	n/a	-17.0%	0.9%	-0.5%	1.0%	1.0%	1.0%	1.0%	1.0%
Annual change in £'s	n/a	-£23.35	£1.06	-£0.58	£1.17	£1.15	£1.16	£1.17	£1.18
Total distribution charge	£137.52	£114.17	£115.23	£114.65	£115.82	£116.97	£118.13	£119.30	£120.48

WPD Total (weighted average)	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
Percentage change in distribution costs	n/a	-13.4%	0.9%	-3.3%	1.0%	1.0%	1.0%	1.0%	1.0%
Annual change in £'s	n/a	-£14.69	£0.87	-£3.14	£0.94	£0.94	£0.94	£0.95	£0.96
Total distribution charge	£109.85	£95.16	£96.03	£92.89	£93.83	£94.77	£95.71	£96.66	£97.62

Notes

1 Revenues are profiled on a "Po/x basis"; revenues fall in 2015/16 and thereafter increase by 1.0% in real terms other than for DPCR5 IIS
2 DPCR4 losses excluded because of uncertainty
3 Smart metering included
4 K factor included in 2014/15
5 DPCR5 tax trigger impact included in 2014/15 and thereafter zero
6 DPCR5 IIS included in 2014/15, 2015/16 and 2016/17 and thereafter zero
7 IFI and LCNF included for DPCR5; NIA and NIC excluded for RIIO-ED1
8 Domestic bill represents Profile 1

How this will impact business customer bills

In 2012/13 prices

WPD West Midlands	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
Percentage change in distribution costs	n/a	-10.2%	0.9%	-5.4%	1.0%	1.0%	1.0%	1.0%	1.0%
Annual change in £'s	n/a	-£24.79	£1.95	-£11.97	£2.11	£2.11	£2.10	£2.14	£2.16
Total distribution charge	£243.71	£218.91	£220.86	£208.89	£211.01	£213.12	£215.22	£217.36	£219.52

WPD East Midlands	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
Percentage change in distribution costs	n/a	-8.2%	0.9%	-4.1%	1.0%	1.0%	1.0%	1.0%	1.0%
Annual change in £'s	n/a	-£18.30	£1.87	-£8.44	£1.97	£1.98	£2.00	£2.03	£2.04
Total distribution charge	£222.01	£203.71	£205.58	£197.14	£199.11	£201.09	£203.10	£205.13	£207.17

WPD South Wales	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
Percentage change in distribution costs	n/a	-22.7%	0.9%	-1.2%	1.0%	1.0%	1.0%	1.0%	1.0%
Annual change in £'s	n/a	-£85.85	£2.66	-£3.58	£3.04	£2.91	£2.94	£2.94	£3.04
Total distribution charge	£377.44	£291.59	£294.25	£290.67	£293.70	£296.61	£299.55	£302.49	£305.54

WPD South West	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
Percentage change in distribution costs	n/a	-17.0%	0.9%	-0.5%	1.0%	1.0%	1.0%	1.0%	1.0%
Annual change in £'s	n/a	-£51.77	£2.34	-£1.29	£2.60	£2.54	£2.57	£2.60	£2.63
Total distribution charge	£304.88	£253.11	£255.45	£254.16	£256.76	£259.31	£261.88	£264.48	£267.10

WPD Total (weighted average)	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
Percentage change in distribution costs	n/a	-13.4%	0.9%	-3.3%	1.0%	1.0%	1.0%	1.0%	1.0%
Annual change in £'s	n/a	-£36.94	£2.18	-£7.91	£2.37	£2.35	£2.36	£2.39	£2.42
Total distribution charge	£276.37	£239.44	£241.62	£233.71	£236.09	£238.43	£240.80	£243.19	£245.61

Notes

1 Revenues are profiled on a "Po/x basis"; revenues fall in 2015/16 and thereafter increase by 1.0% in real terms other than for DPCR5 IIS
2 DPCR4 losses excluded because of uncertainty
3 Smart metering included
4 K factor included in 2014/15
5 DPCR5 tax trigger impact included in 2014/15 and thereafter zero
6 DPCR5 IIS included in 2014/15, 2015/16 and 2016/17 and thereafter zero
7 IFI and LCNF included for DPCR5; NIA and NIC excluded for RIIO-ED1
8 Business bill represents Profile 3

WPD's revenue request for RIIO-ED1

13.5 In the previous chapters of this Business Plan we have explained and shown forecasts for the following:

- core expenditure - capital expenditure, network operating costs and indirects;
- pensions – normal and deficit contributions;
- rates and licence fees;
- transmission exit charges ;
- financing costs - cost of debt and cost of equity.

13.6 Our core expenditure costs (totex costs) are split between fast pot and slow pot as previously explained under "Funding the Business Plan":

- fast pot costs incurred in RIIO-ED1 are recovered in RIIO-ED1;
- slow pot costs incurred in RIIO-ED1 are spread over a number of years known as depreciation to reflect the long term value of network assets.

13.7 Our customer bills are therefore made-up of the following items:

- fast pot costs (including normal pensions);
- depreciation (including normal pensions) on RIIO-ED1 slow pot costs;
- depreciation on previous price control slow pot costs;
- pensions deficit repair payments (including true up from previous price controls);
- rates and licence fees;
- transmission exit charges;
- taxation payments;
- financing costs.

13.8 In addition customer bills may also be adjusted for the following items:

- The fast track reward is included in our plan;
- DPCR5 IQI incentive/cost true-up: our plan takes into account variances between slow pot allowances and actual expenditure in DPCR5 that will be dealt with in RIIO-ED1;
- DPCR5 incentives: our plan does *not* include rewards such as IIS earned in DPCR5 but paid in RIIO-ED1;
- RIIO-ED1 incentive rewards such as IIS are *not* included in the plan;
- DPCR4 losses incentive: our plan does *not* include any reward or penalty for the close-out of the DPCR4 losses mechanism which now seems likely to be settled in 2015/16 and 2016/17 although the amount has yet to be determined.

13.9 We have also considered how our revenues are profiled over the RIIO-ED1 period. WPD would prefer that customers receive a significant one-off reduction in charges in year one of RIIO-ED1 (2015/16) rather than gradually spreading the reduction over a number of years, in order to provide more stability in our charges. Following consultation with our owner we have profiled our revenues so that a there is a one-off reduction of 13.8% in 2015/16 followed thereafter by an increase of 1.0% per annum before inflation for the remainder of the RIIO-ED1 period.

13.10 In total our revenue request for RIIO-ED1 amounts to £10.7bn in 2012/13 prices as detailed in the following tables:

WPD Revenue Requirement in RIIO-ED1 (£m in 2012/13 prices)

West Midlands	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	Total
Fast Pot Costs	52.1	52.1	50.6	51.5	53.1	54.1	53.6	54.1	**421.2**
Depreciation on Slow Post Costs (RAV)	169.5	173.1	174.9	176.5	177.2	178.2	162.7	161.6	**1,373.6**
Pension Deficit Repair Payments	20.7	20.7	20.7	20.7	20.7	20.7	20.7	20.7	**165.7**
Rates and Licence Fees	28.3	28.3	31.3	36.5	42.7	43.4	41.8	41.8	**294.1**
Transmission Exit Charges	12.7	13.0	13.2	13.2	13.5	14.1	14.1	14.1	**108.0**
DPCR5 IQI Incentive/Costs True-up	1.2	1.2	1.3	1.3	1.4	1.5	1.5	1.6	**11.0**
Financing Costs	74.7	76.1	77.3	78.5	79.7	81.1	82.8	84.9	**635.1**
Taxation Payments	18.0	17.9	17.7	16.8	15.5	15.2	15.9	15.9	**133.0**
Fast Track Reward	6.5	6.5	6.3	6.4	6.6	6.8	6.7	6.8	**52.6**
Total - Unprofiled Revenues	**383.7**	**389.1**	**393.3**	**401.5**	**410.5**	**415.0**	**399.8**	**401.5**	**3,194.4**
Revenue Profiling	2.1	0.4	0.1	-4.1	-9.1	-9.6	9.6	11.9	**1.4**
Total - Profiled Revenues	**385.8**	**389.6**	**393.4**	**397.4**	**401.4**	**405.3**	**409.4**	**413.4**	**3,195.8**

East Midlands	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	Total
Fast Pot Costs	57.0	55.7	49.6	50.5	49.9	51.9	54.5	53.0	**422.2**
Depreciation on Slow Post Costs (RAV)	161.1	166.4	170.1	171.1	171.7	171.7	153.3	154.3	**1,319.6**
Pension Deficit Repair Payments	20.4	20.4	20.4	20.4	20.4	20.4	20.4	20.4	**163.3**
Rates and Licence Fees	36.7	36.8	40.6	47.6	55.3	56.0	54.4	54.4	**381.6**
Transmission Exit Charges	10.5	10.5	10.9	10.9	11.6	11.9	12.6	13.8	**92.9**
DPCR5 IQI Incentive/Costs True-up	3.5	3.6	3.8	4.0	4.2	4.3	4.5	4.8	**32.6**
Financing Costs	71.1	73.5	75.2	76.3	77.5	78.7	80.6	83.0	**615.9**
Taxation Payments	16.2	15.8	15.6	14.6	13.2	13.2	13.4	13.3	**115.3**
Fast Track Reward	7.1	7.0	6.2	6.3	6.2	6.5	6.8	6.6	**52.8**
Total - Unprofiled Revenues	**383.7**	**389.8**	**392.4**	**401.6**	**410.0**	**414.6**	**400.5**	**403.4**	**3,196.2**
Revenue Profiling	2.3	0.0	1.2	-4.0	-8.5	-9.1	9.1	10.2	**1.1**
Total - Profiled Revenues	**386.0**	**389.8**	**393.6**	**397.6**	**401.5**	**405.5**	**409.6**	**413.7**	**3,197.3**

South Wales	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	Total
Fast Pot Costs	29.4	29.4	28.0	29.8	27.3	27.4	26.4	26.9	**224.6**
Depreciation on Slow Post Costs (RAV)	83.9	85.0	78.7	78.0	76.6	75.7	75.1	74.5	**627.6**
Pension Deficit Repair Payments	21.6	21.6	21.6	21.6	21.6	21.6	21.6	21.6	**172.9**
Rates and Licence Fees	16.3	16.3	20.1	20.3	20.1	20.5	19.7	19.7	**153.0**
Transmission Exit Charges	8.5	8.5	8.5	8.6	8.6	8.6	8.6	8.8	**68.8**
DPCR5 IQI Incentive/Costs True-up	2.3	2.4	2.5	2.7	2.8	2.9	3.1	3.2	**21.9**
Financing Costs	32.2	33.4	34.7	36.1	37.6	38.8	40.1	41.3	**294.2**
Taxation Payments	7.5	7.2	6.3	5.8	5.9	5.8	6.1	6.1	**50.8**
Fast Track Reward	3.7	3.7	3.5	3.7	3.4	3.4	3.3	3.4	**28.1**
Total - Unprofiled Revenues	**205.4**	**207.6**	**204.0**	**206.6**	**204.0**	**204.7**	**204.1**	**205.5**	**1,641.8**
Revenue Profiling	-6.7	-7.0	-1.5	-1.9	2.7	4.0	6.7	7.4	**3.7**
Total - Profiled Revenues	**198.7**	**200.6**	**202.5**	**204.6**	**206.7**	**208.7**	**210.8**	**212.9**	**1,645.5**

South West	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	Total
Fast Pot Costs	43.0	43.0	42.1	42.9	42.1	42.6	42.6	44.6	**342.9**
Depreciation on Slow Post Costs (RAV)	111.7	115.4	117.7	119.0	120.2	120.9	109.1	109.1	**923.1**
Pension Deficit Repair Payments	35.2	35.2	35.2	35.2	35.2	35.2	35.2	35.2	**281.3**
Rates and Licence Fees	16.3	16.3	17.8	20.8	22.1	22.7	21.4	21.4	**158.9**
Transmission Exit Charges	8.7	8.7	8.7	8.7	9.2	9.2	9.2	9.2	**71.8**
DPCR5 IQI Incentive/Costs True-up	4.3	4.5	4.7	4.9	5.1	5.4	5.6	5.9	**40.4**
Financing Costs	47.5	49.7	51.8	53.8	55.7	57.6	59.8	62.3	**438.2**
Taxation Payments	11.6	11.0	10.3	9.2	8.7	8.3	8.5	7.9	**75.5**
Fast Track Reward	5.4	5.4	5.3	5.4	5.3	5.3	5.3	5.6	**42.9**
Total - Unprofiled Revenues	**283.6**	**289.2**	**293.5**	**300.0**	**303.6**	**307.1**	**296.7**	**301.2**	**2,375.0**
Revenue Profiling	3.3	0.4	-1.1	-4.5	-5.3	-5.8	7.6	6.1	**0.7**
Total - Profiled Revenues	**286.9**	**289.6**	**292.4**	**295.4**	**298.4**	**301.3**	**304.3**	**307.3**	**2,375.7**

WPD Combined	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	Total
Fast Pot Costs	181.5	180.3	170.4	174.7	172.4	175.9	177.1	178.6	**1,410.9**
Depreciation on Slow Post Costs (RAV)	526.1	540.0	541.4	544.6	545.7	546.4	500.2	499.5	**4,243.9**
Pension Deficit Repair Payments	97.9	97.9	97.9	97.9	97.9	97.9	97.9	97.9	**783.1**
Rates and Licence Fees	97.6	97.8	109.8	125.2	140.3	142.5	137.2	137.2	**987.6**
Transmission Exit Charges	40.4	40.7	41.3	41.5	43.0	43.9	44.6	45.9	**341.5**
DPCR5 IQI Incentive/Costs True-up	11.2	11.7	12.3	12.9	13.5	14.1	14.8	15.5	**105.9**
Financing Costs	225.5	232.8	239.0	244.7	250.5	256.3	263.3	271.4	**1,983.5**
Taxation Payments	53.4	51.9	49.9	46.4	43.3	42.5	43.8	43.3	**374.6**
Fast Track Reward	22.7	22.5	21.3	21.8	21.6	22.0	22.1	22.3	**176.4**
Total - Unprofiled Revenues	**1,256.4**	**1,275.7**	**1,283.3**	**1,309.7**	**1,328.1**	**1,341.5**	**1,301.1**	**1,311.6**	**10,407.4**
Revenue Profiling	1.0	-6.2	-1.2	-14.6	-20.2	-20.6	33.0	35.7	**6.9**
Total - Profiled Revenues	**1,257.4**	**1,269.5**	**1,282.0**	**1,295.1**	**1,308.0**	**1,320.9**	**1,334.1**	**1,347.3**	**10,414.3**

Impact on suppliers

13.11 The revenues that we will recover from suppliers are detailed in accordance with DCUSA DCP66A tables. They will be updated every quarter and published separately. They are available at the following link http://www.westernpower.co.uk/About-us/Stakeholder-information/Our-Future-Business-Plan/Supplier-Information.aspx

13.12 WPD understand that charging volatility is a key issue for suppliers and that they seek stable and predictable pricing structures with longer charge notification periods. WPD support the recommendations of Ofgem's October 2012 Decision in relation to measures to mitigate network charging volatility arising from the price control settlement. As part of our plan we have therefore clearly set out the evolution of revenues and charges in an industry common format. We have committed to updating and publishing this information every three months.

13.13 Through our work with suppliers we are aware of other proposals in addition to those in the Ofgem decision document requiring longer notice periods for charges. We are willing to work with suppliers and Ofgem on this issue and would be happy to participate in discussions that investigate the merits of an approach whereby the industry fixes its DUoS prices further in advance of price application so that we can better understand if the transfer of risk from suppliers to distribution businesses is in the best interests of both suppliers and end use customers.

14 Glossary

A

Accident Frequency Rate

The number of accidents that occur divided by the number of people employed (allowing a like for like comparison irrespective of the number of staff employed).

Alliance

A method of working with contractors, where resources from both the main business and the contractors are shared within a combined organisation.

B

Broad Measure of Customer Satisfaction (BMCS)

A composite incentive consisting of a customer satisfaction survey, a complaints metric and stakeholder engagement. It was introduced for DPCR5 and is designed to drive improvements in the quality of the overall customer experience by capturing and measuring customers' experiences of contact with their DNO across the range of services and activities the DNOs provide.

British Telecom 21st Century (BT 21 CN)

British Telecom is in the process of converting its existing telecommunications network to an internet protocol system known as BT 21st Century Network. This will move away from pre-determined hard wired routes for communication to a system that can route communications around the internet where communication paths are not determined.

Building Research Establishment Environmental Assessment Method (BREEAM)

A methodology used by the building industry to assess the environmental aspects of building construction and refurbishment.

Business Carbon Footprint (BCF)

The BCF scheme was introduced as a reputational incentive in DPCR5 to encourage DNOs to consider the direct carbon impact of conducting their operations and to be proactive in the reduction of emissions.

C

Capital expenditure (Capex)

Expenditure on investment in long-lived distribution assets, such as underground cables, overhead electricity lines and substations.

Carbon Plan

First published in December 2011, the Carbon Plan sets out the government's plans for achieving the emissions reductions it committed to in the first 4 carbon budgets (5 year periods each). Emissions in the UK must, by law, be cut by at least 80% of 1990 levels by 2050. The UK was first to set its ambition in law and the Plan sets out progress to date and assesses cost-effective next steps. Within the plan it states "This Carbon Plan sets out a vision of a changed Britain, powered by cleaner energy

used more efficiently in our homes and business, with more secure energy supplies and more stable energy prices, and benefitting from the jobs and growth that a low carbon economy will bring".

Centre for Sustainable Energy (CSE)

An independent national charity that helps people and organisation from the public, private and voluntary sectors meet the twin challenges of rising energy costs and climate change.

Closed Circuit Television (CCTV)

A video based security monitoring system that presents images on television screens in a monitoring centre from cameras installed at remote sites allowing activities to be recorded and intruders to be identified.

Condition Based Risk Management (CBRM)

This is an asset replacement modelling approach that makes use of condition information to forecast which assets require to be replaced and when.

Constant Maturity Swap (CMS)

A constant maturity swap (CMS) is an interest rate swap where the interest rate on one leg is reset periodically, but with reference to a market swap rate rather than LIBOR. The other leg of the swap is generally LIBOR, but may be a fixed rate or potentially another constant maturity rate. The prime factor for a constant maturity swap is the shape of the forward implied yield curves.

Cost Benefit Analysis (CBA)

A methodology that compares the costs of carrying out an investment against the benefits (such as risk reduction or service improvement) to compare different options and demonstrate value for money.

Cost of Debt

The effective interest rate that a company pays for its loans.

Cost of Equity

The rate of return on investment required by a company's shareholders.

Customers Interrupted (CIs)

The number of customers whose supplies have been interrupted per 100 customers per year over all incidents, where an interruption of supply lasts for three minutes or longer, excluding re-interruptions to the supply of customers previously interrupted during the same incident.

Customer Minutes Lost (CMLs)

The average duration of interruptions to supply per year, where an interruption of supply to customer(s) lasts for three minutes or longer.

Customer Service Excellence

This is a Government scheme which recognises organisations that provide effective and excellent customer service. Similar assessments were previously awarded the Charter Mark.

D

DECC

The Government Department of Energy and Climate Change.

Distributed Generation (DG)

Generation connected to the distribution network. It includes wind turbines, domestic solar panels, large scale photo-voltaic farms, hydro-electric power and biomass generators.

Distribution Network Operators (DNOs)

A DNO is a holder of an electricity distribution licence. There are 14 DNOs which are owned by six different groups.

Distribution Price Control Review 5 (DPCR5)

The current price control period running from 1 April 2010 until 31 March 2015. It is the fifth using RPI-X regulation and will be replaced with the RIIO framework from 1 April 2015.

Distribution Use of System (DUoS)

These are the charges levied to suppliers for DNO costs that can be recovered from customers. The amount is determined through price control reviews.

E

EA Technology

EA Technology are a research company that have been contracted jointly by all DNOs to develop and maintain a model (registered name Transform) to assess the cost of the impact of low carbon technologies on the network.

Electricity, Safety, Quality and Continuity Regulations 2002 (ESQCR)

The ESQCR specify safety standards, which are aimed at protecting the general public and customers from danger. In addition, the regulations specify power quality and supply continuity requirements. The regulations were amended in 2006 to include a requirement for resilience tree clearance.

ENMAC™

ENMAC is the trade name for GE Network Solutions control room software used for managing real-time operation of the distribution network.

Extra High Voltage (EHV)

Voltages over 20kV up to, but not including, 132kV.

F

Fast pot

Fast pot is the revenue that is recovered in the year of expenditure.

G

Gearing

A ratio measuring the extent to which a company is financed through borrowing.

General Packnet Radio Service (GPRS)

GPRS is a technology that allows the transfer of data across the mobile phone network.

Guaranteed Standards of Performance (GSOPs)

Guaranteed Standards of Performance set minimum service levels to be met across a range of activities covering supply interruptions, appointments and connections. They are specified in a Statutory Instrument and where a licence holder fails to provide the level of service required, it must make a payment to the customer affected subject to certain exemptions.

H

Health and Safety Executive (HSE)

A Government organisation that has the responsibility of enforcing health and safety legislation.

Health Index (HI)

Framework for collating information on the health (or condition) of distribution assets and for tracking changes in their condition over time.

High voltage (HV)

Voltages over 1kV up to, but not including, 22kV.

I

Incentive on Connections Engagement (ICE)

This is a new incentive being introduced into RIIO-ED1 intended to drive DNOs to improve communication and interaction with major customers.

Information Quality Incentive (IQI)

A regulatory incentive mechanism that drives DNOs to provide accurate cost forecasts in their Business Plans and drive efficient expenditure

Information Technology and Telecoms (IT&T)

Computer and telecommunication systems.

Inspections and Maintenance (I&M)

The activities carried out on a routine basis for the visual checking of the external condition of assets and the invasive examination of plant and equipment.

Interruption incentive scheme (IIS)

The interruption incentive scheme is a mechanism that provides annual rewards and penalties based on each DNO's performance against their targets for the number of customers interrupted per 100 customers (CI) and the number of customer minutes lost (CML).

ISO 14001

This is an international standard for environmental management systems.

L

Load Index (LI)

Framework, introduced as part of DPCR5, demonstrating the utilisation of individual substations or groups of interconnected substations. It is used as a secondary deliverable capturing the effects of load related investment.

Low Carbon Networks Fund (LCNF)

A funding mechanism introduced under DPCR5 to encourage DNOs to prepare for the role they will have to play as GB moves to a low carbon economy. £500m is available for DNOs and partners to innovate and trial new technologies, commercial arrangements and ways of operating networks. The last LCNF competition will run in 2014. It will be replaced by the Network Innovation Competition and Network Innovation Allowance during RIIO-ED1.

LCNF Tier 1

LCNF Tier 1 is a funding mechanism for small innovation projects. During DPCR5, Ofgem has allocated £80m between all DNOs.

LCNF Tier 2

LCNF Tier 2 is a funding mechanism for significant 'flagship' innovation projects. During DPCR5, £320m of will be provided centrally, with DNOs competing for funding.

Low Carbon Technology (LCT)

This is the collective term for devices that reduce the amount of carbon being used for heating, transport and generation. It includes electric vehicles, heat pumps and solar generation.

Low Voltage (LV)

This refers to voltages up to, but not including, 1kV.

N

National Grid

The 400kV and 275kV network used to transport electricity around the country from sources of large scale generation such as power stations and off-shore wind farms to substations that feed into DNO electricity networks.

O

Office of Gas and Electricity Markets (Ofgem)

Ofgem is responsible for regulating the gas and electricity markets in the UK to ensure customers' needs are protected.

P

Perflurocarbon Tracer (PFT)

A chemical that is injected into fluid filled cables, used to speed up the location of leaks.

Priority Service Register (PSR)

A database that records details about vulnerable customers so that additional support can be provided.

R

Real Price Effects (RPE)

Increase in prices, of materials, direct staff or contract labour, over and above increases in the Retail Price Index.

Referral Partners

There are independent organisations (e.g charities) that take an active role in dealing with social issues and have agreed to provide support to people referred to them by WPD.

Regulatory Asset Value (RAV)

The value ascribed by Ofgem to the capital employed in the licensee's regulated distribution business. The RAV is calculated by summing an estimate of the initial market value of each licensee's regulated asset base at privatisation and all subsequent allowed additions to it at historical cost, and deducting annual depreciation amounts calculated in accordance with established regulatory methods. The revenues licensees are allowed to earn under their price controls include allowances for the regulatory depreciation and also for the return investors are estimated to require to provide the capital.

Remote Terminal Unit (RTU)

Communications devices that transmit data about the status of the network back to the control centre.

Resilience Tree Cutting

This is the full removal or extensive cutting of trees that are found to be within the falling distance of overhead power lines. This ensures that they cannot cause damage to the power lines in the event of severe weather.

Revenue = incentives + innovation + outputs (RIIO)

Ofgem introduced a new regulatory framework in 2010 replacing previous RPI-X regime. It places more emphasis on incentives to drive the innovation needed to deliver a sustainable energy network at value for money to existing and future consumers.

RIIO Electricity Distribution 1 (RIIO-ED1)

The price control period that will run from 1 April 2015 to 31 March 2023. It is the first electricity distribution price control that will use the RIIO framework for setting allowances.

RIIO Electricity Distribution 2 (RIIO-ED2)

The electricity distribution price control period that will run from 1 April 2023 to 31 March 2031.

RPI-X

The form of price control currently applied to network monopolies. Each company is given a revenue allowance in the first year of each control period. The price control then specifies that in each subsequent year the allowance will move by 'X' per cent in real terms.

S

Slow pot

Slow pot is where costs are added to the RAV and revenues allow recovery of the costs over time together with the cost of financing this expenditure in the interim.

Smart Grid

A generic term for a range of measures that are used to operate electricity networks allowing more generation or demand (load) to be connected to a given electricity circuit without the need for traditional reinforcement (or upgrade) of that equipment.

Smart Grid Forum (SGF)

The Smart Grid Forum was established by Ofgem and DECC in early 2011 bringing together key opinion formers, experts and stakeholders involved in the development of smart grids, with the aim of providing strategic input to help shape Ofgem's and DECC's thinking and leadership in smart grid policy and deployment.

Sulphur Hexafluoride (SF6)

A potent greenhouse gas widely used in transmission and distribution equipment.

Supervisory Control and Data Acquisition (SCADA)

This is the term used for the systems used to monitor and control distributed assets. It comprises the remote terminal units, communication infrastructure and human interface within central control rooms.

T

Totex

Total of capital expenditure (capex) for network investment plus operational expenditure (opex) for running the business.

Transform Model

The model – developed by EA Technology - which uses a representation of the network and calculates the investment needed to accommodate LCTs using either smart grid solutions or traditional network reinforcement. The smart solutions include 'demand side response' as well as additional technology to move load around the network and utilise the full capacity of assets.

Turnkey

This is a contractual arrangement where the design and construction of a project is handed over to a third party.

V

Vanilla Weighted Average Cost of Capital (Vanilla WACC)

This is the combined cost rate of funding calculated using a pre-tax cost of debt and post-tax cost of equity weighted by notional gearing.

Vulnerable Customers

Customers who are medically dependent upon electricity, have special communication requirements or have other special needs with a dependence upon electricity (e.g. stair lift).

W

Western Power Distribution (WPD)

The electricity distribution network operator that holds four distribution licences in West Midlands, East Midlands, South Wales and South West.

Worst Served Customers

Customers who experience 12 or more higher voltage interruptions over a three year period, with a minimum of three in any one year.

2015-2023

RIIO-ED1 **BUSINESS PLAN**

SA-01 Supplementary Annex - Stakeholder Engagement

June 2013 (updated April 2014)

WESTERN POWER DISTRIBUTION

Serving the Midlands, South West and Wales

SA-01 Stakeholder Engagement
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1 Introduction

1.1 This document is a supplementary annex to the Western Power Distribution (WPD) Business Plan for the eight year period from 1st April 2015 to 31st March 2023.

1.2 It describes WPD's stakeholder engagement processes and their results.

1.3 The stakeholder engagement that is described is relevant to all four WPD distribution licences of West Midlands, East Midlands, South Wales and South West.

1.4 The eight year period aligns with the next regulatory price control review period, known as RIIO-ED1; the first for electricity distribution to be determined using Ofgem's Revenue = Incentives, Innovation and Outputs framework. The Business Plan, supplementary annexes, detailed cost tables and financial models form the submission under RIIO-ED1 to the regulator Ofgem (Office for Gas and Electricity Markets), who will use the information to determine allowed revenues.

Structure of this document

1.5 We appreciate that the readers of the WPD Business Plan suite of documents will range from regulatory experts and well-informed stakeholders through to new customers who may have had little previous knowledge of WPD.

1.6 This document is aimed at readers who require a more detailed understanding of WPD's stakeholder engagement programme. A less detailed description can be found in the main Business Plan Overview document.

1.7 This document is subdivided into the following sections:

Chapter	Title	Content
2	**Introduction to stakeholder engagement in WPD**	A description of what sets WPD's stakeholder engagement apart.
3	**Summary of key findings**	An overview of the findings and summary of the WPD response.
4	**WPD's stakeholder engagement strategy**	A description of how we identify stakeholders and the approach used for engagement with different types of stakeholders.
5	**Stakeholder engagement process used for RIIO-ED1**	A description of the stages of stakeholder engagement used in the preparation of the WPD RIIO-ED1 Business Plan.
6	**Key findings in detail**	A more detailed description of the findings.
7	**Supplementary appendices**	A range of reports and documents that illustrate the process and outcomes from the stakeholder engagement process.

2 Introduction to stakeholder engagement in WPD

2.1 WPD regularly engages with stakeholders. We have always had a clear commitment to working closely with our stakeholders to give them opportunities to provide feedback on our services and shape our plans for the future.

2.2 Improvement in customer service, network performance and business efficiency must come from understanding the areas where we can do better. WPD's stakeholder consultation programme in preparation for RIIO-ED1 is a natural development of our well-established engagement activities.

2.3 Stakeholder feedback directly influences our overall business strategy. We use stakeholder feedback to challenge our performance and develop action plans to address stakeholder concerns and priorities.

2.4 For RIIO-ED1, our stakeholders have been more involved than ever before in our consultation activities.

2.5 The remainder of this annex will outline our strategy and approach to stakeholder engagement, the detailed feedback we have received from our different stakeholder groups and, most importantly, explain the actions we have taken as a result.

What sets our stakeholder engagement programme apart

2.6 **Breadth and quality:** We have engaged with over 4,200 stakeholders on our RIIO-ED1 Business Plan. Many different stakeholders have been involved throughout the process and have become more knowledgeable about our business. This has enabled stakeholders to evaluate our plans critically and in considerable and increasing detail. We place a strong emphasis on talking directly to stakeholders face-to-face at events co-facilitated by WPD staff.

2.7 **Business-led:** Stakeholder engagement is not separate to our day-to-day activities. Members of the WPD senior management team, including local Distribution Managers, who will be responsible for operationally delivering the work, have facilitated our stakeholder workshops so they can learn from our customers first hand.

2.8 **Transparent:** After every stakeholder event we publish an independent report of the findings, followed by a WPD response including an action plan for how we will act on our stakeholders' feedback.

2.9 **Innovative:** We use a wide range of engagement methods and are innovative in our approach. WPD's fourth annual customer awareness campaign began in February 2013 with the unveiling of a brand new TV advert - a bold and novel approach to engagement with millions of customers who have little prior knowledge of WPD. The month-long 'Power for life' campaign, including the screening of the TV advert, also included local newspaper advertising and a four-page leaflet delivered to every home and business in our region, which invited customers to participate in our stakeholder workshops.

2.10 **Inclusive:** We have given 'future bill payers' the opportunity to have a say in our plans, through bespoke university events. We also recognise WPD staff as key stakeholders. WPD's Chief Executive personally conducts 50 staff road shows each year, seeing all 6,100 staff, to communicate the key aspects of our Business Plan and the role staff will play in delivering our promises to customers.

2.11 **Valued by stakeholders:** Our stakeholder workshops have received 99.7% satisfaction ratings from the participants for usefulness and value.

2.12 **A phased approach:** Stakeholders have influenced and helped to shape all aspects of our Business Plan. We have used a phased approach with our stakeholders to build our Business Plan. We began by identifying broad stakeholder priority areas and then developed these into specific proposals for service level improvements. We then gave stakeholders multiple options for investment before finally consulting on our draft Business Plan in full, including all proposed outputs.

3 Summary of key findings

3.1 WPD has carried out an extensive programme of stakeholder engagement, seeking feedback on a range of different options for future services and network investments. The following provides a high level summary of the key findings along with a description of WPD's response to stakeholder views.

Network reliability and availability

During normal weather conditions

3.2 **STAKEHOLDER FEEDBACK:** Network reliability (during normal weather conditions) is the number one priority for our stakeholders and they are not willing to see any deterioration in service.

3.3 Stakeholders would like to see at least a 10% reduction in both power cut frequency and duration from 2011/12 levels. Initial stakeholder engagement, indicating that improvements were expected, was reinforced during our Business Plan discussions where two thirds of stakeholders stated that reducing the number and average duration of power cuts should be a high priority. Over half agreed with WPD's proposals to reduce average frequency and duration of power cuts and a further 30% wanted even greater reductions.

3.4 **WPD RESPONSE:** We proposed to improve network performance so that on average customers will have 13% fewer power cuts (moving from 7 in 10 years, to 6 in 10 years) and have their electricity supplies restored 20% quicker (moving from an average duration of 48 minutes to 38 minutes) based on 2011/12 underlying performance. The final tougher targets agreed with Ofgem will lead to improvements of 16% for power cuts and 23% for the duration.

Worst served customers

3.5 **STAKEHOLDER FEEDBACK:** There should be increased investment to improve network reliability for worst served customers. Stakeholders support Ofgem's decision to change the definition from 15 power cuts in 3 years (lasting 3 minutes or more), to 12 power cuts in 3 years.

3.6 Stakeholders recognise that living in remote areas can make power cuts more likely and they support investment where it improves performance for customers receiving the poorest service. Using the present definition (15 higher voltage power cuts in 3 years), stakeholders would like to see the number of worst served customers reduced by 20%, from 10,000 to 8,000 customers. When WPD proposed to go further (improve by 40%) stakeholders told us to scale-back our plans to, what they felt was, a more reasonable cost per benefitting customer.

3.7 Ofgem have since indicated that the definition of a worst served customer will change. WPD tested improvements against this new definition via 'willingness to pay' research and qualitative workshop discussions. Stakeholders overwhelmingly supported WPD's proposals to apply the same level of improvement previously agreed with stakeholders (20% reduction), to the new definition, therefore reducing the number of worst served customers from around 20,000 to 16,000. A significant proportion of stakeholders (40%) favoured a 20% improvement in network reliability for those 4,000 benefitting customers, at a maximum expenditure per customer of £800.

3.8 **WPD RESPONSE:** We recognise the inconvenience of frequent power cuts and will reduce by 20% the number of customers classified as worst served.

Resilience to severe weather

3.9 **STAKEHOLDER FEEDBACK:** The importance of network resilience to severe weather and flooding is an issue that has increased significantly for stakeholders over the last 18 months, and is now viewed as one of WPD's top three priorities.

3.10 A number of high profile floods during 2012 made stakeholders more aware of the disturbance flooding can cause and 95% would like to see our flood mitigation measures extended to protect more substations.

3.11 Tree clearance to reduce the impact of storms on the electricity network was strongly supported, with half of our stakeholders endorsing WPD's existing tree clearance programme and over 40% wanting the programme to be accelerated.

3.12 **WPD RESPONSE:** We will accelerate the rate of resilience tree trimming by 40%, to complete the programme five years earlier than suggested by Government guidelines (accelerate from 25 years to 20 years), clearing 700km of overhead line each year. We will apply flood defences to an additional 75 substations, reducing the risk of damage to equipment and power cuts due to flooding.

Safety

3.13 **STAKEHOLDER FEEDBACK:** Stakeholders regard safety as a 'given' requirement. It therefore remains a high priority for the way that work is carried out by WPD staff and contractors and how WPD interacts with customers, landowners and other parties.

3.14 **WPD RESPONSE:** Safety is at the heart of everything we do and we will continue to target improvements in our overall safety performance. Our safety outputs include 100% compliance with health and safety law, reducing accidents, enhancing security measures at substations and educating the public; including providing safety information to over 400,000 school children.

Environment

Oil and gas leaks from equipment

3.15 **STAKEHOLDER FEEDBACK:** Minimising WPD's environmental impact by reducing oil and SF_6 gas leaks from equipment is seen as a key issue, although it is viewed as a 'medium' priority when placed in context with other areas for investment.

3.16 Stakeholders would like to see continued improvements to reduce oil leaks through targeted investment, but do not support significantly increased investment. In relation to SF_6 gas leaks, the majority (55%) favoured the removal of the worst 1% of leaking switchgear, because this balanced addressing the assets with the highest leak rates and value for money.

3.17 **WPD RESPONSE:** We will reduce by 75% the volume of oil lost through leaks from oil filled cables through targeted investment to roll out a chemical tracer tagging system that will speed up the location of leaks. There are no alternatives to SF_6 gas at some voltage levels and so we will reduce the volume of SF_6 gas lost by 17%, by replacing 1% of switchgear with the highest leak rates.

Improving visual amenity

3.18 **STAKEHOLDER FEEDBACK:** Undergrounding overhead lines in National Parks and Areas of Outstanding Natural Beauty (AONBs) remains a priority area for stakeholders but this is a polarising issue for many stakeholders and our proposals have received a mixed response.

3.19 During initial engagement stakeholders placed a high priority on increasing this activity. We therefore consulted stakeholders on our plan to increase the number of overhead lines to be undergrounded from 40km to 70km in 8 years. Stakeholders' priorities had changed and 64% asked WPD to scale-back their plans to present levels, or less. In our final round of stakeholder workshops, and in response to WPD's updated proposal to maintain undergrounding at present levels this remained a divisive issue, with 28% stating that WPD should do more than proposed, but with 20% stating WPD should remain at 40km or do even less.

3.20 **WPD RESPONSE:** We will underground 55km of overhead lines by 2023, (presenting an increase of nearly 2km per year on present average levels), working with National Parks and AONB representatives to determine the lines that provide greatest visual amenity benefit. This is in line with majority significant proportion of stakeholders who sought an increase but does not go as far as 70km previously proposed, in recognition of the 64% of customers that did not support large increases.

Low Carbon Technologies (LCTs)

3.21 **STAKEHOLDER FEEDBACK:** Future-proofing the network is a high priority, but stakeholders are very conscious of the uncertainty surrounding the timing and uptake of low carbon technologies. They would like WPD to strike a balance in RIIO-ED1; increasing investment where there is confidence the need exists, but not to go too far ahead of need.

3.22 Stakeholders generally believe that there will be an increase in LCTs that will have an impact on the networks and that WPD will need to accommodate LCTs in a cost effective manner. The majority were of the view that WPD's initial LCT projections were too high, particularly regarding the uptake of electric vehicles and heat pumps.

3.23 **WPD RESPONSE:** We have undertaken a detailed forecasting exercise with the Centre for Sustainable Energy (CSE) to ensure that our 'best view' scenario is evidenced and can be supported. In RIIO-ED1 we will provide a faster response (20% improvement) to customers wanting to connect LCTs, identify potential LCT hotspots and target network investment in these areas using smart interventions and traditional reinforcement.

Connections

Time to connect

3.24 **STAKEHOLDER FEEDBACK:** Stakeholders are very clear that this is an area where we can still do better, despite WPD having the highest satisfaction rating in the industry for our connections service. Stakeholders believe we should shorten the overall time it takes to provide a quotation, and once the quotation is accepted, the time it takes for the connection to be completed.

3.25 43% of business customers and 40% of developers/connections customers wanted improvements to the overall time to connect. The option to improve the overall time to connect by 20% gained most support amongst these customers who have first-hand experience of applying for a connection.

3.26 **WPD RESPONSE:** We will improve the overall time to deliver a connection by 20%. We will do so for all market segments, not just smaller developments.

Communication

3.27 **STAKEHOLDER FEEDBACK:** The connections process should be made easier by providing more frequent, timely communication and alternative methods by which customers can access information.

3.28 Stakeholders overwhelmingly supported the introduction of an online self-service system for enquiries, applications, payments and progress tracking. Stakeholders largely dismissed the provision of a single local point of contact, suggesting that it would introduce an additional person in the chain, delaying communication between the customer and the appropriate WPD contact.

3.29 **WPD RESPONSE:** We will develop online connections processing and progress tracking. We will host quarterly 'surgeries' for connections customers to help them better understand the process and to help us to understand the evolving needs of our customers.

Customer satisfaction

Customer Communication

3.30 **STAKEHOLDER FEEDBACK:** Stakeholders recognise that WPD currently has the highest overall customer satisfaction rating of any DNO group and want this to continue. They have told us that the telephone remains their preferred method of communication; however they would like a choice of communication methods to use, such as social media and real-time power cut information on our website.

3.31 **WPD RESPONSE:** We will continue to be the number one performing DNO group across all elements of the industry's Broad Measure of Customer Satisfaction. We will continue to answer calls within 2 seconds and we will provide on demand messaging via text and social media for customers who want to be kept informed by means other than the telephone. We have already introduced live power cut updates on our website.

Guaranteed Standard of Performance (GSOP) payments

3.32 **STAKEHOLDER FEEDBACK:** Although GSOP payments were never intended to cover consequential loss, and this position remains unchanged, stakeholders have informed WPD that they believe that the value of GSOP payments are too low to cover the impact of the failures.

3.33 **WPD RESPONSE:** Because customers find that they have been inconvenienced when failures occur, WPD proposes to voluntarily double the value of the payments made.

Social obligations

Priority Service Customers

3.34 **STAKEHOLDER FEEDBACK:** WPD has a key responsibility to continue to support vulnerable people, by providing practical support during power cuts and proactive preparation advice and information in advance of an interruption. Stakeholders strongly supported expanding our current support services and increasing the amount of information provided to customers.

3.35 **WPD RESPONSE:** We will ensure the quality of data on our Priority Services Register by contacting all registered customers at least once every two years. We will contact all medically dependent customers every three hours during power cuts, continue to provide practical support via the Royal Voluntary Service (RVS) and British Red Cross, and make 10,000 crisis packs available.

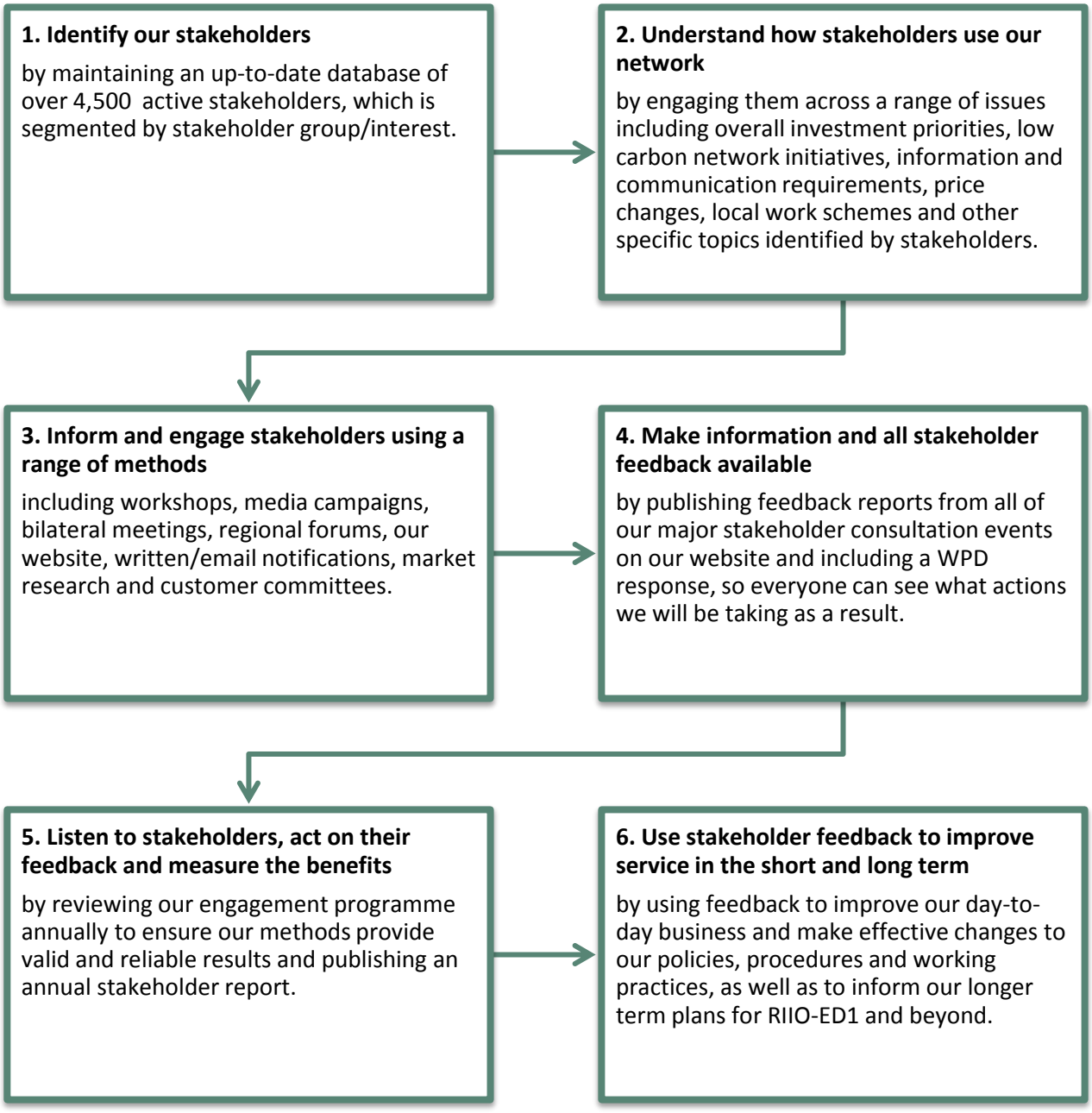
Fuel Poverty

3.36 **STAKEHOLDER FEEDBACK:** There is a role for WPD in tackling wider social issues such as fuel poverty. Stakeholders believe WPD are uniquely placed to support customers due to the interaction we have with them and also the fact that we do not directly bill customers. However, we must not duplicate the responsibilities of other agencies, or deviate too far from our core responsibility to support people during power cuts.

3.37 **WPD RESPONSE:** Building on our existing successful partnership relationships, we will extend our partnership networks, so that we can refer customers to them for assistance. We will also provide bespoke fuel poverty awareness training to WPD frontline staff. By working with partners we will also continue to support initiatives and community-outreach projects specifically to address the causes of fuel poverty.

4 Our stakeholder engagement strategy

4.1 We have a six-stage stakeholder engagement strategy and have been hosting stakeholder workshops since 2008. Our Chief Executive reviews and approves our strategy and action plan annually. The strategy is to:



Additions to our strategy in the light of RIIO-ED1

4.2 When devising our RIIO-ED1 stakeholder engagement programme we chose to extend our core engagement approach to provide the additional information that would be required to help us shape our long term investment priorities and plans. To ensure our consultation programme was of the highest quality, scope and effectiveness, our stakeholder workshops and events have been underpinned by 4 key goals:

Size and breadth

Our programme will engage the largest number of stakeholders, from as wide a range of backgrounds as possible.

The scale of our engagement gives greatest value and integrity to our results.

- We have consulted over 4,200 stakeholders about our Business Plan via a range of methods.
- Our 20 stakeholder workshops attracted an average of 32 attendees per session.
- Each table included a minimum of 8 stakeholders, all from different perspectives/representative groups to ensure discussions were balanced.

Detail

Our programme will develop stakeholder understanding of our business and help ensure their views are well informed.

- We provided comprehensive information – including detailed expenditure figures.
- We consulted on options for investment in 10 core service areas giving customers actual costs and impacts on bills.
- We published our draft Business Plan in March 2013, a month prior to six follow-up stakeholder workshops.
- Stakeholders discussed and evaluated all 67 outputs proposed in our draft Business Plan.

Expert-led

Our stakeholder engagement programme will be led by those responsible for developing the Business Plan.

Every workshop is presented and facilitated by contributors to the Business Plan, including those directly responsible for the six output sections.

This ensures that stakeholder engagement is truly embedded in the business plan development process and not merely a bolt-on box ticking exercise.

Deliverer-led

We will learn from our stakeholders and act on improvement opportunities.

All our workshops are attended and facilitated by local WPD Distribution Managers who will be responsible for delivering the work programme when it is agreed. This allows them to hear first-hand what matters most to stakeholders, and to understand how these priorities are being addressed in our Business Plan.

It also gives stakeholders the opportunity to speak to engineers with local knowledge, to discuss the practicalities of delivery and explore opportunities for co-working and to co-ordinate planning and scheduling.

We will not wait for RIIO-ED1 to deliver improvements that can be done now.

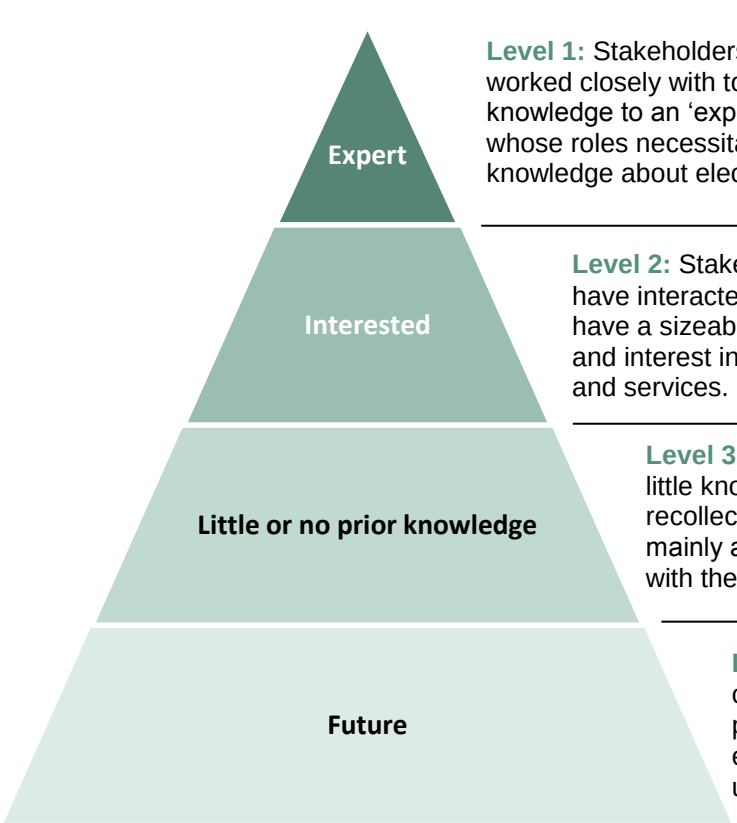
Our stakeholder groups

4.3 All our stakeholders are important to us. We update our stakeholder database annually and it currently contains over 4,500 active stakeholder contacts.

4.4 On an on-going basis we undertake a wide range of engagement activities with different stakeholders including:

- domestic and business customers;
- major energy users and suppliers;
- local authorities;
- parish councils;
- other DNOs;
- other utilities (including electricity suppliers);
- environmental groups;
- regulatory bodies;
- vulnerable customer representatives;
- emergency planners;
- educational institutions;
- connections customers;
- distributed generation customers and developers;
- future customers;
- all WPD staff.

4.5 Our stakeholders have a wide range of knowledge and interest levels in what we do. To ensure our stakeholder engagement activities are comprehensive and inclusive, we tailor our approach so we have an appropriate method of engagement depending on their interest:



Level 1: Stakeholders who we have worked closely with to build their knowledge to an 'expert' level, or those whose roles necessitate an in-depth knowledge about electricity distribution.

Methods of engagement:
- Customer Panel
- Stakeholder workshops
- Draft Business Plan and consultation guide

Level 2: Stakeholders who have interacted with WPD, and have a sizeable knowledge of, and interest in, our operations and services.

- Stakeholder workshops
- Draft Business Plan and consultation guide
- Customer surveys
- Bilateral meetings

Level 3: Stakeholders with little knowledge or recollection of WPD, who mainly associate 'energy' with their supplier only.

- Customer surveys
- Market research
- Media awareness campaign
- Annual stakeholder report
- Website

Level 4: Future customers (bill payers by 2023), e.g. A-level & university students.

- Customer surveys
- Bespoke workshops
- Media awareness campaign
- Website

Our methods of engagement:

Building our RIIO-ED1 Business Plan with stakeholders

4.6 Since 2010, we have engaged with over 4,200 external stakeholders specifically on our plans for RIIO-ED1, via:

- 20 stakeholder workshops (with a wide cross-section of stakeholders);
- 2 'future customers' workshops (with university students)
- 2 'social obligations' workshops (with vulnerable customers, representatives and agencies)
- 7 Customer Panel meetings (with "expert" stakeholders);
- 8 focus groups (with domestic customers);
- 1,208 'willingness to pay stated preference' interviews (with domestic customers);
- 426 'willingness to pay stated preference' interviews (with business customers);
- 6 connections and distributed generation surgeries;
- 774 distributed generation customer interviews;
- 408 vulnerable customer surveys (with customers on the Priority Service Register);
- 2 energy supplier forums;
- 50 staff roadshows.

4.7 Following stakeholder workshops, Customer Panel meetings and willingness to pay research, we publish reports on our website detailing all of the feedback received, as well as a WPD response outlining the conclusions we have reached and how this will impact on our plans.

4.8 Engagement carried out with stakeholders in each of the four stakeholder knowledge and interest levels , is never carried out in isolation. We share the feedback from each of these fora with stakeholders in the other levels, and use the feedback gained to inform the content of our future engagement.

4.9 Examples of our engagement methods, per stakeholder knowledge and interest level, include:

Level One – Expert:

WPD Customer Panel

4.10 We have established a permanent Customer Panel that gives a broad range of stakeholders the chance to shape our thinking and future priorities at a strategic, highly informed level.

4.11 The Customer Panel is attended by WPD's Chief Executive and members meet quarterly to voice their opinions, concerns and ideas in an open forum.

4.12 The Customer Panel has been in place since 2009.

4.13 Through their expert knowledge the Customer Panel is able to shape our broader strategic thinking and offer expert analysis and refinement of our Business Plan as a whole. Outputs from all meetings are published on our website including detailed minutes and actions formally recorded.

4.14 Each Customer Panel member represents one of our stakeholder segments. The Customer Panel's membership is therefore regularly evolving to ensure it continues to be representative

of our diverse customer base. Growing from 11 original attendees, there are now 20 permanent members from regional and national groups including: the British Red Cross, Major Energy Users' Council, B&Q, Energy Saving Trust, the Co-Operative, RVS, Warwickshire Police, Severn Trent Water, West Coast Energy, Clearwell Parish Council and Lincoln University.

WPD Customer Panel – Joint statement of endorsement from members

"Western Power Distribution (WPD) was the first DNO to adopt open and enduring stakeholder engagement, long before RIIO-ED1. They have led the way by giving stakeholders a clear say and involvement in strategic decisions for the future of the business.

WPD's Customer Panel was the first of its kind and currently enables us to regularly meet the senior company managers, see the company at work and learn more about what WPD is doing, where and when. The transparent and open approach affords us (the customer panel) the opportunity to comment on policy and feedback concerns and suggestions to management and key decision makers directly.

WPD proactively engage our group at an early stage with first sight of new policies, strategies and investment proposals to provide appropriate constructive challenge to recommendations and support before they are more widely consulted on at stakeholder workshops.

Collectively the professional experience and knowledge of the invited members have enabled consideration of the outputs proposed by WPD for RIIO-ED1 in order to submit a plan that would be most beneficial for stakeholders and customers. WPD respect both positive and negative responses and address issues accordingly.

WPD's approach to engagement is transparent, genuine and well thought out, using a wide range of methods. Meetings are a worthwhile use of our time as we see our suggestions implemented to ensure customers continue to receive the best possible overall customer service."

Level Two – Interested:

Stakeholder workshops

4.15 We have held 20 stakeholder workshops since 2010 in relation to our RIIO-ED1 Business Plan.

4.16 The events focussed in detail on various aspects of our business that stakeholders had indicated were important to them. The events allowed WPD to identify stakeholder priorities and suggestions for improvements to services and processes. We were able to test and refine our proposals, identify areas for further consultation and, where required by stakeholders, provide additional detail.

4.17 The events have attracted 650 stakeholders representing a broad cross-section of customer groups. Stakeholders included large customers, suppliers, manufacturers, local authorities, emergency planners, environmental groups, vulnerable customer representatives, parish councils, health trusts and universities. Each table featured an average of 8 stakeholders, all from a different stakeholder interest groups, that allowed for fair and balanced discussions from a wide range of perspectives.

4.18 Sessions were held in urban and rural locations across WPD's regions to ensure a representative view. Events were held in Nottingham, Birmingham, Cheltenham, Gloucester, Exeter, Cardiff and Bristol.

4.19 All round-table discussions were run by independent facilitators to stimulate conversation and to ensure workshop reports were independent and unbiased.

4.20 All tables included a senior manager from WPD to provide context and to answer stakeholder questions.

4.21 The full-day sessions involved presentations from WPD to give an overview of the company and our activities and to provide important context to the topics for discussion, including current WPD performance and a detailed explanation of our future plans.

4.22 Stakeholders then participated in facilitated, qualitative round-table discussions followed by quantitative electronic voting in order to give stakeholders an instant overview of the consensus amongst those in attendance. In the afternoon there were optional sessions where stakeholders could discuss topics of specific interest with a relevant "expert" from WPD who is operationally responsible for that service area.

4.23 For example, our six stakeholder workshops in November 2012 were structured as follows:

- We presented:
  - various options for investment and costs;
  - the corresponding service improvement each option would deliver;
  - the maximum impact on the average domestic electricity bill; with respect to:

Workshop 1:	Workshop 2:
Reducing power cuts	Improving service for remote ("worst served") customers
Improving network resilience to severe weather	Undergrounding overhead lines in National Parks and Areas of Outstanding Natural Beauty
Protecting equipment from flooding risk	Improving service for new connections customers (process speed and communications)
Reducing oil and gas leaks from equipment	Innovating customer communication methods

- A separate session was held in the afternoon specifically on low carbon investment scenarios, led by our Design and Development Manager.

Level Three – No prior knowledge:

'Power for life' media awareness campaign

4.24 Stakeholder feedback, in particular from vulnerable customers, students and young people, is that raising awareness of WPD should be a high priority.

4.25 We therefore run a month long 'Power for life' awareness campaign every year where we send a newsletter to every customer and run a series of television adverts.

4.26 The purpose of the campaign is to:

- raise awareness of who we are and what we do;
- report on our current performance and what we are doing to improve our service;
- invite customers to have an input in our stakeholder engagement programme and help shape our future investment plans.

4.27 WPD's fourth annual awareness campaign began in February 2013 with the unveiling of a brand new television advert - a bold and novel approach to engagement with millions of customers who have little knowledge of WPD.

4.28 The month-long campaign, could be viewed on all ITV regions serving our operational area, as well as on S4C in Wales and the 'On Demand' services for ITV and Channel 4. The advert and a range of other information about the campaign are also featured on the WPD website.

4.29 In addition, a four-page information leaflet was delivered to every home and business (7.8 million) in our region, whilst advertising appeared in every regional daily and evening newspaper and included contact information for people wishing to get in touch.

4.30 The 'Power for life' newsletter included an overview of our stakeholder engagement programme, our plans for RIIO-ED1 and an invitation for customers to participate in our consultation process. See appendix A08.

4.31 This ensured that customers with little or no prior knowledge of WPD were given the opportunity to understand our business and have their say on our future plans. In 2012, respondents to our media campaign took part in our 'willingness to pay' research, one month later. Several have also attended Business Plan workshops.

4.32 Over 2,000 customers from 20 major towns and cities across our region took part in face-to-face opinion research, pre and post campaign. This was designed to gauge awareness levels, identify what information customers would most like to receive from us and their preferred method of receiving it.

4.33 Following the 2013 campaign there was a considerable increase in awareness of WPD – 56% amongst those who recalled the campaign – compared with 28% of those who could not.

4.34 Customers also endorsed the methods used by WPD, by highlighting newsletters, TV and radio, and the WPD website as their preferred methods of receiving information from us.

Level Four – Future:

Future customers workshops

4.35 Given that WPD's Business Plan covers the period up to 2023, we have identified a new stakeholder segment for specific consultation. In 2013 we ran a series of workshops with university students to give future electricity bill payers the opportunity to influence and feedback on our plans.

4.36 The sessions at Nottingham University and Bristol University were attended by a number of interested students.

4.37 Every effort was made to engage with as broad a range of students as possible. At Nottingham University we used the university's own database of 209 societies and sent invitations by email. At Bristol University, we placed a number of posters at locations around the Students' Union building and also emailed students directly, using a specialist student marketing company.

4.38 Following an introductory presentation from WPD we held facilitated, qualitative round-table discussions about WPD's future plans with respect to:

- reducing power cuts;
- customer communication methods and the use of social media;
- climate change mitigation and protecting the network from severe weather;
- smart networks and low carbon technology.

4.39 Students echoed the views of wider stakeholders in their support of investment to deliver a more reliable network and fewer power cuts. The consensus was that any power cut lasting more than one hour was extremely inconvenient. They therefore supported investment plans to further reduce the average duration of power cuts for WPD customers and to lower the guaranteed standard threshold.

4.40 Although students can see a role for social media to provide updates during power cuts, most would prefer information via text messages and via our website.

4.41 They felt it was important that WPD try to raise our profile and therefore supported on-going customer awareness campaigns.

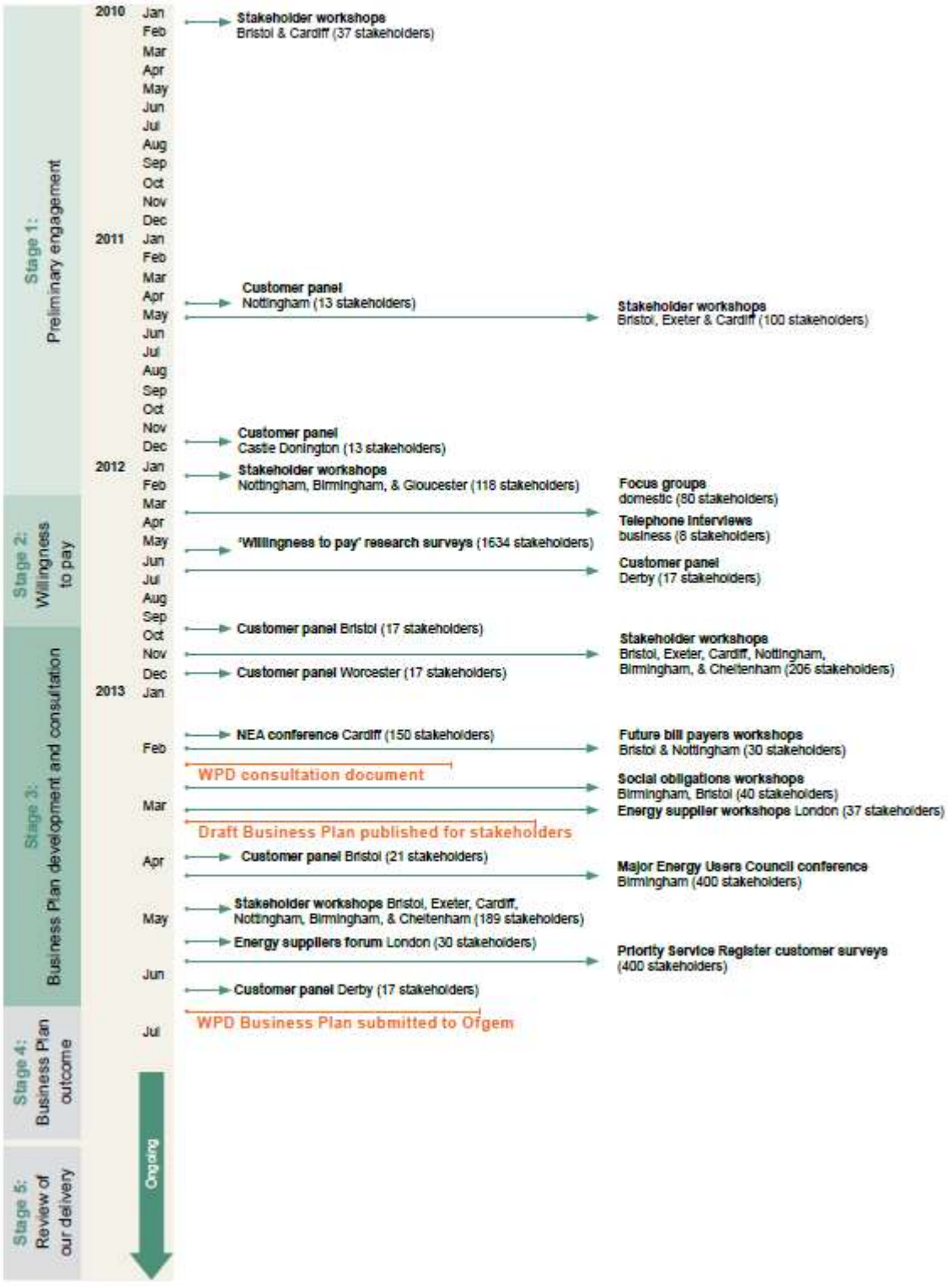
4.42 For the full findings reports from these workshops, see Appendix A06.

5 Our stakeholder engagement process for RIIO-ED1

5.1 Our RIIO-ED1 engagement programme has five phases:

Phase	Timing	Objective
1 - Preliminary engagement	January 2010 – December 2011	To ensure all stakeholder interest areas have been recognised and suitable representatives identified. We also sought to understand their preferred method of communication and to hear first-hand the issues that most concern them.
2 - Willingness to pay research	January 2012 – August 2012	To group stakeholders' priorities into common areas for focus within the Business Plan, to identify specific levels of service improvement achievable under each priority area and to understand customers' 'willingness to pay' for improved performance.
3 - Business Plan development and consultation	September 2012 – July 2013	To provide stakeholders with the opportunity to shape the WPD Business Plan by presenting stakeholders with options for network investment, the level of service improvement each option would deliver, the overall costs and the impact on the average electricity bill.
4 - Business Plan outcomes	July 2013 – Ofgem decision (February 2014)	To communicate how we incorporated stakeholder feedback into our Business Plan, highlight any significant changes from our previous proposals, and to identify the key performance measures stakeholders would like us to use to monitor our progress and enable them to hold us to account for delivering on our promises.
5 – Business Plan delivery/performance review	April 2015 onwards	To provide an update on our progress in delivering the investment plans, our performance against key output measures and to identify areas of emerging stakeholder interest or concern.

Engagement timetable



Phase One – Identifying our priorities

Overview

5.2 Stakeholders were predominantly engaged via qualitative discussion workshops. WPD held events in Bristol, Exeter and Cardiff in May 2011, the findings from which can be found in Appendix A01, and in Nottingham, Birmingham and Gloucester in February 2012, the findings from which can be found in Appendix A02.

5.3 Stakeholders were asked to identify and discuss their priorities for short (next 5 years) and long term investment using traffic light indicator boards, with respect to:

- customer service;
- network performance;
- environmental performance;
- innovation (to facilitate a low carbon future).

Summary of stakeholder feedback

	Rank	Stakeholder priorities identified	May 2011			Feb 2012		
			Exeter	Bristol	Cardiff	Nottingham	Birmingham	Gloucester
		Number of stakeholders	*37*	*32*	*31*	*34*	*50*	*34*
HIGH PRIORITY	1	Maintain current service levels	Highest (Top 3)	Highest (Top 3)	Highest (Top 3)	Highest (Top 3)	Highest (Top 3)	Highest (Top 3)
	2	Low carbon innovation[1]	Highest (Top 3)	High	High	Highest (Top 3)	High	High
	3	Flood (and climate change) mitigation	High	Highest (Top 3)	Highest (Top 3)	Med/low	Highest (Top 3)	Highest (Top 3)
	4	Future proofing asset replacement	High	High	High	High	High	High
	5	Network resilience to severe weather and emergencies	High	High/med	Highest (Top 3)	Medium	Highest (Top 3)	High
	6	Reducing power cuts	Medium	Medium	Medium	Highest (Top 3)	High	Highest (Top 3)
MEDIUM PRIORITY	7	Oil/gas leaks from equipment	Highest (Top 3)	Highest (Top 3)	Medium	Medium	Med/low	Med/low
	8	Customer communication	Med/low	Med/low	Medium	Medium	High/med	High
	9	Remote ('worst served') customers	Medium	High/med	Medium	Med/low	Medium	Medium
	10	Improving the new connections service	Med/low	Low	Low	High	High/med	High
	11	Undergrounding in National Parks and AONBs	Medium	Medium	High	Low	Medium	Med/low
LOWER PRIORITY	12	Reducing business carbon footprint*	Med/low	Med/low	High/med	-	-	-
	13	Metal theft prevention*	-	-	-	Med/low	High/med	Low
	14	Reducing dips (short interruptions)*	Med/low	High/med	Low	-	-	-
	15	Protecting habitats and species	Med/low	High/med	Medium	Low	Med/low	Low

*Any workshops where feedback is denoted by a dash, indicates that the topic was not discussed at that event.
[1]Priorities subsequently grouped under the category of 'innovation to facilitate a low carbon future':

5.4 Stakeholder views related to low a carbon future are detailed in the table below :

	Rank	Stakeholder priorities identified	May 2011			Feb 2012		
			Exeter	Bristol	Cardiff	Nottingham	Birmingham	Gloucester
		Number of stakeholders	*37*	*32*	*31*	*34*	*50*	*34*
HIGH PRIORITY	1	Trial technologies and innovation to facilitate low carbon networks	High	High	High	High	High	High
	2	Making better use of current system capacity (e.g. substation monitoring and dynamic asset rating)*	-	-	-	High	High	High
	3	Installing a smart network (including installing equipment to enable real-time data exchanges)	High	Medium	High	High	High	High
	4	Facilitating connections of local renewable energy	High	Med/low	High	High/med	High	High
MEDIUM PRIORITY	5	Facilitating the Renewable Heat Incentive*	High	Med/low	High/med	-	-	-
LOWER PRIORITY	6	Electric vehicle charging	Low	Low	Low	Med/low	Med/low	Low

Phase Two – Willingness to pay

Overview

5.5 Working with the market research company 'Accent', we held focus groups with 90 domestic and business customers and undertook 1,634 in-depth telephone surveys (1,208 randomly-selected domestic customers, and 426 randomly-selected business customers). This was a statistical exercise in which customers made various choices relating to different levels of service improvement, from which an average 'willingness to pay' figure (as an additional to their current annual electricity bill) was derived. The full findings reports from these surveys can be found in Appendix A04.

5.6 We used the priority areas identified by stakeholders in Phase One to identify more specific service improvement options. For example, having identified that 'reducing power cuts' was a high stakeholder priority, we split this into power cut 'frequency' and 'duration'. Similarly we divided 'improving the new connections service' into 'speed of the process' and 'communication during the process'. We asked stakeholders whether they would like to see WPD maintain current service levels, deliver improved service in return for increased bills, or deliver lower levels of service in return for lower bills. The table below illustrates an example for average duration of power cuts:

Average duration of power cuts (over 3 mins)	65 minutes (increase to)
	60 minutes *(base - maintain)*
	55 minutes (reduce to)
	50 minutes (reduce to)

5.7 For the full list of testing levels surveyed, see Appendix A03.

Summary of stakeholder feedback

	Rank	Category	Willingness to pay for various improvement levels (additional to annual bill)
HIGH WILLINGNESS TO PAY	1	Improving service for worst served customers*	£1.01 - £3.27
	2	Undergrounding in National Parks and AONBs	£2.37 - £2.98
	3	Reducing oil and gas leaks from equipment	£2.09 - £2.50
	4	Average duration of power cuts	£1.44 - £2.28
	5	Investment to support the connection of low carbon technologies	£1.71 - £2.13
MEDIUM WILLINGNESS TO PAY	6	Average frequency of power cuts	£1.51 - £1.84
	7	Guaranteed standard threshold for restoration of supply (time allowed to restore supply before compensation available)	£0.97 - £1.62
	8	Customer communication methods (all)	£1.00 - £1.61
	9	Customer communication methods (connections customers)	£0.92 - £1.56
LOWER WILLINGNESS TO PAY	10	Network resilience to severe weather	£1.29
	11	Time taken to receive a new connection	£1.15 - £1.23
	12	Network resilience to flooding	£0.38 - £0.97
	13	Guaranteed standard definition of a worst served customer (number of power cuts before compensation available)	£0.93

* Levels of service improvement were tested against the DPCR5 definition (15 or more higher voltage power cuts (over 3 minutes) in 3 years) and subsequently a revised definition (12 or more power cuts (over 3 minutes) in 3 years), which has subsequently been agreed by Ofgem as the new definition for the RIIO-ED1 period.

How we used the willingness to pay results

5.8 The headline findings from the willingness to pay (WTP) research were somewhat surprising – despite the UK recession and economic downturn total WTP for domestic customers averaged at an additional £28.08. This increase was broadly similar to the levels indicated at the last price control period where average WTP by the end of DPCR5 was £27.23

5.9 We shared the WTP findings with our expert Customer Panel, who strongly rejected the idea of significant increases to customer bills.

5.10 The WTP survey is an important part of determining our programme, and we have used it to identify detailed customer priorities, but not simply as a blanket justification for increased expenditure.

5.11 Our analysis of costs and benefits has also considered other factors. For example, social considerations such as fuel poverty have led us to take into account the ability of low-income customers to afford higher bills. This has been reinforced by stakeholder feedback at our social obligations workshops, which stated that as part of WPD's plans to address fuel poverty we have a responsibility to continue to deliver improvements to customers without compromising affordability. We have also undertaken economic cost benefit analyses to justify the most appropriate levels of expenditure.

5.12 In order to derive customers' WTP, research is conducted with respondents being blind to the actual costs of delivering service improvements. Our next stage of consultation (Phase Three) therefore applied actual costs of delivery to the improvement levels given greatest priority by the WTP research. On the whole, we found that the costs of delivery were much lower than the derived WTP values. Where significantly greater improvements were deemed practicably deliverable, but for a higher impact on bills closer to the WTP figures, we also presented these options.

5.13 Stakeholders overwhelming supported performance improvements offered at the lower costs.

5.14 For example, when discussing measures to reduce oil and gas leaks from equipment, research indicated a WTP ranging from £2.09 -£2.50 (£2.50 for the highest improvement level to replace

the worst 10% of equipment.) After applying actual costs of investment to these improvement levels, we presented stakeholders with the following options, for which the estimated maximum bill impact ranged from £0.10-£1.00:

	Percentage of equipment replaced with highest leakage rate	Total cost over 8 years	Maximum extra on domestic bill every year
Option 1: NOW	Worst 1% *Oil leaks 4% → 1%* *SF6 leaks 0.6% → 0.5%*	£14.0m	10p
Option 2	Worst 5% *Oil leaks 4% → 1%* *SF6 leaks 0.6% → 0.3%*	£65.0m	50p
Option 3	Worst 10% *Oil leaks 4% → 1%* *SF6 leaks 0.6% → 0.2%*	£132.0m	£1.00

5.15 Despite the biggest improvement option having a significantly lower impact on customer bills than the figures derived from WTP, the preferred option (by 55% of stakeholders) was for the option to tackle the worst 1% of equipment at a maximum bill impact of 10p. This trend was seen for all options presented at these workshops. This further reinforced the stakeholder view that significant increases to customer bills were not acceptable and justified WPD's primary use of WTP to ensure our investment priorities align to customers' preferences.

Phase Three – Business Plan consultation

Overview

5.16 We presented actual costs for investment and a series of detailed options for service improvement delivery, based on the improvement levels most favoured by stakeholders in Phase Two.

5.17 In November 2012 we presented our proposals with respect to ten priority areas, at a series of six workshops. Stakeholders were presented with options for investment and actual costs, the detailed service improvement each investment option would deliver and a view of the potential impact on the average domestic electricity bill. Stakeholders were asked to discuss and vote for their preferred investment option.

5.18 The findings report from these workshops can be found in Appendix A05.

5.19 Taking account of the stakeholder feedback received at these workshops, in February 2012 we published our 'Business Plan consultation with stakeholders – Have your say', which can be found in Appendix A09. This document detailed WPD's updated 'minded to' position in each investment area, with a breakdown per WPD region, along with 14 consultation questions.

5.20 To ensure that as many stakeholders as possible were able to review and influence our plans, the consultation was published on our website and sent to all stakeholders who attended our November 2012 workshops. We received responses from a wide range of stakeholders including domestic customers, local authorities, energy suppliers, AONB groups and energy suppliers.

5.21 A summary of the consultation responses received can be found in Appendix A10.

5.22 The feedback received to this consultation helped to refine aspects our Business Plan. We published a full draft of our Business Plan in March 2013 (see Appendix A11), accompanied by a shorter Business Plan summary document (see Appendix A12).

5.23 We held six further stakeholder workshops in April 2013 to present all 67 outputs from our draft Business Plan. Stakeholders were asked to discuss "packages" of common outputs, as well as individual items they would like us to do more or less of. For example:

Reliability & Availability – Outputs package 1: Improving network performance		
OUTPUT	**NOW**	**2023**
1. On average customers will have 13% fewer power cuts and have their electricity supplies restored 20% quicker.	*7 in 10 years 48 mins*	*6 in 10 years 38 mins*
2. Ensure that a minimum of 85% of customers have their power restored within an hour on HV faults.	*80.78%*	*85%*
3. Reduce by 20% the number of customers classified as worst served.	*20,000*	*16,000*
4. Reduce by 20% the number of customers experiencing a power cut >12 hours.	*12,764*	*10,200*

5.24 Stakeholders were asked:

- Does the amount of information given (and the way it is presented) allow you to sufficiently understand WPD's plans?
- Do you understand the outputs WPD plan to deliver as a result of their investment?
- Do you agree with WPD's approach? Do you agree with their proposed outputs?
- Are there any areas where you want WPD to go further or do less?

5.25 The findings reports from these workshops can be found in Appendix A13.

5.26 WPD's draft Business Plan was published online, along with 20 consultation questions. We welcomed final comments from stakeholders before the submission of the Business Plan to Ofgem.

Summary of stakeholder feedback

5.27 The executive summaries of the feedback received to our Business Plan consultation and associated stakeholder workshops can be found in Appendices A05, A10 and A13.

6 Key findings in detail

6.1 In this section we provide more details about the issues discussed within the different phases of stakeholder engagement, the options presented and the stated preferences from stakeholders. We also provide details of the WPD response following both Phase Two and Phase Three.

Network reliability and availability – Power cuts

6.2 In April 2013, 86% of stakeholders agreed with WPD's draft plans and outputs to improve network performance.

Phase 1– Preliminary engagement: Stakeholder feedback (May 2011-February 2012)

6.3 **Power cuts:** Although reducing power cuts was seen as a medium to high priority, maintaining the current levels of network performance (as a minimum) was consistently identified as the number one priority. Current WPD performance was deemed very good, with recognition that power cuts had decreased in recent years.

6.4 **Quality of supply:** Shorter interruptions ('dips') were deemed less significant to customers and a low priority.

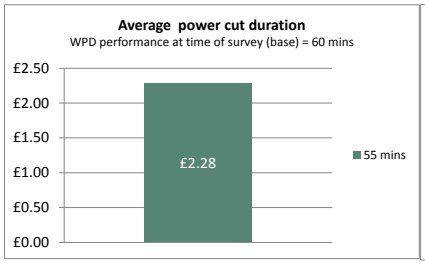
6.5 **Worst served customers:** Improving service for customers experiencing a much higher than average number of power cuts was generally considered a medium priority. Some stated that customers should accept a worse service if they live in rural or remote areas, though for others the point was made that they pay the same for their electricity as those in urban areas.

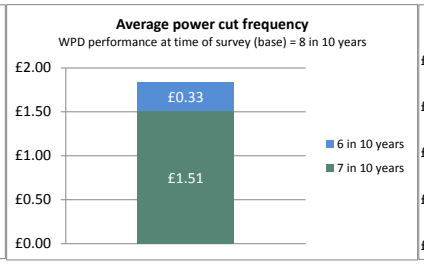
Phase 2 – Willingness to pay (WTP) research: Stakeholder feedback (March – August 2012)

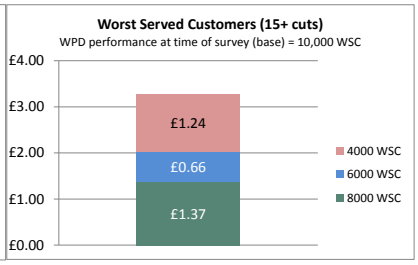
6.6 **Power cut duration:** Stakeholders would most like to see a 10% improvement on current performance, with a WTP an additional £2.28 by 2023. There was no support for improvement beyond this scenario.

6.7 **Power cut frequency:** There was a maximum WTP of £1.84, but the most favoured option was a 13% improvement on current performance, with a WTP an additional £1.51 by 2023.

6.8 **Worst served customers:** There was a maximum WTP of £3.27 (the highest of any area) for a very dramatic reduction of 60% of the number of customers currently classified as 'worst served'. The most favoured option was a 20% improvement, with a WTP an additional £1.37 by 2023.







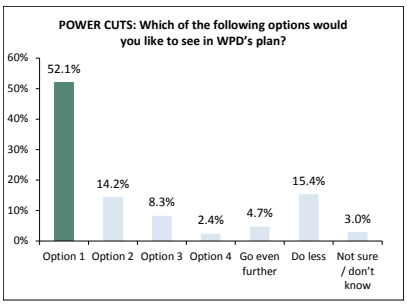
Use of willingness to pay (WTP) research

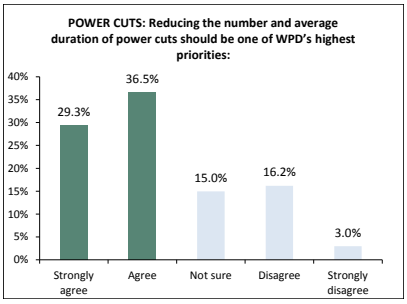
6.9 Although WTP findings gave a wide range of values for various levels of improvement, the greatest proportion of the total WTP in each area was for a reduction in power cut duration of 5 minutes, average frequency to reduce to 7 power cuts in 10 years and the number of worst served customer to improve by 10%. The corresponding investment options and actual costs presented to customers in Phase Three, focused on achieving performance improvements either side of these preferred levels.

Options presented to stakeholders:

	Average frequency	Average duration	Total cost over 8 years	Maximum extra on domestic bill every year
NOW	8 in 10 years	60mins	-	-
Option 1 WPD's current view	7.75 in 10 years	52mins	£30m	40p
Option 2	7.5 in 10 years	51mins	£60m	55p
Option 3	7 in 10 years	48mins	£130m	£1.00
Option 4	6 in 10 years	41mins	£310m	£2.20

Stakeholder feedback:

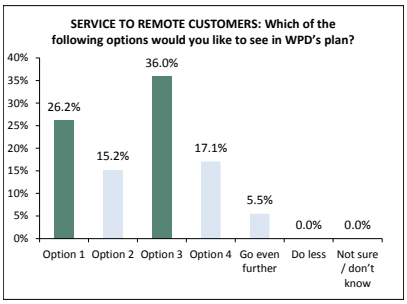


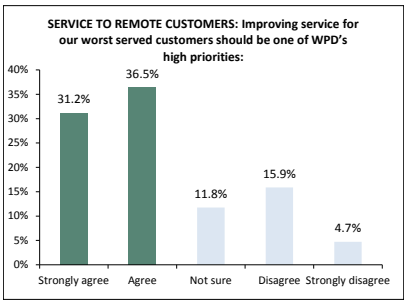


Options presented to stakeholders:

	Improvement	Total cost over 8 years	Maximum extra on domestic bill every year
Option 1: NOW	10k worst served customers	-	-
Option 2	Reduce from 10k to 8k	£1.2m (£600 per customer)	2p
Option 3: WPD's current view	Reduce from 10k to 6k	£3.6m (£900 per customer)	5p
Option 4	Reduce from 10k to 4k	£8.1m (£1350 per customer)	15p

Stakeholder feedback:





WPD RESPONSE:

Power cuts – frequency and duration

6.10 The investment options presented in November 2012 were based on average WPD performance at the time (8 in 10 years, and 60 minutes). Since then we have taken into account more recent performance data where improvements have been made, together with more challenging future targets indicated by Ofgem.

6.11 Applying the same rate of improvement previously requested by stakeholders to the new Ofgem performance targets, we will improve network performance so that on average customers will have 13% fewer power cuts (moving from 7 in 10 years, to 6 in 10 years) and have their electricity supplies restored 20% quicker (moving from an average duration of 48 minutes to 38 minutes).

Worst served customers

6.12 Previous engagement confirmed that a 20% reduction in the number of worst served customers was desirable. Following the change of definition from 15+, to 12+ power cuts (greater than 3 minutes) in 3 years, we have assumed the same level of improvement under the new definition.

6.13 Recognising the inconvenience of frequent power cuts, we will reduce by 20% the number of customers classified as worst served (moving from 20,000 to 16,000 customers).

Phase 3 – Business Plan consultation (April – June 2013)

6.14 86% agreed with WPD's draft plans and outputs to improve network performance.

6.15 The majority of stakeholders (40%) would like worst served customers to see a 20% reduction in the number of power cuts experienced, at a maximum expenditure per benefitting customer of £800.

6.16 **WPD RESPONSE:** We will continue with the proposals for performance improvements. For worst served customers we will apply the 20% improvement previously agreed to the new definition of a worst served customer, benefitting 4,000 customers.

Network reliability and availability – Resilience to severe weather

6.17 In April 2013, 91% of stakeholders agreed with WPD's draft plans and outputs to enhance network resilience to severe weather.

Phase 1 – Preliminary engagement: Stakeholder feedback (May 2011-February 2012)

6.18 'Being prepared for emergencies' including resilience tree cutting and flood mitigation measures, continued to increase in importance to stakeholders throughout our consultation process.

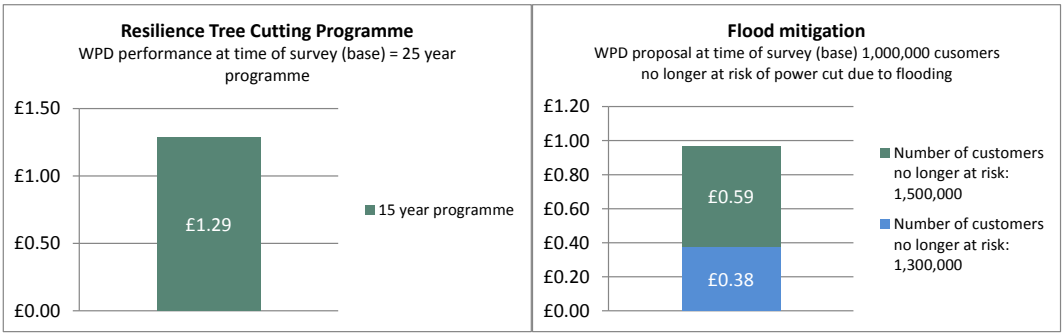
6.19 **Resilience tree cutting:** Stakeholders told us that the current programme is working and on the whole WPD has a good track record of restoring supplies quickly following severe weather.

6.20 **Flood mitigation:** This was generally deemed the most important environment-related issue discussed. A number of stakeholders had experienced the effects of severe flooding on the network and therefore told us that protecting major substations was a very high priority.

Phase 2 - Willingness to pay (WTP) research: Stakeholder feedback (March – August 2012)

6.21 **Resilience tree cutting:** Stakeholders indicated that they would most like to see an acceleration of the rate of resilience tree trimming, to complete the programme 10 years earlier than suggested by Government guidelines, with a WTP an additional £1.29 by 2023.

6.22 **Flood mitigation:** There was a maximum WTP of £0.97 for the preferred improvement option to protect 200 major substations that provide supplies to 1,500,000 customers.



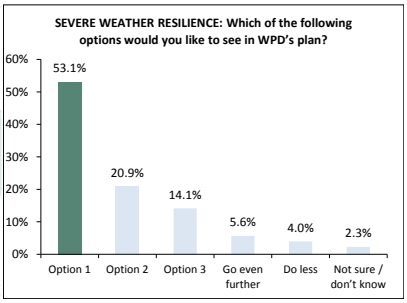
Use of willingness to pay (WTP) research

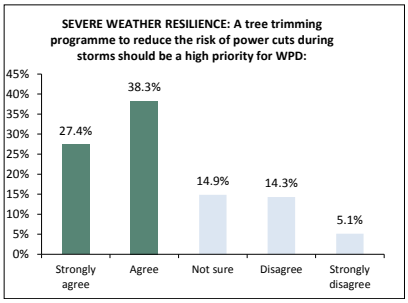
6.23 For resilience tree cutting the only option supported by WTP was for the maximum level proposed, to accelerate the tree trimming programme to be completed in 15 years. The three investment options presented in Phase Three therefore built up to and included this level, but the actual costs were significantly less than the indicative values derived by WTP. For flood mitigation WTP findings gave a range of values, but the greatest proportion of the total WTP was for the maximum improvement proposed, to protect substations providing supplies to 1.5m customers (this accounted for £0.59 of the total £0.97 WTP indicated). The corresponding investment options presented in Phase Three, again built up to and included this improvement level, and at lower cost than the WTP values.

Options presented to stakeholders:

	Duration of resilience tree trimming programme	Total additional cost over 8 years	Maximum extra on domestic bill every year
Option 1: WPD's current view	25 year	Nil	Nil
Option 2	Accelerate to 20 years	£14.7m	14p
Option 3	Accelerate to 15 years	£45.7m	45p

Stakeholder feedback:



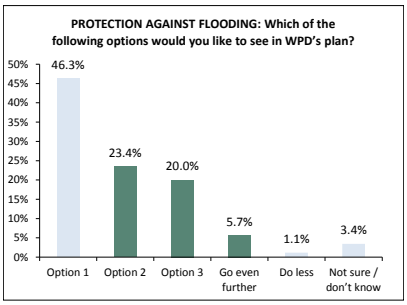


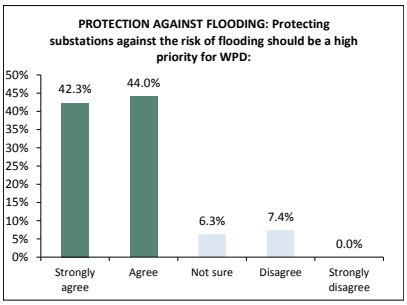
6.24 Whilst the majority of stakeholders supported continuing with a 25 year programme, a significant proportion (41%) wanted to see some acceleration of the programme.

Options presented to stakeholders:

	Number of major substations protected	Number of customers (no longer at risk power cut due to flooding)	Total cost over 8 years	Maximum extra on domestic bill every year
Option 1: WPD's current view	100	1,000,000	£34.0m	Nil
Option 2	150	1,300,000	£50.0m	20p
Option 3	200	1,500,000	£67.0m	50p

Stakeholder feedback:





6.25 Almost half of stakeholders (49%) wanted WPD to protect more major substations from flooding than proposed (100 sites).

WPD RESPONSE:

Resilience tree cutting

6.26 In line with stakeholder feedback that protecting the network from severe weather and storms is now a 'top 3' priority, coupled with a high proportion of stakeholders voting to accelerate our clearance programme, we proposed to accelerate the present rate of resilience tree trimming to complete the programme five years earlier than suggested by Government guidelines (accelerate from 25 years to 20 years), clearing 700km of overhead line per annum.

Flood mitigation

6.27 Given that protecting substations from flooding is such a high priority for stakeholders, we proposed to bring forward the number of flood mitigation measures installed and protect a higher number of sites in the DPCR5 period (2010-2015) than originally planned. This would see 120 major substations protected before 2015. We would then apply flood defences to an additional 75 substations by 2023. This would ensure that 195 substations would have been protected since 2010.

Phase 3 - Business Plan consultation (April – June 2013)

6.28 91% agreed with WPD's draft plans and outputs to enhance network resilience to severe weather.

6.29 Protecting substations from the risk of flooding remained an extremely high priority, with 21% requesting that WPD protect more than 75 major substations in the RIIO-ED1 period.

6.30 **WPD RESPONSE:** We will maintain our plans to protect a further 75 sites by 2023 as this, coupled with the increased number of sites protected in the DPCR5 period (2010-2015), will ensure that all major WPD substations identified as being at specific risk of flooding will be protected. Throughout RIIO-ED1 we will continue to monitor the risk posed by surface water, river and coastal flooding, and our investment programme will be reactive to new Environment Agency data.

Environment – Low carbon innovation scenarios

6.31 In April 2013, 74% of stakeholders agreed with WPD's draft plans and outputs to facilitate increased volumes of Low Carbon Technologies (LCTs).

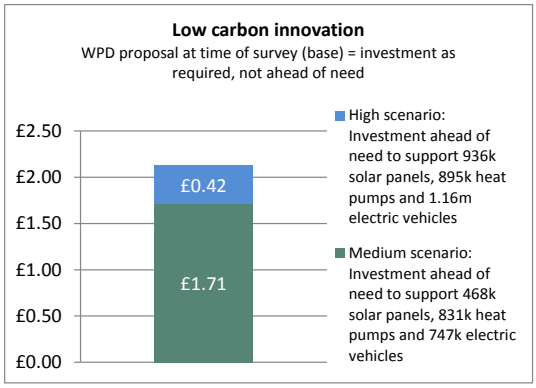
Phase 1 – Preliminary engagement: Stakeholder feedback (May 2011-February 2012)

6.32 Most stakeholders were of the view that 'future proofing' is essential but WPD should adopt an incremental approach to upgrading assets by increasing expenditure in areas where we have confidence the need exists, but not going too far ahead of need in case the uptake is slower than expected. Using innovation to support the existing network and 'make better use of the current system capacity' was seen as a higher priority.

6.33 For many stakeholders, facilitating the connection of renewable energy was one of the most pressing priorities for WPD. A number stated that this area presents a huge challenge for WPD over the next price control period and many questioned the viability of certain types of low carbon technologies. For example, WPD were encouraged to only adopt a watching brief with regards to facilitating electric vehicle charging infrastructure.

Phase 2 - Willingness to pay (WTP) research: Stakeholder feedback (March – August 2012)

6.34 Whilst there was a high overall WTP, at a maximum of £2.13, the most favoured option was to invest ahead of need to support the connection of a medium-level scenario of LCTs, for which there was a WTP an additional £1.71 by 2023.



6.35 **WPD RESPONSE:** Given the overall uncertainty voiced by stakeholders about the uptake of low carbon technologies, we undertook detailed work with the Centre for Sustainable Energy to develop a 'best view' of the future to plan for the impact of LCTs, providing a more detailed view of the likely volumes and way LCTs will cluster on the network.

Phase 3 - Business Plan consultation (November 2012-March 2013)

6.36 A number of stakeholders were of the view that WPD's 'best view' projections were challenging. Of all the types of technology included, stakeholders stated that projections for the uptake of electric vehicles were the most optimistic, followed by renewable heat (heat pumps).

6.37 There was a good deal of support for the introduction of smart grid technologies, but stakeholders were clear that the levels of service to customers should not suffer as a result of their introduction.

6.38 **WPD RESPONSE:** We scaled back our electric vehicles projection from 'medium' to 'low' and our renewable heat projection from 'high' to 'medium'.

6.39 We proposed to improve the time to provide a response to customers wanting to use LCTs by 20% and reduce costs for future customers by developing smart solutions for network management. We would use advanced network monitoring and smart meter data to identify LCT 'hotspots' (where high uptake levels and 'clusters' of LCTs are likely) so that reinforcement can be targeted at the parts of the network where it is most likely to be required.

Phase 3 - Business Plan consultation (April – June 2013)

6.40 74% agreed with WPD's draft plans and outputs to facilitate increased volumes of Low Carbon Technologies (LCTs).

6.41 Keeping the cost of connection low and reducing the time taken to provide a response to customers remained a key priority for stakeholders. 27% wanted WPD to do more to reduce costs by developing smart solutions to network management, and 18% wanted WPD to deliver more than a 20% improvement in response times to customers.

6.42 **WPD RESPONSE:** We will make reducing customer costs to connect LCTs a key focus of our low carbon innovation projects. We will benchmark the average time to provide a response to customers based on 2014/15 performance to better inform the improvement target (currently 20%) proposed.

6.43 19% of stakeholders want WPD to do more to identify LCT hotspots to inform our decision making regarding network reinforcement.

6.44 **WPD RESPONSE:** In line with previous stakeholder feedback, our plans will strike a balance to avoid investing too far ahead of need in case uptake is slower or different than expected. Present information from the Centre for Sustainable Energy forecasts a high take-up of LCTs on specific circuits that make up approximately 7% of our network. We will take the opportunity to increase transformer or cable capacity whilst carrying our asset replacement at these locations.

Environment – Network environmental impact

6.45 In April 2013, 82% of stakeholders agreed with WPD's draft plans and outputs to reduce the environmental impact of the network.

Phase 1 – Preliminary engagement: Stakeholder feedback (May 2011-February 2012)

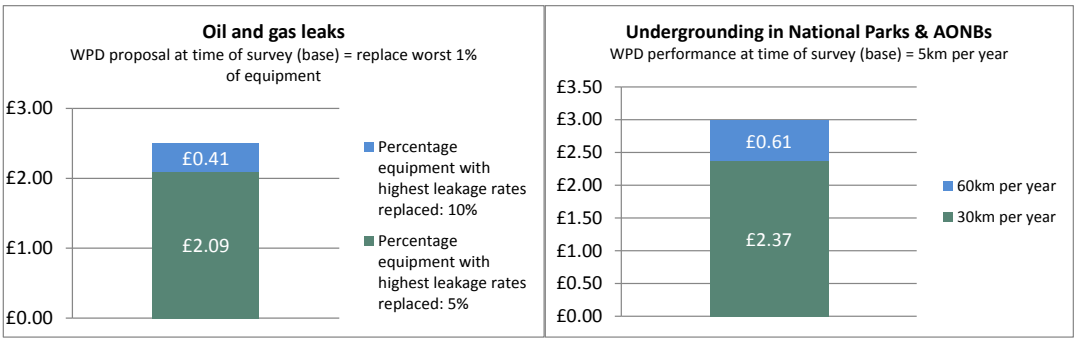
6.46 **Oil and gas leaks from equipment:** Although many stakeholders were of the view that minimising leakage from fluid-filled cables and gas-filled switchgear was a serious issue, it was frequently deemed to be a medium priority. Most stakeholders felt that the threat was manageable and that WPD should monitor this and continue to drive improvements, but should not devote significant resource to upgrading assets to deal with this, unless replacement was deemed essential.

6.47 **Undergrounding overhead lines in National Parks and AONBs:** This was an issue that a number of stakeholders felt very passionately about. Most agreed this was desirable in iconic sites but stakeholders as a whole generally viewed this as a medium priority when placed in context with the other topics discussed.

Phase 2 - Willingness to pay (WTP) research: Stakeholder feedback (March – August 2012)

6.48 **Oil and gas leaks from equipment:** There was a very high overall WTP for improvements in this area, at a maximum of £2.50. However the most favoured option was to replace the worst 5% of equipment with the highest leakage rates, for which there was a WTP an additional £2.09 by 2023.

6.49 **Undergrounding overhead lines in National Parks and AONBs:** There was a very high overall WTP for improvements in this area, at a maximum of £2.98. The most favoured option was to significantly increase the amount of undergrounding to 30km per year (six times higher than the current rate of 5km per annum), for which there was a WTP an additional £2.37 by 2023.



6.50 **WPD RESPONSE:** As a result of the willingness to pay results, WPD proposed to increase undergrounding levels by 75% from 40km in 8 years (5km per year) to 70km. Although this is an increase it did not go as far as WTP indicated because to go significantly further was not deemed practically deliverable, based on engagement with National Park and AONB representatives who stated that successful delivery depends on getting an approved programme with all relevant stakeholders.

Phase 3 - Business Plan consultation (November 2012-March 2013)

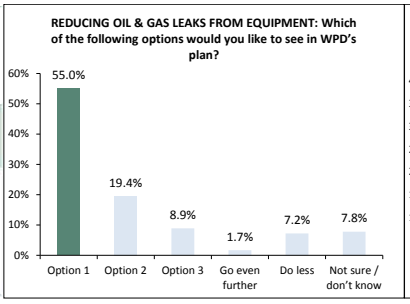
Use of willingness to pay (WTP) research

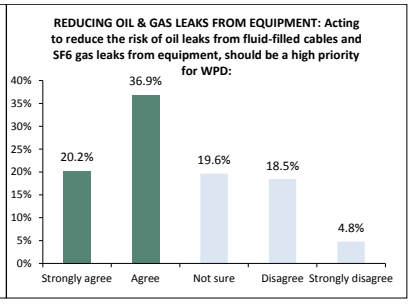
6.51 Although WTP findings gave a range of values for various levels of improvement, the greatest proportion of the total WTP was to reduce oil and gas leaks from equipment by replacing the worst 5% of equipment (£2.09 of the total £2.60 WTP) and to underground 30km of overhead lines each year, meaning 240km in 8 years (£2.37 of the total £2.98 WTP). The corresponding investment options and actual costs presented to customers in Phase Three, focused on achieving performance improvements building up to and including these preferred levels.

Options presented to stakeholders:

	Percentage of equipment replaced with highest leakage rate	Total cost over 8 years	Maximum extra on domestic bill every year
Option 1: NOW	Worst 1% *Oil leaks 4% → 1%* *SF6 leaks 0.6% → 0.5%*	£14.0m	10p
Option 2	Worst 5% *Oil leaks 4% → 1%* *SF6 leaks 0.6% → 0.3%*	£65.0m	50p
Option 3	Worst 10% *Oil leaks 4% → 1%* *SF6 leaks 0.6% → 0.2%*	£132.0m	£1.00

Stakeholder feedback:



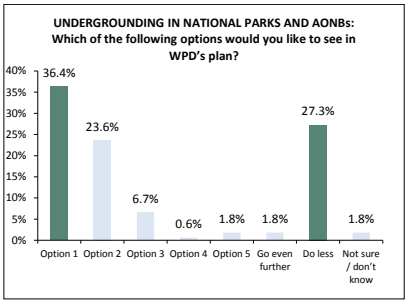


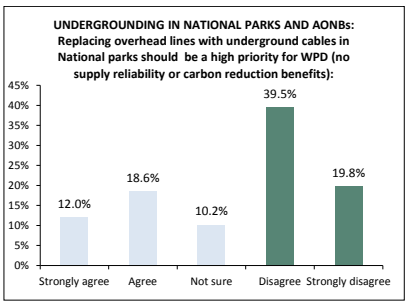
6.52 The majority of stakeholders (55%) agreed with the level of investment and improvement proposed, whilst a further 7.2% favoured doing even less.

Options presented to stakeholders:

	KM overhead line undergrounded (in 8 years)	Total cost over 8 years	Maximum extra on domestic bill every year
Option 1:NOW	40km	£6m	**9p**
Option 2: WPD's current view	70km	£10.5m	**16p**
Option 3	120km	£18m	**28p**
Option 4	240km	£36m	**56p**
Option 5	480km	£72m	**£1.12**

Stakeholder feedback:





6.53 The majority of stakeholders (59%) disagreed with this being classified as a high priority for WPD. 64% voted for an option less than the proposed option to underground 70km in 8 years.

WPD RESPONSE:

Oil and gas leaks from equipment

6.54 We proposed to reduce by 75% the volume of oil lost through leaks from oil filled cables, by rolling out a chemical tracer tagging system that will speed up the location of leaks. There are no alternatives to use of SF_6 gas in switchgear and so we would reduce the volume of SF_6 gas lost through leakage by 17%, by replacing 1% of switchgear with the highest leak rates.

Undergrounding overhead lines in National Parks and AONBs

6.55 After initially proposing to increase the amount of cables undergrounded from 40km over 8 years to 70km, we updated our proposal to continue at current levels (40km) in response to stakeholders overwhelmingly asking us to scale-back our plans.

Phase 3 - Business Plan consultation (April - June 2013)

6.56 82% agreed with WPD's draft plans and outputs to reduce the environmental impact of the network.

6.57 However, 25% of stakeholders wanted WPD to do more than reducing SF_6 gas leakage by 17%.

6.58 **WPD RESPONSE:** We will maintain our plans, as this will see leakage rates drop from 0.7% to under 0.6% of the total volume of SF_6 gas used within the network. Cost benefit analysis supports this and cannot justify going significantly further.

6.59 28% of stakeholders wanted WPD to underground more than 40km of overhead lines in National Parks and AONBs in 8 years; although 20% wanted WPD to do less than proposed.

6.60 **WPD RESPONSE:** We will increase the amount of overhead lines being undergrounded to 55km in 8 years (6.9km per year). However, as a compromise this does not go as far as previously proposed (70km), in order to take into account that one in five customers did not want WPD to do more.

Environment – Business carbon footprint

6.61 In April 2013, 78% of stakeholders agreed with WPD's draft plans and outputs to reduce their carbon footprint.

Phase 1 – Preliminary engagement: Stakeholder feedback (May 2011-February 2012)

6.62 There was little agreement on the importance of this issue. Certain stakeholders felt that WPD should be leading the way on this issue but the majority felt that this is something that is expected of all companies in all sectors and WPD should be striving to similarly lower the impact of their business operations on the environment. In the context of other priorities for improvement, this was generally seen as a medium priority for the future.

6.63 It was stated that WPD should lower their carbon footprint through better efficiency, more recycling and improved ways of working, rather than through increased expenditure. This was therefore not carried forward as an area to be assessed by willingness to pay research.

6.64 **WPD RESPONSE:** We proposed to ensure all replacement vehicles have lower CO_2 emissions than those they replace, all new or substantially refurbished buildings meet, the 'excellent' standard under the Building Research Establishment Environmental Assessment Method (BREEAM) and reduce the amount of waste sent to landfill by 5% per annum.

Phase 3 - Business Plan consultation (April – June 2013)

6.65 78% agreed with WPD's draft plans and outputs to reduce their carbon footprint.

6.66 However, 44% of stakeholders wanted WPD to do more than reducing residual waste (in depots and offices) sent to landfill by 5% per annum.

6.67 **WPD RESPONSE:** We have increased and accelerated our reduction target. We will reduce waste sent to landfill by 20% by 2017 (year two of the RIIO-ED1 period) and will deliver a 5% reduction per annum thereafter.

Connections

6.68 In April 2013, 86% of stakeholders agreed with WPD's draft plans and outputs to make the connections service faster and more efficient.

6.69 94% agreed with WPD's draft plans and outputs to improve communications during the connections process.

6.70 76% agreed with WPD's draft plans and outputs to facilitate a competitive connections market.

Phase 1 – Preliminary engagement: Stakeholder feedback (May 2011-February 2012)

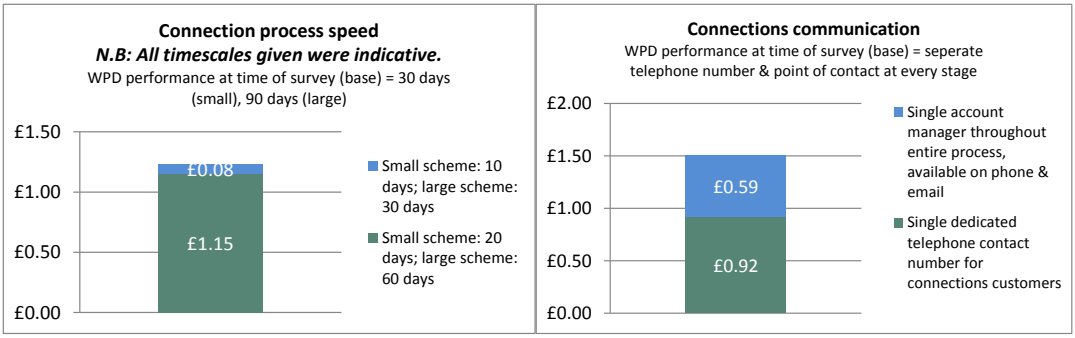
6.71 Overall, stakeholders felt that improving the service WPD offers for new connections should be a medium priority, although this topic has increased in importance to stakeholders over time.

6.72 It was widely felt that anything that could be done to make the process easier for people wanting to connect to the network would be a positive, and that working in partnership with local authorities and developers was one way that WPD could make this happen.

Phase 2 - Willingness to pay (WTP) research: Stakeholder feedback (March – August 2012)

6.73 **Process speed:** Stakeholders would most like to see an improvement of 33% in the time taken to provide a connection, with a WTP an additional £1.15 by 2023.

6.74 **Communication:** There was a maximum WTP of £1.56 for improvements in this area, but the preferred option was to provide a single dedicated telephone number for connections customers, with better expertise at first point of contact (to enable discussions about the customers' specific requirements), for which there was a WTP an additional 92p by 2023.



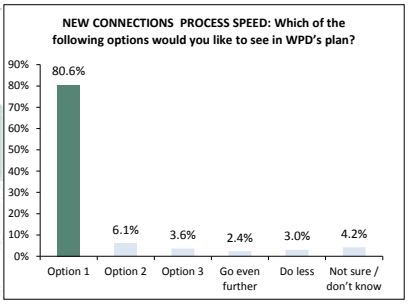
Phase 3 - Business Plan consultation (November 2012-March 2013)

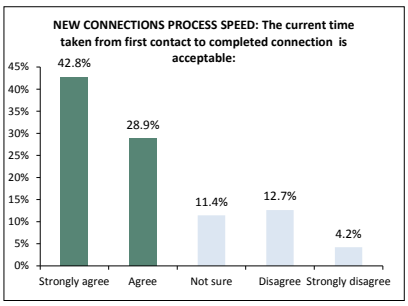
6.75 In terms of process speed, although WTP findings gave a range of values for various levels of improvement, the greatest proportion of the total WTP was to improve the speed of connection to 20 days for small schemes and 60 days for large schemes. The corresponding investment options and actual costs presented to customers in Phase Three therefore focused on achieving performance improvements either side of this preferred level. With regards to communication the greatest proportion of WTP was to introduce a dedicated telephone contact number for connections customers and therefore the options presented in Phase Three gave actual costs for delivering this option, along with two additional options for improving communication, and a final choice to just continue as at present.

Options presented to stakeholders:

	Average time from first contact to completed connection	Total cost over 8 years	Maximum extra on domestic bill every year
Option 1: WPD's current view	Small scheme: 30 days Large scheme: 90 days	-	-
Option 2:	Small scheme: 20 days Large scheme: 60 days	£28.3m	22p
Option 3	Small scheme: 10 days Large scheme: 30 days	£56.6m	44p

Stakeholder feedback:

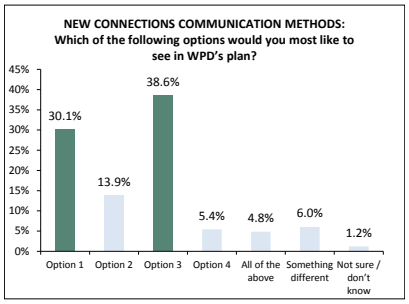




Options presented to stakeholders:

	Communication methods	Total cost over 8 years	Maximum extra on domestic bill every year
Option 1: NOW	A separate point of contact at each stage: enquiry, application, wayleaves/consents, on-site works/construction.	-	-
Option 2: Current view	Now plus a dedicated contact number (better expertise at first contact)	£3.2m	3p
Option 3: Current view	Now plus applications, payments, job tracking etc online	£2m	1p
Option 4	A single local point of contact throughout whole process	£50m	35p

Stakeholder feedback:



6.76 Aside from simply maintaining the current methods of communication (option 1), for which there was strong stakeholder support (30%), the greatest support was for the inclusion of online applications payments and job tracking for which 43% of stakeholders voted (38% voted for this options alone, plus 5% voted for all the options presented).

WPD RESPONSE:
Connections process speed

6.77 We proposed to shorten the overall time taken to provide a connection by 20%.

Communication

6.78 We proposed to enhance online connections processing and progress tracking in 2013 (in advance of the RIIO-ED1 period). In addition, we would host quarterly 'surgeries' for customers to better understand our processes, ensure information provided in documentation and online is effective and work with major customers to identify where processes can be improved.

Facilitating a competitive market

6.79 We will continue to improve customer awareness of third party connection providers and work with these providers to extend the scope of contestable work to HV and reinforcement work.

Phase 3 - Business Plan consultation (April – June 2013)

6.80 86% agreed with WPD's draft plans and outputs to make the connections service faster and more efficient.

6.81 However, 27% want WPD to do more than improve the overall time to connect by 20%.

6.82 **WPD RESPONSE:** We will deliver the 20% improvement quicker than previously proposed, achieving it by 2019 (half way through the RIIO-ED1 period). We will then carry out a review to suggest further improvements that can be made.

6.83 94% agreed with WPD's draft plans and outputs to improve communications during the connections process.

6.84 76% agreed with WPD's draft plans and outputs to facilitate a competitive connections market.

6.85 However, of those in agreement 21% want WPD to do more to improve awareness of third party connection providers.

6.86 **WPD RESPONSE:** In advance of 2015 and the introduction of the Incentive on Connections Engagement (ICE), we will set up an engagement working group for major connections customers. We will work with them to improve multiple aspects of the connections process, including specifically how to raise awareness of third party connections providers amongst all customers. We will monitor awareness levels through annual surveys and track the impact of improvements

.

Customer satisfaction

6.87 In April 2013, 96% of stakeholders agreed with WPD's draft plans and outputs relating to customer service and complaints.

6.88 94% agreed with WPD's draft plans and outputs relating to customer communication.

Phase 1 – Preliminary engagement: Stakeholder feedback (May 2011-February 2012)

6.89 It was widely recognised that WPD currently delivers very high levels of customer satisfaction. This is reflected across all elements of the Broad Measure of Customer Satisfaction, in which WPD ranks as the number one performing DNO group.

6.90 Stakeholders stated that their preferred method of communication is still the telephone. This is especially true of elderly customers.

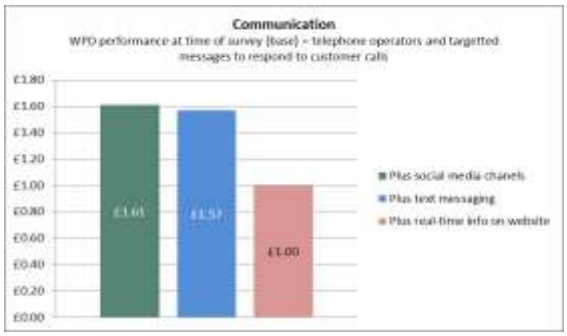
6.91 The introduction of new and innovative methods of customer communication was widely seen as a medium to low priority for the future; however, customers have told WPD that they would welcome more of a choice and more control over the service they receive.

6.92 Customers would like WPD to include options for self-service such as providing easy access to key information during power cuts, via the internet. Most felt that WPD could do more to utilise new technology such as smartphones in order to keep customers informed in real-time.

Phase 2 - Willingness to pay (WTP) research: Stakeholder feedback (March – August 2012)

6.93 Overall there was medium WTP for the introduction of new communication channels. The options presented were not inter-dependent and there is therefore a separate WTP figure for each. The most popular options were the introduction of social media channels, for which there was a WTP an additional £1.61 by 2023; and enabling customers to and receive information via SMS text messaging, for which there was a WTP an additional £1.57 by 2023.

6.94 There was no WTP to receive a call-back every hour during a power cut.

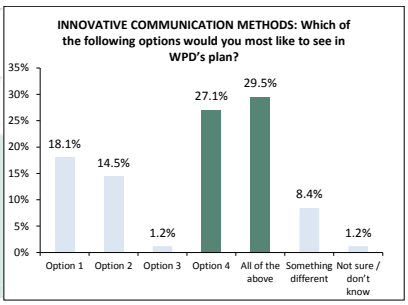


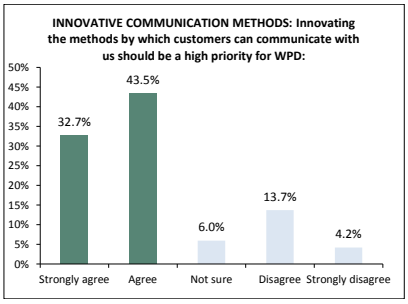
Phase 3 - Business Plan consultation (November 2012-March 2013)

Options presented to stakeholders:

	Communication methods	Total cost over 8 years	Maximum extra on domestic bill every year
Option1: NOW	Telephone operators and automated messages to respond to calls	-	-
Option 2: Current view	Now plus 2-way text messaging	£3m	3p
Option 3: Current view	Now plus social media channels	£3m	3p
Option 4: Current view	Now plus real-time outage info on the website	£2m	2p

Stakeholder feedback:





6.95 Real time outage information on WPD's website was the most popular option (57% voted for this option, or 'all of the above'), whilst 48% also supported text messaging during power cuts. Although social media channels on their own were not popular, almost one third of stakeholders, voted for 'all of the above'.

6.96 For stakeholders the key priority during a power cut is having access to useful and accurate information, especially an estimated time of restoration and a proactive call-back should this information dramatically change.

6.97 Stakeholders continue to see considerable value in our stakeholder engagement events. In November 2012, 99% of stakeholders stated that they found the workshops useful and that they had sufficient opportunity to express and discuss their views.

WPD RESPONSE:

Customer service & complaints

6.98 We proposed to continue to be the number one performing company across all elements of the Broad Measure of Customer Satisfaction and maintain certification to the Customer Service Excellence Standard. We would resolve at least 65% of complaints within one day and continue to have the lowest number of complaints where the Ombudsman has to get involved.

Customer communication

6.99 We would continue to respond to customer telephone calls within 2 seconds, have a low abandoned call rate of less than 1% and always provide an option to talk to a WPD call handler.

6.100 We would provide a restoration time for every power cut and will call back all customers who have been in contact about a fault.

6.101 We would introduce real-time power cut information on our website in 2013 (in advance of the RIIO-ED1 period) and also provide messaging via text and social media.

Stakeholder engagement

6.102 We proposed to continue to host a Customer Panel four times a year, host stakeholder workshops in a minimum of six locations per year and continue to produce an annual stakeholder report detailing actions taken as a result of engagement.

Phase 3 - Business Plan consultation (April – June 2013)

6.103 96% agreed with WPD's draft plans and outputs relating to customer service and complaints performance.

6.104 However of those in agreement, 19% want WPD to go further and resolve more complaints within one day that the 65% proposed.

6.105 WPD RESPONSE: We will resolve at least 70% of complaints within one day.

6.106 94% agreed with WPD's draft plans and outputs relating to customer communication.

6.107 90% agreed with WPD's draft plans and outputs relating to stakeholder engagement.

6.108 WPD RESPONSE: We will adopt all the proposals in the draft Business Plan.

Social Obligations

Phase 1 – Preliminary engagement: Stakeholder feedback (May 2011-February 2012)

6.109 The topic of customer vulnerability was not raised by stakeholders as an area of significant concern or high priority for improvement in the future. WPD's overall power cut response and the support provided to customers, including the vulnerable, was widely recognised as very good. This was therefore not carried forward as an area to be assessed by willingness to pay research. However, we have subsequently carried out extensive engagement with customers and experts in this area to ensure that our social obligations proposals are well justified.

WPD's approach to engagement

6.110 Our Customer Panel provided views on how WPD should address our social obligations and we worked closely with one particular member from the British Red Cross to develop a delivery strategy. They agreed that WPD should have a role in supporting vulnerable customers and told us that we should:

- develop new ways to maintain up-to-date Priority Service Register (PSR) records;
- focus on enhancing our existing core services in conjunction with partner organisations (such as the British Red Cross, RVS and Local Resilience Forums) and embed them further into routine business operations;
- engage with customers, where the opportunity arises, to provide access to information and advice about energy affordability issues;
- avoid duplicating assistance available from other organisations by building referral networks with community organisations.

6.111 **WPD RESPONSE:** We developed our Vulnerable Customer Strategy and specific actions proposed for RIIO-ED1, based on these priorities. We shared our draft proposals at the National Energy Action Conference in Cardiff in January 2013, gaining strong support.

6.112 Given that this topic did not register as a high priority area for stakeholders at our broader stakeholder workshops, the decision was taken to host two separate workshops specifically on WPD's social obligations proposals.

6.113 Following an introductory presentation from WPD, we held facilitated, qualitative round-table discussions about WPD's future plans with respect to:

- Improving the data held on WPD's Priority Service Register (PSR);
- Improving the power cut support services provided for vulnerable customers;
- Addressing fuel poverty and cold homes.

6.114 The workshops took place in February 2013 at Birmingham and Bristol and were attended by 41 stakeholders.

6.115 Participants represented a wide range of organisations including

charities, parish councils, housing associations, humanitarian support agencies, energy advisory services, emergency services and energy suppliers. The organisations represented included:

- British Red Cross
- Shelter
- Citizens Advice Bureau
- Energy Saving Trust
- National Energy Action
- Stratford-upon-Avon District Council
- N Power
- E.ON
- EDF
- Wales and West Utilities
- Advice Network
- Consumer Focus
- Action with Communities in Rural England (ACRE)
- Centre for Sustainable Energy

6.116 The full findings reports from these workshops can be found in Appendix A07.

Phase 3 - Business Plan consultation: Stakeholder feedback

Improving the data held on WPD's Priority Service Register (PSR)

6.117 Stakeholders stated that more work should be undertaken to raise the profile of the Priority Services Register and it was agreed that data on vulnerable customers should be updated regularly. A number of stakeholders were of the view that contact with vulnerable customers to update information should be more frequent than every two years.

6.118 WPD RESPONSE: To ensure that PSR records are regularly checked, WPD will set up a dedicated team of staff trained to contact customers once every two years to validate their details. We will pilot this in advance to ensure that we develop the most effective and efficient approach. With such a large number of customers currently registered (over 715,000) we will maintain our target to contact customers every two years, but will review the suitability of this on an on-going basis.

6.119 The general consensus was that WPD ought to work more effectively in partnership with other organisations to share data and that this should be a two-way activity.

6.120 WPD RESPONSE: We will continue to work with a range of partners to distribute our information leaflets, publicise the PSR and WPD's emergency telephone numbers. Where data protection allows WPD will work with other public service centred organisations such as utilities, local authorities, housing associations and the health service to identify additional customers that should be on the PSR, and where possible to share and improve data.

Improving the power cut support services provided for vulnerable customers

6.121 Stakeholders agreed that when there is a power cut, good communication is key. Contacting vulnerable customers as soon as possible to let them know that WPD is aware of the problem was seen as vitally important.

6.122 WPD RESPONSE: We will continue to help vulnerable customers prepare for power cuts and provide practical support during power cuts via partner agencies such as the RVS and British Red Cross.

6.123 It was felt that four hours without power was a very long time for certain vulnerable customers and that regular updates ought to be given.

6.124 WPD RESPONSE: We will use PSR data to contact medically dependent customers within the first 3 hours of a prolonged power cut (during the hours of 8am to 8pm) to provide updates on power restoration times and identify if additional support or further contact is required.

6.125 There was a good deal of praise for the crisis packs that WPD offers for vulnerable customers, although it was noted that it was important that these are distributed to those vulnerable customers who need them most.

6.126 WPD RESPONSE: In addition to providing advice on how customers can be prepared for power interruptions, we will offer more direct assistance by distributing 10,000 crisis packs (including items such as an analogue phone, torch, gloves, gel hand-warmer, blanket and information leaflets) via our own staff and our partners.

Addressing fuel poverty and cold homes

6.127 Stakeholders were clear that WPD should avoid duplicating the good work that is already being carried out by organisations whose sole purpose is dealing with issues relating to fuel poverty.

6.128 WPD RESPONSE: We will work with new and existing partners to develop a referral framework of regional agencies such as local authorities, Citizens Advice, voluntary agencies and energy charities that can be contacted for assistance on fuel poverty issues.

6.129 There is a certain stigma attached to fuel poverty and this presents a challenge for WPD. Contact Centre staff will need to be sensitive when asking questions to identify whether or a not a customer would benefit from assistance.

6.130 WPD RESPONSE: We will work with partners to develop bespoke communication and listening skills training for front line Contact Centre staff to enable them to identify the key warning signs of fuel poverty and refer customers to appropriate organisations that can help.

7 Appendices

A01: May 2011 Stakeholder workshops – Findings report

7.1 WPD held 3 stakeholder workshops in May 2011 in Bristol, Exeter and Cardiff, to begin our consultations for the RIIO-ED1 period. The aim of the workshops was to ask stakeholders for views on which of WPD's current investment priorities should continue after 2015 and to identify priorities for the longer term future. Stakeholders were asked to take part in two separate workshop sessions to discuss priorities under the themes of delivering a low carbon sustainable future, themed "environment", "network performance" and "customer service".

7.2 The executive summary of findings from these workshops can be found at: http://www.westernpower.co.uk/docs/About-us/Stakeholder-information/Our-future-business-plan/Supporting-Stakeholder-information/May-2011-stakeholder-workshops-executive-summary.aspx

7.3 The full findings report can be found at: http://www.westernpower.co.uk/docs/About-us/Stakeholder-information/Our-future-business-plan/Supporting-Stakeholder-information/May-2011-stakeholder-workshops-findings-report.aspx

A02: February 2012 Stakeholder workshops – Findings report

7.4 WPD held 3 stakeholder workshops in February 2012 in Nottingham, Birmingham and Gloucester, following the acquisition of the electricity networks in the East and West Midlands. The sessions were intended to gauge the views of stakeholders in the newly acquired network areas and to bring the company's programme of engagement ahead of RIIO-ED1 into line with the rest of the WPD regions where initial workshops had already taken place. As per the workshops held in May 2011, it was our intention to engage with a broad cross-section of stakeholders to identify priorities for investment over the upcoming price control review period. Whilst following a similar format and topics as those discussed in May 2011, in response to emerging stakeholder interest we added an explicit section on "innovation".

7.5 The executive summary of findings from these workshops can be found at: http://www.westernpower.co.uk/docs/About-us/Stakeholder-information/Our-future-business-plan/Supporting-Stakeholder-information/February-2012-stakeholder-workshops-executive-summ.aspx

7.6 The full findings report from the Nottingham workshops can be found at: http://www.westernpower.co.uk/docs/About-us/Stakeholder-information/Our-future-business-plan/Supporting-Stakeholder-information/February-2012-stakeholder-workshop-Nottingham.aspx

7.7 The full findings report from the Birmingham workshops can be found at: http://www.westernpower.co.uk/docs/About-us/Stakeholder-information/Our-future-business-plan/Supporting-Stakeholder-information/February-2012-stakeholder-workshop-Birmingham.aspx

7.8 The full findings report from the Gloucester workshops can be found at: http://www.westernpower.co.uk/docs/About-us/Stakeholder-information/Our-future-business-plan/Supporting-Stakeholder-information/February-2012-stakeholder-workshop-Gloucester.aspx

A03: March – June 2012 Willingness to Pay – Testing attributes

	Attribute	Levels to test
1	**Frequency of power cuts (over 3 mins)**	10 in 10 years
		9 in 10 years
		8 in 10 years (base)
		7 in 10 years
		6 in 10 years
2	**Average duration of power cuts (over 3 mins)**	65 minutes
		60 minutes (base)
		55 minutes
		50 minutes
3	**Restoration of supply- time allowed to restore supply before compensation available:**	18 hours (base)
		12 hours
		6 hours
4	**Worst served customers: Number of customers experiencing 15 cuts or more in 3 years:**	10,000 (base)
		8,000
		6,000
		4,000
5	**Worst served customers: Number of customers experiencing 12-14 cuts in 3 years**	35,000 (base)
		28,000
		21,000
		14,000
6	**Definition of worst served customers- number of cuts defining a worst served customer:**	15 (base)
		12
7	**Network resilience to major storms - programme duration to reduce likelihood that trees fall into strategically important overhead lines during severe weather**	25 years (base)
		20 years
		15 years
8	**Network resilience to flooding- number of customers no longer at risk**	1,000,000 (base)
		1,300,000
		1,500,000
9	**Reducing oil and gas leaks from equipment - percentage equipment with highest leakage rates replaced:**	1% (base)
		5%
		10%
10	**Undergrounding overhead lines in areas of outstanding natural beauty - Km undergrounded per year:**	5km per year (base)
		15km per year
		30km per year
		60km per year
11	**Innovation to facilitate a low carbon economy (and meet UK carbon reduction targets) - low carbon technology investment:**	As and when required; not ahead of need (base)
		Ahead of need to support 104k solar panels, 184k heat pumps and 430k electric vehicles
		Ahead of need to support 468k solar panels, 831k heat pumps and 747k electric vehicles
		Ahead of need to support 936k solar panels, 895k heat pumps and 1.16m electric vehicles
12	**New connections (1) - time taken from first contact to completed connection**	Small scheme: 30 days; large scheme: 90 days (base)
		Small scheme: 20 days; large scheme: 60 days
		Small scheme: 10 days; large scheme: 30 days
13	**New connections (2) - communication channels for new connections:**	Separate telephone number and point of contact at each stage
		A single dedicated telephone contact number for connections customers
		A single account manager, available by phone, through the entire process
		A single account manager through the entire process, available by phone or by email if preferred
		A single account manager through the entire process, available by phone or by email if preferred, with all information available online (applications, payments, job tracking etc on our website)
14	**Communication improvements & innovation - methods of contact**	Automated messages or telephone operators to respond to customer calls (base)
		Automated messages or telephone operators to respond to customer calls, plus call backs every hour to provide information updates
		Automated messages or telephone operators to respond to customer calls, plus text messages to provide information updates

		Automated messages or telephone operators to respond to customer calls, plus social media channels (e.g. twitter) to provide information
		Automated messages or telephone operators to respond to customer calls, plus real-time information on our website (e.g. live network information / power cut checking and reporting)
		(Business only) Automated messages or telephone operators to respond to customer calls, plus a dedicated helpline for business customers

A04: March – June 2012 Willingness to Pay – Findings report

Qualitative workshops:

7.9 To inform our future investment strategy we undertook research to derive customers' priorities for investment and willingness to pay to deliver these. As a precursor to the full quantitative willingness to pay interviews, we conducted face-to-face engagement via 8 focus groups (with domestic customers) and 8 in-depth telephone interviews (with business customers). These workshops aimed to:

- Capture qualitative comments from stakeholders about what they believe should be WPD's top priorities for the future.
- Check stakeholder understanding of the key issues to be surveyed.
- Identify where further explanation/context is needed in order to enable meaningful responses.
- Finalise the attributes and levels to be tested in the quantitative interviews.
- Amend the wording of the questions, to ensure we are using the most appropriate language, avoiding jargon and technical terms.

7.10 The full qualitative findings report can be found at: http://www.westernpower.co.uk/docs/About-us/Stakeholder-information/Our-future-business-plan/Supporting-Stakeholder-information/March-to-June-2012-willingness-to-pay-qualitative.aspx

Quantitative workshops:

7.11 We undertook around 1208 domestic and 426business telephone interviews between 2 May and 11 June 2012 to derive customers' willingness to pay for improvements in fourteen different areas of service provision. Customer willingness to pay was established through choice experiments (carried out for us by specialist market research company, Accent) with customers offered choices between different service levels and bills.

7.12 The full quantitative findings report can be found at: http://www.westernpower.co.uk/docs/About-us/Stakeholder-information/Our-future-business-plan/Supporting-Stakeholder-information/March-to-June-2012-willingness-to-pay-quantitative.aspx

A05: November 2012 Stakeholder workshops – Findings report

7.13 WPD held six stakeholder workshops in November 2012, to support the development of our Business Plan. The events took place in Nottingham, Birmingham, Cheltenham, Exeter, Cardiff and Bristol. The following documents detail the methodology used and the feedback given by WPD's stakeholders at each of these events.

7.14 Having identified stakeholder's overall priorities and interest areas at previous events (in the South West in May 2011 and in the Midlands in February 2012), at the workshops in November stakeholders were asked to discuss a range of improvement options in each priority area. As well as recording all qualitative discussions, we used electronic voting to capture quantitative feedback from stakeholders.

7.15 The executive summary of findings from these workshops can be found at: http://www.westernpower.co.uk/docs/About-us/Stakeholder-information/Our-future-business-plan/Supporting-Stakeholder-information/November-2012-stakeholder-workshops-executive-summ.aspx

7.16 The full findings report from the Nottingham workshops can be found at: http://www.westernpower.co.uk/docs/About-us/Stakeholder-information/Our-future-business-plan/Supporting-Stakeholder-information/November-2012-stakeholder-workshops-Nottingham.aspx

7.17 The full findings report from the Birmingham workshops can be found at: http://www.westernpower.co.uk/docs/About-us/Stakeholder-information/Our-future-business-plan/Supporting-Stakeholder-information/November-2012-stakeholder-workshops-Birmingham.aspx

7.18 The full findings report from the Cheltenham workshops can be found at: http://www.westernpower.co.uk/docs/About-us/Stakeholder-information/Our-future-business-plan/Supporting-Stakeholder-information/November-2012-stakeholder-workshops-Cheltenham.aspx

7.19 The full findings report from the Exeter workshops can be found at: http://www.westernpower.co.uk/docs/About-us/Stakeholder-information/Our-future-business-plan/Supporting-Stakeholder-information/November-2012-stakeholder-workshops-Exeter.aspx

7.20 The full findings report from the Cardiff workshops can be found at: http://www.westernpower.co.uk/docs/About-us/Stakeholder-information/Our-future-business-plan/Supporting-Stakeholder-information/November-2012-stakeholder-workshops-Cardiff.aspx

7.21 The full findings report from the Bristol workshops can be found at: http://www.westernpower.co.uk/docs/About-us/Stakeholder-information/Our-future-business-plan/Supporting-Stakeholder-information/November-2012-stakeholder-workshops-Bristol.aspx

A06: February 2013 Future bill payers workshops – Findings report

7.22 In the interest of engaging young people and giving them a say on our future plans, especially as many are likely to be bill payers by 2023, we held two workshops at the University of Nottingham and the University of Bristol. The sessions gave students the opportunity to influence and feedback on our plans and proposed Business Plan outputs, in respect to reducing power cuts, customer communication (including social media), protecting the network from severe weather and helping to facilitate smart networks.

7.23 The executive summary of findings from these workshops can be found at: http://www.westernpower.co.uk/docs/About-us/Stakeholder-information/Our-future-business-plan/Supporting-Stakeholder-information/February-2013-future-bill-payers-executive-summary.aspx

7.24 The full findings report from both workshops can be found at: http://www.westernpower.co.uk/docs/About-us/Stakeholder-information/Our-future-business-plan/Supporting-Stakeholder-information/February-2013-future-bill-payers-findings-report.aspx

A07: February 2013 Social Obligations workshops – Findings report

7.25 Having developed a new vulnerable customer strategy for WPD, we presented these proposals and the corresponding outputs from our Business Plan, to a range of interested stakeholders at two workshops specifically focusing on WPD's social obligations. The workshops took place in February 2013 at Birmingham and Bristol.

7.26 The executive summary of findings from these workshops can be found at: http://www.westernpower.co.uk/docs/About-us/Stakeholder-information/Our-future-business-plan/Supporting-Stakeholder-information/February-2013-Social-Obligations-workshops-executi.aspx

7.27 The full findings report from the Bristol workshop can be found at: http://www.westernpower.co.uk/docs/About-us/Stakeholder-information/Our-future-business-plan/Supporting-Stakeholder-information/February-2013-Social-Obligations-workshop-Bristol.aspx

7.28 The full findings report from the Birmingham workshop can be found at: http://www.westernpower.co.uk/docs/About-us/Stakeholder-information/Our-future-business-plan/Supporting-Stakeholder-information/February-2013-Social-Obligations-workshop-Birmingh.aspx

A08: February 2013 'Power for Life' newsletter to customers

7.29 As part of WPD's annual media awareness campaign, alongside TV and regional newspaper advertising, the following four-page information newsletter was sent to every WPD customer (7.8 million).

7.30 WPD's 'Power for life' newsletter for 2013 can be found at: http://www.westernpower.co.uk/docs/About-us/Stakeholder-information/Our-future-business-plan/Supporting-Stakeholder-information/February-2013-Power-For-Life-newsletter.aspx

A09: February 2013 'Have your say' consultation

7.31 Following the series of stakeholder workshops held in November 2012, WPD launched the following consultation document for wider stakeholders. It presented stakeholders with options for investment including actual costs and the service improvement each option would deliver in relation to areas of WPD's service provision, identified as priorities by stakeholders. It included all changes to WPD's proposals in the light of the feedback received in the November workshops. There were 14 consultation questions posed. The document was published online and sent to 2,000 contacts on out stakeholder database.

7.32 WPD's 'Have Your Say' consultation document can be found at: http://www.westernpower.co.uk/docs/About-us/Stakeholder-information/Our-future-business-plan/Supporting-Stakeholder-information/February-2013-Have-Your-Say-consultation.aspx

A10: February 2013 Have your say' - Summary of responses

Q1 Do you agree that WPD's investment programme should, as a minimum, aim to maintain its current levels of service until 2023?
50% of respondents felt that WPD's investment programme should aim to maintain its current levels of service, whilst 40% of respondents felt that WPD should improve service levels "to ensure there are fewer supply failures." E.g. one electricity supplier stated that the current network resilience targets are at the right level and should not be outperformed.

Q2 Are our assumptions about the uptake of low carbon technologies reasonable for our current 'best view' scenario? Which of the scenarios do you think is most likely?
40% of respondents replied to this question and they all agreed our assumptions were reasonable. Half of these respondents opted for scenario one (high emissions reductions due to low carbon heat) and half thought scenario three (high emissions reductions due to low carbon heat and transport) most likely.

Q3 Are you satisfied with the current reliability of your electricity supply?
Of the respondents who answered this question (some were not responding as customers but as stakeholders) 33% were satisfied with their current reliability and 67% were not.

Q4 Do you agree WPD should focus on reducing the overall level of power cuts and do you support the investment options proposed?
80% of respondents agreed that WPD should focus on reducing the overall level of power cuts and supported the proposed investment options.

Q5 Do you agree WPD should increase investment in tree trimming to improve the networks' resilience to severe weather? Which of the investment options do you support?
75% of the respondents who answered this question agreed that WPD should increase investment in tree trimming to improve the networks' resilience to severe weather. Of these respondents 67% opted for option 3 (15 year programme). Some respondents did not choose an option and one said 15 years was still too long.

Q6 Do you agree WPD should invest more on flood defences for substations? Which of the investment options do you support?
100% of the respondents who answered this question agreed that WPD should invest more on flood defences. Of these respondents 67% opted for option 2 (protect 150 substations) and 33% chose option 3 (protect 200 substations).

Q7. Do you agree WPD should reduce the risk of oil and SF_6 gas leaks from equipment? Which of the investment options do you support?
100% of the respondents who answered this question agreed that WPD should reduce the risk of oil and SF_6 gas leaks from equipment with option 1 (WPD's proposal to replace the worst 1% of equipment) being the favoured option.

Q8. Do you agree WPD should invest to improve service to our most remote customers? Which of the investment options do you support?
100% of the respondents who answered this question agreed that WPD should improve service to our most remote customers with option 2 (reduction of 4,000 worst served customers) being the favoured option and option 3 (reduction of 6,000 worst served customers) receiving some support.

Q9. If you have had experience of working with WPD to deliver a scheme, how did you find the experience?
No comments.

Q10. Do you agree WPD should continue to invest at the current rate? Which of the investment options do you support?

Of the respondents who answered this question, 50% said WPD should continue to invest at the current rate and 50% thought WPD should do more. One respondent (a preservation association) responded only about this question and urged WPD to invest more.

Q11. What aspects of the new connections process would you most like WPD to focus on improving?
There was some support for improvement in the connection arena including support for WPD focusing on the completed connections process.

Q12. Overall time to connect: Which improvement option do you support?
100% of those who responded to this question opted for option 1 (WPD's current view, a 20% improvement on the average time to connect).

Q13. Communication methods: Which improvement option do you support?
The majority of those who responded to this question opted for option 2 (web based self service) with some support for option 1 (a dedicated number and better expertise at first point of contact).

Q14. How can we make it easier for our customers to communicate with us? Which of the improvement options do you support?
Respondents suggested retaining a UK based contact centre, local numbers to call from mobiles to ensure it's free to the user and information online. No support for social media such as twitter was evident. 100% of those who selected a preferred option chose option 2 (sending and receiving information via text message).

Additional comments:
Increase in customer bills
An electricity supplier expressed concern about the increase in investment spend above DPCR5 levels. They would like to understand what asset replacement has already been completed and the impact of it on customer service.

They sought clarification on whether WPD's assumptions account for a likely reduction in demand due to smart meters. They felt that the £14m per annum to accommodate the connection of Low Carbon Technologies, alongside £68m per annum for general reinforcement is overstated. They expressed the view that WPD can improve service without increasing costs to customers by utilising smart meter data and established technology such as smart phones and social media.

A11: March 2013 WPD draft Business Plan

7.33 In advance of our stakeholder workshops in April 2013, to consult on WPD's draft Business Plan and all outputs, the Plan was published online in March 2013. Details were sent to all contacts on WPD's stakeholder database.

7.34 A copy of the draft Business Plan can be found at: http://www.westernpower.co.uk/docs/About-us/Stakeholder-information/Our-future-business-plan/Supporting-Stakeholder-information/March-2013-WPD-draft-Business-Plan.aspx

A12: April 2013 WPD draft Business Plan – Summary for stakeholders

7.35 To accompany our stakeholder workshops in April 2013, WPD produced a simplified summary document to capture the key points of the plan and to outline all of the outputs proposed. This document was presented to stakeholders at these workshops, prior to the discussion sessions.

7.36 The summary of WPD's draft Business Plan can be found at: http://www.westernpower.co.uk/docs/About-us/Stakeholder-information/Our-future-business-plan/Supporting-Stakeholder-information/April-2013-draft-WPD-Business-Plan-summary-for-sta.aspx

A13: April 2013 Stakeholder workshops – Findings report

7.37 In order to communicate the key aspects of our draft Business Plan WPD hosted six workshops in Nottingham, Birmingham, Cheltenham, Exeter, Cardiff and Bristol. The sessions included a wide range of stakeholders, and gave them the opportunity to qualitatively discuss all the outputs proposed within the Plan and to quantitatively vote on the appropriateness of our proposals as a whole, as well as to highlight any aspects they would like WPD to amend.

7.38 The executive summary of findings from these workshops can be found at: http://www.westernpower.co.uk/docs/About-us/Stakeholder-information/Our-future-business-plan/Supporting-Stakeholder-information/April-2013-Stakeholder-workshop-executive-summary.aspx

7.39 The full findings report from the Nottingham workshops can be found at: http://www.westernpower.co.uk/docs/About-us/Stakeholder-information/Our-future-business-plan/Supporting-Stakeholder-information/April-2013-stakeholder-workshop-report-Nottingham.aspx

7.40 The full findings report from the Birmingham workshops can be found at: http://www.westernpower.co.uk/docs/About-us/Stakeholder-information/Our-future-business-plan/Supporting-Stakeholder-information/April-2013-stakeholder-workshop-report-Birmingham.aspx

7.41 The full findings report from the Cheltenham workshops can be found at: http://www.westernpower.co.uk/docs/About-us/Stakeholder-information/Our-future-business-plan/Supporting-Stakeholder-information/April-2013-stakeholder-workshop-report-Cheltenham.aspx

7.42 The full findings report from the Exeter workshops can be found at: http://www.westernpower.co.uk/docs/About-us/Stakeholder-information/Our-future-business-plan/Supporting-Stakeholder-information/April-2013-stakeholder-workshop-report-Exeter.aspx

7.43 The full findings report from the Cardiff workshops can be found at: http://www.westernpower.co.uk/docs/About-us/Stakeholder-information/Our-future-business-plan/Supporting-Stakeholder-information/April-2013-stakeholder-workshop-report-Cardiff.aspx

7.44 The full findings report from the Bristol workshops can be found at: http://www.westernpower.co.uk/docs/About-us/Stakeholder-information/Our-future-business-plan/Supporting-Stakeholder-information/April-2013-stakeholder-workshop-report-Bristol.aspx

2015-2023

RIIO-ED1 **BUSINESS PLAN**

SA-02 Supplementary Annex - Incentives

June 2013 (updated April 2014)

WESTERN POWER DISTRIBUTION

Serving the Midlands, South West and Wales

SA-02 Incentives
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1 Introduction

1.1 This document is a supplementary annex to the Western Power Distribution (WPD) Business Plan for the eight year period from 1st April 2015 to 31st March 2023.

1.2 It describes the incentives specified by Ofgem and adopted or modified by WPD that are necessary to create an environment that will drive the delivery of long term outputs through investment and application of efficient business processes.

1.3 It describes the incentives that should apply to all four WPD distribution licences of West Midlands, East Midlands, South Wales and South West.

1.4 The eight year period aligns with the next regulatory price control review period, known as RIIO-ED1; the first for electricity distribution to be determined using Ofgem's Revenue = Incentives, Innovation and Outputs framework. The Business Plan, supplementary annexes, detailed cost tables and financial models form the submission under RIIO-ED1 to the regulator Ofgem (Office for Gas and Electricity Markets), who will use the information to determine allowed revenues.

Structure of this document

1.5 We appreciate that the readers of the WPD Business Plan suite of documents will range from regulatory experts and well informed stakeholders through to new customers who may have had little previous knowledge of WPD.

1.6 This document is aimed at readers who require a more detailed understanding of the incentives that will be in operation during RIIO-ED1. A less detailed description of the incentives can be found in the main Business Plan Overview document.

1.7 This document is subdivided into the following sections:

Chapter	Title	Content
2	**Overview of Incentives**	A brief description of what incentives are and why Ofgem uses them.
3	**Safety Incentives**	The incentives that drive compliance with health and safety law.
4	**Reliability Incentives**	The incentives that drive improvements to network reliability.
5	**Environmental Incentives**	The incentives that will lead to the reduction in losses and a lower carbon footprint.
6	**Connections Incentives**	The incentives that drive an improvement to the service for customers connecting to the network.
7	**Customer Satisfaction Incentives**	The incentives that lead to improvements in customer satisfaction.
8	**Social Obligation Incentives**	The mechanisms that will be used to reward improvements in the services provided for vulnerable customers.
9	**Innovation Incentives**	The additional allowances that are available through a competitive process to fund projects that lead new solutions to manage the transition to a low carbon economy.
10	**Efficiency Incentives**	The mechanisms that drive DNOs to be more efficient
11 Appendix A1	**GSOP payments**	A description of the performance GSOPs with a comparison of proposed payment levels from Ofgem and WPD
12 Appendix A2	**Connection GSOP payments**	A description of the connections GSOPs with a comparison of proposed payment levels from Ofgem and WPD

2 Overview of incentives

2.1 The RIIO-ED1 incentive mechanisms are designed to encourage DNOs to deliver a range of outputs and do so efficiently. This means that many of the regulatory incentives are closely related to the outputs Ofgem will monitor.

2.2 The mechanisms used can be financial or reputational.

2.3 Financial incentives provide rewards for outperformance or apply penalties where service fails to meet targets or standards. The RIIO handbook states that for a financial incentive to apply there needs to be:

- clarity on the output being incentivised;
- confidence in the data being used to assess the output;
- evidence that the output is important to customers;
- confidence that the output is not covered by other incentives or other obligations.

2.4 Reputational incentives compare performance against peers usually illustrating relative positions in league tables. These encourage improvement through the reputational advantage of being recognised as a leading performer. They provide benchmarking information which assists DNOs in questioning how they might identify actions to improve performance.

2.5 There are other obligations that incentivise behaviour and these generally relate to compliance with the law, licences and industry codes. This document does not describe these obligations unless Ofgem has specifically indicated that delivery of outputs will be linked to them.

2.6 WPD accepts the range of incentives proposed by Ofgem and does not propose any additions or removals. WPD will seek to maximise rewards and avoid penalties across all the incentive mechanisms.

2.7 WPD accepts the rates and levels of the incentives proposed by Ofgem with the only exception being the penalty payment rates associated with Guaranteed Standards of Performance where WPD will double the value of Ofgem's proposed payment values to customers.

2.8 Ofgem uses a number of different ways of describing the value of incentives and these include:

- Return on Regulatory Equity (RORE) specified in basis points with reference to the notional proportion of the RAV that is financed by equity. The actual financial values are determined once allowances are set;
- percent of annual base revenue. The actual financial values are determined once allowances are set;
- cash value for payments to customers.

3 Safety incentives

3.1 There are no financial incentives for safety.

3.2 Health and safety law defines the obligations and the Health and Safety Executive (HSE) enforce regulations. Failure to comply can result in the HSE serving improvement notices, prohibition notices or prosecutions. These can result in reputational damage, fines or in some cases imprisonment.

3.3 Levels of safety performance within WPD are very high. We will continue to strive to improve our levels of safety for members of the public, contractors and our staff.

4 Reliability incentives

Interruptions Incentive Scheme (IIS)

4.1 The IIS provides rewards for outperformance (and applies penalties for underperformance) against targets for the average number of interruptions and the average duration of those interruptions.

4.2 It considers both unplanned power cuts and planned outages, but the target setting mechanisms are different.

4.3 Targets for unplanned interruptions are derived from industry benchmarks and have improvement factors applied so that they get tougher over time.

4.4 Planned targets are derived from past performance so that where DNOs make improvements to working practices these are 'locked in' to future targets and where work volumes drive an increase in interruptions the targets are relaxed so that DNOs are not adversely penalised for doing more work.

4.5 Performance is measured through well-defined guidelines that have been refined since the introduction of IIS in 2002/3. Reporting is externally audited annually to ensure that the details of interruptions are being accurately recorded and reported.

4.6 The value of the incentive mechanism is shown in the table below.

Value of incentive for IIS		
Incentive Mechanism	**Maximum Reward**	**Maximum Penalty**
Interruptions incentive scheme overall exposure	+250 RORE basis points	-250 RORE basis points

Reliability Guaranteed Standards of Performance (GSOPs)

4.7 The Electricity (Standards of Performance) Regulations 2010 define the guaranteed standards, covering a range of different network reliability circumstances, where customers are entitled to payments where DNOs fail to meet the standards.

4.8 These are established measures of performance that will be continued into RIIO-ED1, but Ofgem have proposed the following changes:

- The standard for restoration of supplies under normal weather conditions will be reduced from 18 to 12 hours;
- Payments for failures will be increased to reflect inflation forecasts.

4.9 They are intended to be minimum standards and therefore failures should be avoided.

4.10 The proposed change to the standard for restoration of supplies in normal weather is being introduced to drive DNOs to reduce the duration of power cuts.

4.11 Whilst failures lead to a financial cost, there is also a strong reputational incentive to minimise the number of failures. WPD accepts Ofgem's proposed changes to this incentive scheme.

4.12 We will voluntarily double the value of payments for failures against guaranteed standards. Whilst we do not anticipate that the provision of these enhanced compensation levels will have a significant financial impact on WPD, we feel there is a need to ensure customers feel adequately recompensed should our service standards fail to meet minimum expectations.

4.13 The individual standards and payment values proposed by Ofgem and WPD are shown in appendix A1.

5 Environmental incentives

Losses discretionary reward

5.1 Previous price controls have included a financial incentive for losses, but difficulties with measuring losses have led Ofgem to propose a change to the incentive arrangements.

5.2 For RIIO-ED1 loss reduction will be driven by a mechanism that consists of four elements:

- licence obligations;
- loss reduction expenditure in business plans;
- annual reporting obligations;
- a discretionary reward.

5.3 The discretionary reward will provide financial payments for DNOs that undertake additional losses reduction actions over and above those set out in business plans. WPD agrees with Ofgem's proposed changes to this incentive scheme.

5.4 The value of the incentive mechanism is shown in the table below.

Value of incentive for losses discretionary reward		
Incentive Mechanism	**Maximum Reward**	**Maximum Penalty**
Losses discretionary reward – year 2 of RIIO-ED1	£8m	n/a
Losses discretionary reward – year 4 of RIIO-ED1	£10m	n/a
Losses discretionary reward – year 6 of RIIO-ED1	£12m	n/a

Business Carbon Footprint

5.5 The business carbon footprint incentive was introduced in DPCR5 and is a reputational scheme where DNO performance is published in league tables.

5.6 In RIIO-ED1, the league tables will be supplemented by descriptions of the positive actions being taken by DNOs to reduce emissions.

5.7 These details will be published in Ofgem's Electricity Distribution Annual Report.

6 Connections incentives

6.1 There are a number of existing and new incentives such as 'Time to Connect' and the 'Incentive on Connections Engagement' aimed at improving the service provided for customers connecting to DNO networks.

Connection Guaranteed Standards of Performance (Connections GSOPs)

6.2 The final proposals for DPCR5 introduced new standards to establish minimum levels of service and to set out the level of compensation to customers where these standards are not met.

6.3 There are thirty guaranteed standards of performance covering all the aspects of connection provision including:

- providing budget estimates;
- providing quotations for connections;
- contacting customers to schedule work;
- commencing works on site;
- completing work on site;
- completing energisation;
- repairing faults on unmetered connections;
- providing quotations for unmetered supplies;
- quotation accuracy;
- failure to make a payment for failure against one of the standards.

6.4 Each failure of a standard results in a payment to the customer with the majority of connections standards having a per day cumulative penalty.

6.5 Ofgem are not proposing any changes to the Connection GSOPs.

6.6 The individual standards and payment values proposed by Ofgem and WPD are shown in appendix A2.

Customer satisfaction survey

6.7 Ofgem's Broad Measure of Customer Satisfaction (BMCS) monitoring contains an element that rewards or penalises DNOs for the levels of customer satisfaction. Customers that have requested a connection are surveyed and their answers provide a score. The overall average score is then compared against a target.

6.8 Ofgem propose to increase the value of this incentive and to have it only apply to minor connections (since they will introduce the Incentive on Connections Engagement for major connection customers). WPD accepts Ofgem's proposed changes to this incentive scheme.

6.9 The value of the incentive mechanism is shown below (note that this is an integral part of the BMCS).

Value of incentive for connection customer satisfaction survey		
Incentive Mechanism	**Maximum Reward**	**Maximum Penalty**
Connection customer satisfaction survey	+0.5% of base revenue	-0.5% of base revenue

Time to Connect Incentive

6.10 The 'overall time to connect' is a combination of the time to provide a quotation and, once the offer is accepted, the time taken to complete the necessary connection works.

6.11 Ofgem will be introducing a new incentive mechanism in RIIO-ED1 that rewards DNOs for outperforming time to connect targets.

6.12 It is aimed at encouraging DNOs to develop ways to speed up the various elements of providing a connection, including providing greater assistance in the early stages so that enquiries are dealt with quickly.

6.13 This will only apply to minor connections i.e. single and small developments up to four connections. WPD accepts Ofgem's proposed new incentive scheme.

6.14 The value of the incentive mechanism is shown in the table below.

Value of incentive for time to connect		
Incentive Mechanism	**Maximum Reward**	**Maximum Penalty**
Time to connect incentive	+0.4% of base revenue	n/a

Incentive on Connections Engagement (ICE)

6.15 ICE is a new incentive being proposed for RIIO-ED1 which will penalise DNOs that do not engage adequately with larger connection customers i.e. those requiring more than four connections. It is being implemented to focus DNOs on understanding and meeting the needs of major connection customers.

6.16 DNOs will be required to identify, engage with and respond to the needs of connection customers. The activities undertaken will be reported to Ofgem every two years and separate submissions will be required for each market segment. A penalty will be applied where the actions carried out fail to meet minimum requirements.

6.17 The ICE incentive will not apply to those larger connection market segments that have passed the competition test. WPD accepts Ofgem's proposed new incentive scheme.

6.18 The total value of the incentive mechanism across all of the larger connection market segments is shown in the table below.

Value of incentive for ICE		
Incentive Mechanism	**Maximum Reward**	**Maximum Penalty**
Incentive on connection engagement	n/a	-0.9% of base revenue

7 Customer satisfaction incentives

Broad Measure of Customer Satisfaction (BMCS)

7.1 The BMCS was introduced in DPCR5 to ensure that DNOs are focused on providing good service to customers.

7.2 The BMCS is an incentive mechanism that provides rewards or penalties in three areas of customer service: customer satisfaction, complaints and stakeholder engagement.

7.3 Customer satisfaction is assessed through a survey and deals separately with three types of interaction:

- customers requesting a connection (minor connections only);
- customers experiencing a supply interruption;
- customers making a general enquiry.

7.4 The complaints part of the BMCS results in penalties where DNOs do not meet the specified target performance. The measure is subdivided into four components with greater weighting applied to repeat complaints and complaints that take longer than 31 days to resolve.

7.5 The final part of the BMCS considers stakeholder engagement with rewards available for DNOs that engage well and use the information obtained to improve the service provided to customers. This incentive has been strengthened to encourage DNOs to focus more on issues relating to vulnerable customers. WPD accepts Ofgem's proposed changes to this incentive scheme.

7.6 The values of the different elements of the incentive mechanism are shown in the table below.

Value of incentive for Broad Measure of Customer Satisfaction		
Incentive Mechanism	**Maximum Reward**	**Maximum Penalty**
Customer satisfaction survey – connections	+0.5% of base revenue	-0.5% of base revenue
Customer satisfaction survey – interruptions	+0.3% of base revenue	-0.3% of base revenue
Customer satisfaction survey – general enquiries	+0.2% of base revenue	-0.2% of base revenue
Complaints metric	n/a	-0.5% of base revenue
Stakeholder engagement incentive	+0.5% of base revenue	n/a
Total	**+1.5% of base revenue**	**-1.5% of base revenue**

8 Social obligations incentives

Stakeholder engagement for vulnerable customers

8.1 DNOs have an important role in helping vulnerable customers.

8.2 To encourage DNOs to make changes for vulnerable customers Ofgem proposes to enhance the reward available for the stakeholder engagement part of the BMCS. The increased value of the incentive will specifically be used to assess and reward the steps being taken to improve the quality of data DNOs hold about vulnerable customers and the enhanced services that are provided.

8.3 The methodology to assess DNOs' performance is not yet established but Ofgem have stated that the mechanism will include assessment of:

- how DNOs use data about vulnerable customers;
- the development of additional services;
- targeting of support;
- working in partnership with other organisations.

8.4 WPD accepts Ofgem's proposed changes to this incentive scheme.

8.5 The value of the incentive mechanism is shown below. Note that this is part of the BMCS.

Value of incentive for stakeholder engagement for vulnerable customers		
Incentive Mechanism	**Maximum Reward**	**Maximum Penalty**
Stakeholder engagement for vulnerable customers	+0.5% of base revenue	n/a

9 Innovation incentives

9.1 There are a number of different mechanisms that will be in place to drive DNOs to deliver innovation. Business plans are required to specify an Innovation Strategy. There will be an annual allowance for small scale projects and a competition for larger projects.

Network Innovation Competition

9.2 In DPCR5 Ofgem introduced the Low Carbon Networks Fund (LCNF) to encourage DNOs to take a more proactive approach to innovation, knowledge sharing, anticipating the low carbon future and collaborative working with third parties. The concepts were extended into the first RIIO price control for electricity transmission (RIIO-T1) where the Network Innovation Competition (NIC) is equivalent to Tier 2 funding under the LCNF. During RIIO-ED1 the LCNF will be replaced by the NIC.

9.3 The NIC will provide funding for large scale projects, but both DNOs and transmission companies will bid for the funding through an annual competition. Bids will be judged on the environmental and low carbon benefits they provide.

9.4 Ofgem has stated that the annual funding available under the Transmission settlement will be £30m per annum and for years one and two of RIIO-ED1 a further £60m will be available. In 2016 Ofgem will review the NIC and determine the level of funding that will be available for the remainder of the RIIO-ED1 period.

9.5 WPD accepts Ofgem's proposed changes to innovation incentives.

9.6 The value of the incentive mechanism is shown below.

Value of incentive for Network Innovation Competition								
	15/16	16/17	17/18	18/19	19/20	20/21	21/22	22/23
Declared for RIIO-T1	£30m	£30m	£30m	£30m	£30m	£30m		
Declared for RIIO-ED1	£60m	£60m	tba	tba	tba	tba	tba	tba
Current total	**£90m**	**£90m**	**£30m**	**£30m**	**£30m**	**£30m**		

10 Efficiency incentives

Efficiency incentive rate

10.1 The RIIO framework is designed to ensure that DNOs face a strong financial incentive to deliver outputs at an efficient cost.

10.2 The price control review process provides allowances for DNOs that are derived from benchmarking and set at efficient levels. Efficient DNOs will deliver their outputs without incurring additional costs.

10.3 The efficiency incentive rate is used to drive DNOs to seek out further efficiencies and to avoid overspending.

10.4 It works by sharing savings and additional costs between DNOs and customer. Where a DNO finds additional savings, it gets to keep a proportion of the savings and customers benefit by having the rest returned through lower DUOS charges. Where a DNO incurs additional expenditure, this is not fully funded by customers; DNOs have to pay a proportion of the costs. The proportions used for both savings and overspending are the same. So where a DNO has an efficiency incentive rate of 70%, it will keep 70% of savings and fund 70% of any overspend.

10.5 Ofgem will assign one efficiency incentive rate for a DNO group. This means that for WPD the efficiency incentive rate will be derived by comparing the costs for all four licence areas against Ofgem's view of costs at the time of setting the price control.

10.6 To prevent DNOs from under-delivering outputs and falsely appearing efficient, Ofgem has introduced retrospective adjustments and penalties for outputs that are not delivered. This will drive DNOs to carry out the specified work programmes and will allow the efficiency mechanism to adjust for the cost of delivering the work. WPD accepts Ofgem's proposed incentive scheme.

Information Quality Incentive (IQI)

10.7 The IQI is designed to incentivise DNOs to provide accurate cost forecasts that reflect efficient expenditure in price control cost forecasts.

10.8 It operates around a matrix that compares DNOs submissions to Ofgem's views of costs. It determines DNO allowances and sets the efficiency incentive rate. DNOs are awarded a higher efficiency incentive rate and additional revenue when forecasts align more closely with Ofgem's views. Where DNOs' forecast costs appear to be inefficient, the efficiency incentive rate is set lower and allowances are reduced so that DNOs earn lower returns.

10.9 The mechanism discourages DNOs from providing costs that are lower than they actually incur. Such submissions would make company costs appear to be more efficient than they are. This would result in allowances in line with the request and would attract a higher efficiency incentive rate. This would penalise companies that provided falsely low forecast because funding would be limited and the higher efficiency rate would make them pay for a greater proportion of any overspending.

10.10 The IQI also discourages DNOs from overstating financial requirements. This results in Ofgem reducing allowances in line with their benchmarking and attracts a lower efficiency rate. Companies have less to spend and have to return a greater proportion of any savings. WPD accepts Ofgem's proposed incentive scheme.

11 Appendix A1 – GSOP Payments

Reporting code	Service	Ofgem proposed RIIO-ED1 Guaranteed standards payments	WPD proposed RIIO-ED1 Guaranteed standards payments
EGS1	Responding to failure of distributor's fuse (Regulation 12)	£30 for domestic and non-domestic customers	£60 for domestic and non-domestic customers
EGS2	Supply restoration - normal conditions (Regulation 5)	£75 for domestic customers, £150 for non-domestic customers, £35 for each further 12 hours	£150 for domestic customers, £300 for non-domestic customers, £70 for each further 12 hours
EGS2A	Supply restoration: multiple interruptions (Regulation 11)	£75 for domestic and non-domestic customers	£150 for domestic and non-domestic customers
EGS2B	Supply restoration - normal conditions (5,000 or more premises interrupted) (Regulation 6)	£75 for domestic customers, £150 for non-domestic customers, £35 for each further 12 hours up at a cap of £300 per customer	£150 for domestic customers, £300 for non-domestic customers, £70 for each further 12 hours up to a cap of £600 per customer
EGS2C	Supply restoration – rota disconnections (Regulation 8)	£75 for domestic customers, £150 for non-domestic customers	£150 for domestic customers, £300 for non-domestic customers
EGS4	Notice of planned interruption to supply (Regulation 14)	£30 for domestic customers, £60 for non-domestic customers	£60 for domestic customers, £120 for non-domestic customers
EGS5	Investigation of voltage complaints (Regulation 15)	£30 for domestic and non-domestic customers	£60 for domestic and non-domestic customers
EGS8	Making and keeping appointments (Regulation 19)	£30 for domestic and non-domestic customers	£60 for domestic and non-domestic customers
EGS9	Payments owed under the standards (Regulation 21)	£30 for domestic and non-domestic customers	£60 for domestic and non-domestic customers
EGS11 (EGS11A, EGS11B and EGS11C)	Supply restoration: severe weather conditions (Regulation 7)	£35 for domestic and non-domestic customers, plus £35 for each further 12 hours up to a cap of £300 per customer	£75 for domestic and non-domestic customers, plus £70 for each further 12 hours up to a cap of £600 per customer

12 Appendix A2 – Connection GSOP Payments

Reporting code	Service	Ofgem proposed RIIO-ED1 Guaranteed standards payments	WPD proposed RIIO-ED1 Guaranteed standards payments
1A	Provision of budget estimate <1MVA	£65 - One off payment	£130 – One off payment
1B	Provision of budget estimate >1MVA	£65 - One off payment	£130 – One off payment
2A	Provision of a quotation for a single LV single phase service connection	£15 for each working day after the end of the prescribed period up to and including the day on which the quotation is dispatched	£30 for each working day after the end of the prescribed period up to and including the day on which the quotation is dispatched
2B	Provision of a quotation for small LV projects: • 2-4 LV single phase domestic services or • for connections to 1-4 LV single phase domestic premises involving an extension to the LV network or • a single two or three phase whole current metered connection (not requiring an extension to LV network)	£15 for each working day after the end of the prescribed period up to and including the day on which the quotation is dispatched	£30 for each working day after the end of the prescribed period up to and including the day on which the quotation is dispatched
3A	Provision of any other LV demand quotation	£65 for each working day after the end of the prescribed period up to and including the day on which the quotation is dispatched	£130 for each working day after the end of the prescribed period up to and including the day on which the quotation is dispatched
3B	Provision of an HV demand quotation	£135 for each working day after the end of the prescribed period up to and including the day on which the quotation is dispatched	£270 for each working day after the end of the prescribed period up to and including the day on which the quotation is dispatched
3C	Provision of a EHV demand quotation	£200 for each working day after the end of the prescribed period up to and including the day on which the quotation is dispatched	£400 for each working day after the end of the prescribed period up to and including the day on which the quotation is dispatched

Reporting code	Service	Ofgem proposed RIIO-ED1 Guaranteed standards payments	WPD proposed RIIO-ED1 Guaranteed standards payments
4A	Contact customer (post acceptance) about scheduling <5 LV service connections covered by 2A & 2B	£15 for each working day after the end of the prescribed period up to and including the day on which contact occurs	£30 for each working day after the end of the prescribed period up to and including the day on which contact occurs
4B	Contact customer (post acceptance) about scheduling other LV demand connections	£65 for each working day after the end of the prescribed period up to and including the day on which contact occurs	£130 for each working day after the end of the prescribed period up to and including the day on which contact occurs
4C	Contact customer (post acceptance) about scheduling HV demand connections	£135 for each working day after the end of the prescribed period up to and including the day on which contact occurs	£270 for each working day after the end of the prescribed period up to and including the day on which contact occurs
4D	Contact customer (post acceptance) about scheduling EHV demand connections	£200 for each working day after the end of the prescribed period up to and including the day on which contact occurs	£400 for each working day after the end of the prescribed period up to and including the day on which contact occurs
5	Commence LV,HV & EHV demand works on customer's site	£25 for each working day after the agreed date up to and including the day on which the works are commenced	£50 for each working day after the agreed date up to and including the day on which the works are commenced
6A	Complete service connection works	£35 for each working day after the agreed date up to and including the day on which the works are completed	£70 for each working day after the agreed date up to and including the day on which the works are completed
6B	Complete LV works (including phased works)	£135 for each working day after the agreed date up to and including the day on which the works are completed	£270 for each working day after the agreed date up to and including the day on which the works are completed
6C	Complete HV works (including phased works)	£200 for each working day after the agreed date up to and including the day on which the works are completed	£400 for each working day after the agreed date up to and including the day on which the works are completed
6D	Complete EHV works (including phased works)	£270 for each working day after the agreed date up to and including the day on which the works are completed	£540 for each working day after the agreed date up to and including the day on which the works are completed

Reporting code	Service	Ofgem proposed RIIO-ED1 Guaranteed standards payments	WPD proposed RIIO-ED1 Guaranteed standards payments
7A	Complete LV energisation works (including phased works)	£135 for each working day after the agreed date up to and including the day on which energisation occurs	£270 for each working day after the agreed date up to and including the day on which energisation occurs
7B	Complete HV energisation works (including phased works)	£200 for each working day after the agreed date up to and including the day on which energisation occurs	£400 for each working day after the agreed date up to and including the day on which energisation occurs
7C	Complete EHV energisation works (including phased works)	£270 for each working day after the agreed date up to and including the day on which energisation occurs	£540 for each working day after the agreed date up to and including the day on which energisation occurs
8A	Emergency Fault Repair response	£65 one off payment	£130 one off payment
8B	High Priority Fault Repair – Traffic Light Controlled	£15 for each working day after the end of the prescribed period up to and including the day on which the fault rectification works are completed	£30 for each working day after the end of the prescribed period up to and including the day on which the fault rectification works are completed
8C	High Priority Fault Repair – non Traffic Light Controlled	£15 for each working day after the end of the prescribed period up to and including the day on which the fault rectification works are completed	£30 for each working day after the end of the prescribed period up to and including the day on which the fault rectification works
8D	Multiple unit fault repair	£15 for each working day after the end of the prescribed period up to and including the day on which the fault rectification works are completed	£30 for each working day after the end of the prescribed period up to and including the day on which the fault rectification works are completed
8E	Single unit fault repair	£15 for each working day after the end of the prescribed period up to and including the day on which the fault rectification works are completed	£30 for each working day after the end of the prescribed period up to and including the day on which the fault rectification works are completed

Reporting code	Service	Ofgem proposed RIIO-ED1 Guaranteed standards payments	WPD proposed RIIO-ED1 Guaranteed standards payments
9	Provision of a quotation – New Works order (1-100 units)	£15 for each working day after the end of the prescribed period up to and including the day the quotation is dispatched	£30 for each working day after the end of the prescribed period up to and including the day the quotation is dispatched
10A	New works order - completion of works on a new site	£15 for each working day after the end of the prescribed period up to and including the day the works are completed	£30 for each working day after the end of the prescribed period up to and including the day the works are completed
10B	New works order - completion of works on adopted highways	£15 for each day after the end of the prescribed period up to and including the day on which the works are completed	£30 for each day after the end of the prescribed period up to and including the day on which the works are completed
11A	Quotation accuracy review scheme challenge single LV single phase service connection (aligns to 2A)	£335 - one off payment	£670 – one off payment
11B	Quotation accuracy review scheme challenge for small LV projects (aligns to 2B)	£670 – one off payment	£1340 – one off payment
12	Where a Distributor fails to make a payment under the regulations	£65 – one off payment	£130 – one off payment

2015-2023

RIIO-ED1 **BUSINESS PLAN**

SA-03 Supplementary Annex - Innovation, Smart Grids, Smart Meters, Losses and Climate Change Adaptation

June 2013 (updated April 2014)

WESTERN POWER DISTRIBUTION

Serving the Midlands, South West and Wales

SA-03 Innovation, Smart Grids, Smart Meters, Losses and Climate Change Adaptation
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1 Introduction

1.1 This document is a supplementary annex to the Western Power Distribution (WPD) Business Plan for the eight year period from 1st April 2015 to 31st March 2023.

1.2 It describes WPD's approach to innovation and describes how we continue to innovate within our business to improve efficiency and set the foundations for smart grids.

1.3 The document applies to all four WPD distribution licences of West Midlands, East Midlands, South Wales and South West.

1.4 The eight year period aligns with the next regulatory price control review period, known as RIIO-ED1; the first for electricity distribution to be determined using Ofgem's Revenue = Incentives, Innovation and Outputs framework. The Business Plan, supplementary annexes, detailed cost tables and financial models form the submission under RIIO-ED1 to the regulator Ofgem (Office for Gas and Electricity Markets), who will use the information to determine allowed revenues.

Structure of this document

1.5 We appreciate that the readers of the WPD Business Plan suite of documents will range from regulatory experts and well informed stakeholders through to new customers who may have had little previous knowledge of WPD.

1.6 This document is aimed at readers who require a more detailed understanding of WPD's strategies for Innovation, Smart Grids, Smart Meters, Losses and Climate Change Adaptation. A less detailed description can be found in the main Business Plan Overview document.

1.7 This document is subdivided into the following sections:

Chapter	Title	Content
2	**Innovation Strategy**	A description of WPD's Innovation Strategy, including the initiatives we have already adopted, our plans for adoption of LCNF project outputs and steps we can take now to prepare for The Carbon Plan
3	**Smart Grid Strategy**	An explanation of how our network will evolve into a Smart Grid, and the interactions that we will have with customers to make more flexible use of capacity.
4	**Smart Meters**	A description of WPD's involvement in the smart meter roll out and an explanation of how we will make use of smart meter data to manage our network.
5	**Losses Strategy**	An explanation of how losses occur and the actions that we can take to reduce losses on our network in the future.
6	**Climate Change Adaptation**	A description of the effects that Climate Change will have on WPD, an assessment of the key priorities for us and the work we are undertaking to prepare for changes to our climate.

2 Innovation strategy

2.1 The WPD Innovation Strategy is now available as a standalone document that can be found using the following hyperlink: http://www.westernpower.co.uk/docs/Innovation-and-Low-Carbon/Innovation-Strategy-Final.aspx

2.2 For completeness the contents are reproduced on the following pages. Please be aware that the formats and page numbers may be different when comparing the Business Plan and the standalone Innovation Strategy.

Executive Summary

Role of innovation within WPD

2.3 Innovation is core to our business strategy. We always seek to find better ways of working. We have adopted many innovative ideas into day to day operations that improve the efficiency and effectiveness of the way we deliver our services to customers. Our track record of innovation and change spans from the implementation of good innovative ad-hoc ideas from staff all the way through to formal innovation projects.

2.4 We look for innovative developments across six broad areas;

- low carbon networks – supporting future electricity demand and generation requirements;
- smart meters – maximising the benefits from more detailed network data;
- smart grids – developing new techniques and utilising enhanced data to help develop more dynamic network control;
- environment – reducing our business impact on the environment;
- customer service – developing smarter ways of delivering better customer service;
- business efficiency – searching out better processes, equipment and technology that ensures we continue to be efficient.

2.5 These areas of work are interdependent and progress in one area will often help to enhance innovation development in another.

2.6 The objectives of WPD's innovation are to:

- develop new smart techniques that will accommodate increased load and generation at lower costs than conventional reinforcement;
- improve performance against one or more of our core goals of safety, customer service, reliability, the environment or cost effectiveness;
- ensure solutions are compatible with the existing network;
- deliver solutions so that they become business as usual;
- provide value for money.

2.7 The way that we approach innovation is fundamental to delivering the objectives efficiently. WPD's Innovation Strategy is to:

- actively involve staff from across the business in the generation of ideas, development of solutions and implementation of projects;
- work with our stakeholders to understand their needs;
- make use of innovation incentives and funding provided by the Government, the regulator and other funding organisations;
- use a small core team to coordinate innovation projects;
- define clear objectives for each project so that delivery can be focused and progress can be tracked;
- avoid theoretical research or innovation which does not have clear objectives;
- incorporate innovative solutions into existing equipment and processes (e.g. the purchase of equipment that is ready for the retro fit of automation);
- share what we learn with other organisations and learn from others.

2.8 Customers and stakeholders are a valuable source of ideas as they are directly affected by our performance. Our stakeholder engagement process for innovation is the same as for all other areas of our business. Innovation is a key theme of our stakeholder engagement sessions. Stakeholders understand that innovation cuts across all areas of our business and provides improvements and benefits to all the areas.

2.9 New ideas also come from several other sources. They can come from within WPD and are often based on improvements to existing practice or recent experiences. They can also

incorporate learning from other DNO projects. In some cases academia will approach us with a theoretical idea which we can develop into a solution. We also look for ideas in other sectors where there is the potential for technology developed outside of the electricity industry to be brought in, modified and used.

2.10 Our existing portfolio of innovation projects is already shaping how we are thinking about the future. We will continue to innovate and undertake new projects that will build upon what we have already learnt from the projects we and other DNOs have carried out. We set out within this Innovation Strategy the progress we have already made, the projected output from the various projects currently being undertaken and the future projects planned.

Document purpose

2.11 This document sets out the detailed Innovation Strategy for Western Power Distribution (WPD). It describes our approach to innovation and describes how we continue to innovate within our business to improve efficiency and set the foundations for smart grids.

2.12 It will be reviewed and re-issued annually to reflect changing external factors, business priorities and to incorporate learning from the previous 12 months. The document applies to all four WPD distribution licences of West Midlands, East Midlands, South Wales and South West.

2.13 The Innovation Strategy looks at the long term development of our distribution assets and customer service caused by changing customer needs. The Strategy looks through to 2030, yet naturally provides more detail on the shorter term priorities, requirements and proposed initiatives.

2.14 This document provides all the information that Ofgem requires in an Innovation Strategy for a licenced network operator, namely:

- evidence of how DPCR5 innovation funding (i.e. IFI & LCN Fund) has been used effectively and resulted in improved outcomes for consumers (paragraphs 2.19-2.127);
- the high-level problem(s) and/or challenge(s) which the sector/company expects to face over the period, and the justification for initiating projects to address these (paragraphs 2.128-2.152);
- the consequences of innovation(s) not occurring (paragraphs 2.153-2.162);
- the process or methodology by which the company will decide the focus for innovation during RIIO-ED1 (paragraphs 2.163-2.179);
- demonstration that the problems/challenges have been identified/prioritised and justified in consultation with stakeholders (paragraphs 2.180-2.189);
- discussion of the relative priorities, risks, benefits, value for money and potential customer impacts (paragraphs 2.163-2.179);
- deliverables and potential deliverables from the research or development or trials, such as defined learning on an issue, revised codes, new charging methodologies etc. (paragraphs 2.191-2.252);
- a description of the business's processes for reviewing and updating their innovation strategies within the price control period. (paragraphs 2.253-2.282);
- a description of the business's approach to ensuring the efficient roll-out of successful innovation into business as usual (including innovation developed by other DNOs) (paragraphs 2.283-2.290).

Introduction

What is innovation?

2.15 Innovation is the process of having new ideas, developing them into practical solutions and implementing them into equipment or processes in order to improve network performance or customer service. It will provide solutions that are better, cheaper or quicker than the current ways of doing things. The Low Carbon Network Fund and the Government's Carbon Plan bring huge change and significant opportunities to innovate. Innovation does not have to be on a large scale; sometimes improvements can be achieved through evolutionary change, involving incremental improvement to existing methods.

Why do we innovate?

2.16 We rely on innovation to maintain our position as a frontier performer in network performance and customer service. Innovation is targeted at all of the key outputs of safety, cost efficiency, customer service, reliability and environment. In the past innovation has proved beneficial by allowing us to continually improve in these areas. Future innovation will allow us to continue these improvements and will also help us to address the challenges brought about by the Carbon Plan.

How do we innovate?

2.17 Innovation is core to our business strategy. We have a small innovation team dedicated to exploring innovative ideas including the delivery of smart grid projects. Our projects are predominantly generated from ideas from staff and stakeholders. When our projects involve the installation of equipment on our network or require a change to business processes we do this in the same way as our standard engineering activities using the skills and efficiencies of our engineering teams. We also draw on the expertise of our suppliers and help them develop solutions. Furthermore, we work with a range of research establishments utilising their specialist skills.

Stakeholder involvement

2.18 Innovation is a key theme of all stakeholder engagement sessions. Our stakeholder engagement process for innovation is the same as for all other areas of our business. Stakeholders understand that innovation cuts across all areas of our business and can provide improvements and benefits to all the areas. We welcome ideas from our stakeholders and openly encourage them to put forward their suggestions.

Background

Government and regulation

2.19 Our main sources of innovation funding are managed by Ofgem, the industry regulator. Ofgem has established a variety of funding mechanisms to develop future networks that support the Government's Carbon Plan. We work with both Ofgem and the Department of Energy and Climate Change (DECC) to support their ambitions, targets and meet their and our obligations.

2.20 We also engage with DECC on related matters such as Climate Change Adaptation (CCA) that looks to the longer term effects of climate change on the UK electricity industry.

2.21 We actively engage in the development of regulatory and legislative policy and our learning from innovation projects informs the proposals we make in our responses to consultations. The results from our projects are published and freely available via our website, which enables Ofgem, DECC and other organisations to benefit from our learning.

Innovation funding within the UK

2.22 In the period between 2005 and 2010, Ofgem set up the Innovation Funding Incentive (IFI). Its purpose was to improve the quality of research and development within the UK electricity industry. The Registered Power Zone scheme (RPZ) was also set up to support network demonstration projects.

2.23 In 2010, and continuing through to 2015, Ofgem introduced the Low Carbon Networks Fund (LCNF). The LCNF is designed to support the development of low carbon technologies within the UK electricity industry and facilitate the changes brought about by the Carbon Plan. It contains three elements; large scale projects funded through a competitive process (Tier 2); smaller scale projects that are self-certified (Tier 1) and a discretionary reward where Ofgem will provide an additional allowance for companies that successfully develop learning that generates benefits for the industry.

2.24 We are undertaking five of the nineteen Tier 2 LCNF projects which have been awarded to date. Similarly WPD is running twelve of the thirty seven smaller Tier 1 projects being developed across the industry.

2.25 In RIIO-ED1 the Network Innovation Allowance (NIA) and Network Innovation Competition (NIC) will replace the current funding schemes. The competitive element will have a greater value and will also be open to the electricity transmission companies. We will continue to develop innovation projects through these mechanisms.

2.26 We have also secured support and funding from the Engineering and Physical Sciences Research Council (EPSRC) and the Technology Strategy Board (TSB).

2.27 Furthermore we are also part of two consortia working on Energy Technologies Institute (ETI) projects.

Benefits from research and development

2.28 The Innovation Funding Incentive (IFI) & Registered Power Zone (RPZ) mechanisms were designed to deliver value to end consumers through safety improvements, increased cost efficiency, improved customer service and reliability and also environmental improvements. A definition of technical terms and project assessment methodology is set out in the Electricity Network Association (ENA) standard G85/2.

2.29 Examples of successful IFI projects completed since 2005 are listed in the table below along with which outputs they benefit. This is followed by a brief description of each project.

IFI Projects	Safety improvement	Cost efficiency improvement	Customer service improvement	Reliability improvement	Environmental improvement
Reference network model		✓	✓	✓	✓
Condition inspection of overhead primary circuit lines by helicopter	✓	✓	✓	✓	✓
Understanding networks with high penetrations of DG	✓	✓	✓		✓
Impact of climate change and weather analysis	✓	✓	✓	✓	✓
Non- intrusive testing of tower foundations		✓		✓	✓
Control system automation algorithm		✓	✓		✓
Harmonic issues on distribution networks		✓	✓	✓	✓
Electric vehicles	✓	✓	✓		✓
Earthing information system	✓	✓		✓	✓
Generating value from smart meter data		✓	✓	✓	
Condition based risk management	✓	✓		✓	✓
11kV voltage optimisation project		✓	✓	✓	✓

Reference network model

Safety improvement	Cost efficiency improvement	Customer service improvement	Reliability improvement	Environmental improvement
	✓	✓	✓	✓

2.30 The project created a model that could represent different circuit groups, to allow power system analysis of network performance. Parameters can be changed allowing us to predict the effects of different investment options. The output has been used subsequently within further IFI studies including in the support of Smart Grid Forum modelling work.

Condition inspection of overhead primary circuit lines by helicopter

Safety improvement	Cost efficiency improvement	Customer service improvement	Reliability improvement	Environmental improvement
✓	✓	✓	✓	✓

2.31 The trial evaluated an innovative line inspection and condition assessment process that combined several technology areas such as high resolution photography and new condition categorisation. The learning has advanced inspection techniques and has been fully incorporated into company policies and regular helicopter inspection activities.

Understanding networks with high penetrations of distributed generation (DG)

Safety improvement	Cost efficiency improvement	Customer service improvement	Reliability improvement	Environmental improvement
✓	✓	✓		✓

2.32 The project improved our understanding of the effect of increasing output from a cluster of micro generators on a distribution network (in particular thermal rating, voltage rise and fault level). It identified ways to change conventional network design to maximise the penetration of micro generation. The research and modelling activity subsequently led to validation projects through LCNF projects.

Impact of climate change and weather analysis

Safety improvement	Cost efficiency improvement	Customer service improvement	Reliability improvement	Environmental improvement
✓	✓	✓	✓	✓

2.33 A DEFRA funded project involving climate projections was used to develop new methodologies and probalistic predictions to assess specific energy industry impacts. The project has improved our knowledge allowing us to better plan for future scenarios including the increase risks of both flooding and lightning as well as changes to the thermal loading of overhead lines.

Non-intrusive testing of tower foundations

Safety improvement	Cost efficiency improvement	Customer service improvement	Reliability improvement	Environmental improvement
	✓		✓	✓

2.34 This project evaluated various non-destructive testing techniques to assess the strength of tower foundations. The techniques included: Transient Dynamic Response; Linear Polarisation Resistance; Pulse Velocity Measurements and Ground Penetrating Radar. The project supported the development of new technologies that are now used during condition assessment of towers.

Control system automation algorithm

Safety improvement	Cost efficiency improvement	Customer service improvement	Reliability improvement	Environmental improvement
	✓	✓		✓

2.35 The project developed and demonstrated the benefits of self-healing networks using an automated switching algorithm that could carry out real time circuit status analysis and tracing to identify source and alternative supplies. The project led to a wider trial and rollout of the algorithm to the WPD region. The functionality has led to this type of functionality becoming a core offering within Network Management Systems (NMS).

Harmonic issues on distribution networks

Safety improvement	Cost efficiency improvement	Customer service improvement	Reliability improvement	Environmental improvement
	✓	✓	✓	✓

2.36 This analysis and research project produced a report on the harmonic problems due to converter plant being installed on electricity networks. The learning allowed us to further develop ENA planning guidelines and continues to inform the on-going industry review of the industry standards such as the ENA's Engineering Recommendation G5/4.

Electric vehicles

Safety improvement	Cost efficiency improvement	Customer service improvement	Reliability improvement	Environmental improvement
✓	✓	✓		✓

2.37 The project investigated the impact of charging electric vehicles on conventionally designed distribution networks. It demonstrated different connection scenarios and mitigation options. The project confirmed that the impact on distribution network from a modest uptake of small electric vehicles is low. The project learning has subsequently led to further studies into power quality and harmonics caused by larger electric vehicles under the LCNF Tier 1 project entitled Electric Boulevards.

Earthing information system

Safety improvement	Cost efficiency improvement	Customer service improvement	Reliability improvement	Environmental improvement
✓	✓		✓	✓

2.38 This project developed a Geographic Information System (GIS) to assist DNOs in the installation of rural ground earthing systems. Carried out in conjunction with UK Power Networks and the British Geological Survey, it provides a graphical presentation of ground conditions and estimates the likelihood of suitable earthing resistance being met. The system has recently been further developed and is now provided as an overlay in our GIS systems used regularly by network planners.

Generating value from smart meter data

Safety improvement	Cost efficiency improvement	Customer service improvement	Reliability improvement	Environmental improvement
	✓	✓	✓	

2.39 This Technology Strategy Board (TSB) funded project was delivered jointly with the Centre for Sustainable Energy (CSE). It looked at possible methods of undertaking data mining on the vast pool of data that will be available following the smart meter roll out, and how the information produced can be of maximum use to WPD and the wider industry. This project helped inform WPD's RIIO-ED1 Smart Metering Strategy.

Condition Based Risk Management (CBRM)

Safety improvement	Cost efficiency improvement	Customer service improvement	Reliability improvement	Environmental improvement
✓	✓		✓	✓

2.40 The integrated Condition Based Risk Management project has delivered a tool to determine optimum replacement triggers for network assets. CBRM data is also being used to optimise maintenance periods based on condition.

11kV Voltage Optimisation project

Safety improvement	Cost efficiency improvement	Customer service improvement	Reliability improvement	Environmental improvement
	✓	✓	✓	✓

2.41 The 11kV Voltage Optimisation project was able to demonstrate the benefits of wide scale voltage reduction while keeping end point customer voltages within statutory limits. The learning led to further studies as part of the LV Network Templates project and the recent publication of discussion papers along with a proposed further demonstration project in South Wales.

Business innovation during DPCR5

Innovation performance to date

2.42 Innovation has always been a key part of WPD's development strategy and our ability to take an innovative approach to day to day working and problems that we face has made us the most successful DNO in the UK.

2.43 Innovation projects often come from ideas that have flowed from staff and these have helped us to deliver excellent levels of performance in safety, reliability, customer service, the environment and cost efficiency.

2.44 Some recent examples of our day to day business innovation are detailed within the table below, which also identifies the areas where improvements have been achieved.

Business Innovation during DPCR5	Safety improvement	Cost efficiency improvement	Customer service improvement	Reliability improvement	Environmental improvement
ENMAC Mobile	✓	✓	✓	✓	
Condition inspection of overhead primary circuit lines by helicopter	✓	✓	✓	✓	✓
LV monitoring	✓	✓	✓		
Pre-installed LV monitoring	✓	✓	✓		
Stakeholder engagement			✓		
Dynamic line ratings		✓	✓		✓
Customer "call backs"	✓	✓	✓		✓
Text backs	✓	✓	✓		✓

ENMAC Mobile (operational innovation)

Safety improvement	Cost efficiency improvement	Customer service improvement	Reliability improvement	Environmental improvement
✓	✓	✓	✓	

2.45 We were the first DNO to use hand held devices in 'real time' to control and manage high voltage switching operations. The hand held devices are in constant communication with our network management system ENMAC.

2.46 Our operational staff use the hand held device to receive operational instructions and confirm completed action back to control. This has enabled us to reduce the volume of voice traffic into our control centres. Staff in the field are able to be more efficient as the number of jobs that can be processed concurrently by the Network Management System (NMS) is significantly improved. This is of particular benefit at peak times of the day when operational staff in the field are starting or finishing planned works at similar times.

2.47 Real time communications also allow the operational status of the network to be updated as soon as alterations occur on the system. These immediate updates improve the information available for our contact centre staff and High Volume Call Taker (HVCT) systems, which in turn improves the information we can provide to customers.

2.48 After the successful implementation of the high voltage switching element we added a low voltage incident management system to the package. This addition allows field staff to take details of faults and incidents directly on the device and provide updates from site that previously relied upon voice updates being provided after completion of work.

2.49 As with high voltage operations the low voltage updates from the field are used to keep the operational status of incidents up to date and to ensure that customers receive accurate messaging and good information from our contact centre or HVCT about what is happening.

2.50 This system has been in use in South West and South Wales since 2007 and became business as usual in West Midlands and East Midlands during 2013.

11kV network automation and automatic restoration (operational innovation)

Safety improvement	Cost efficiency improvement	Customer service improvement	Reliability improvement	Environmental improvement
✓	✓	✓	✓	✓

2.51 Remote control of the network is not new, with DNOs generally having remote control and indication down to the level of 11kV equipment at major substations since the 1980s.

2.52 Installing remote control capability beyond major substations and onto the 11kV network was a logical next step to improve performance in remote rural areas where customers are supplied by long overhead lines. Being able to operate switch points remotely, without the need for a person to be on site to do so, significantly improves restoration times.

2.53 We have taken this technology one step further and extended its use into urban areas where large numbers of customers can be affected by faults.

2.54 We have linked the remote control switching devices with our NMS to operate the network automatically when a fault occurs. In most cases this can be achieved in less than a few minutes of a fault occurring, which significantly reduces the impact on customers.

2.55 This system can operate with pre-written scripts or by using dynamic network assessment to learn the status of the network and operate the most appropriate sequence of switching to restore supplies.

2.56 We are now investigating even more flexible methods of automatic network management to ensure that we can meet the requirement to operate the network more dynamically in the future. Our Project FALCON LCNF trial will further develop this application incorporating real time power flow analysis and load management into network reconfiguration decisions.

Pre-installed LV monitoring capability

Safety improvement	Cost efficiency improvement	Customer service improvement	Reliability improvement	Environmental improvement
✓	✓	✓		

2.57 LV cabinets are normally supplied with relatively simple peak demand indicators built into them. We specify cabinets that have high quality current transformers installed so that, if required in the future, more accurate monitoring equipment can be fitted without interrupting customer supplies or replacing the cabinet.

Pre-installed automation capability

Safety improvement	Cost efficiency improvement	Customer service improvement	Reliability improvement	Environmental improvement
✓	✓	✓		

2.58 Switchgear for our distribution network can be pre-wired to accept automation equipment and can have current transformers (CTs) fitted to detect the passage of fault current. Pre-wiring all of our new switchgear allows us to provide flexibility in placing automation equipment as our networks develop. Automation can be fitted where it is needed without replacing the switchgear.

Stakeholder engagement process

Safety improvement	Cost efficiency improvement	Customer service improvement	Reliability improvement	Environmental improvement
		✓		

2.59 Our Stakeholder Engagement process has used a selection of interaction methods, from group sessions through to individual telephone interviews. At our group sessions we have made use of electronic voting systems to allow each individual participant to register specific views. We have worked with various customer groups and have included sessions with university students to capture the views of our future customers.

Dynamic line ratings

Safety improvement	Cost efficiency improvement	Customer service improvement	Reliability improvement	Environmental improvement
	✓	✓		✓

2.60 The success of the Registered Power Zone project, RPZ1, showed that we can establish dynamic line ratings on our 132kV overhead line network. This allows us to accommodate more demand or generation when the network or environmental conditions allow it.

Customer 'call backs' and texts

Safety improvement	Cost efficiency improvement	Customer service improvement	Reliability improvement	Environmental improvement
✓	✓	✓		✓

2.61 We have implemented processes where we ask customers who have reported faults to us if they would like us to call them back once the fault is repaired and the network is restored.

2.62 This call back allows us to confirm that the customer is back on supply, provide guidance to the customer where the power has been restored but they are still off supply (such as guidance on resetting a trip switch) and to allow us to take feedback from the customer to learn where our service can be improved in the future.

2.63 We also offer text messaging as an alternative method of contacting customers.

DPCR5 Smart Enablers

Continuing with plans set in place during DPCR5

2.64 Whilst we are developing new smarter techniques to support low carbon technology (LCT) developments, we will continue to provide electricity to customers by constructing new network and maintaining our existing assets. We will also be reinforcing the network in response to load increases.

2.65 Whenever this work is done we have an opportunity to look ahead to the future. Assets commissioned today are likely to still be in place beyond 2050 and in preparation for future load growth, we can take advantage of installing assets with a higher specification or with functionality inbuilt for future use.

2.66 We already provide some preparation for the future and will continue to develop a wider range of 'future-proof' innovative options in RIIO-ED1.

Pre-installing LV monitoring capability

2.67 It is anticipated that we will require more data about the LV network to inform automatic network management schemes. Whilst the data requirements are simple (e.g. near real time voltage and current readings) they are not currently available. The easiest place to obtain this data is at the low voltage distribution cabinets at distribution substations. These cabinets have historically been fitted with simple CTs to give an indication of peak load on a local meter.

2.68 When the cabinets are manufactured it is a simple process to uprate the CT to a more accurate unit and wire it to a terminal block where monitoring equipment can be connected when required. This prewiring enables the use of more complex monitoring equipment without the need to interrupt customers or work on the cabinet. The additional cost of these CTs is low relative to the full cost of the cabinet (1.4% of the total cost). WPD has been specifying this arrangement since 2010 and we will continue to do so.

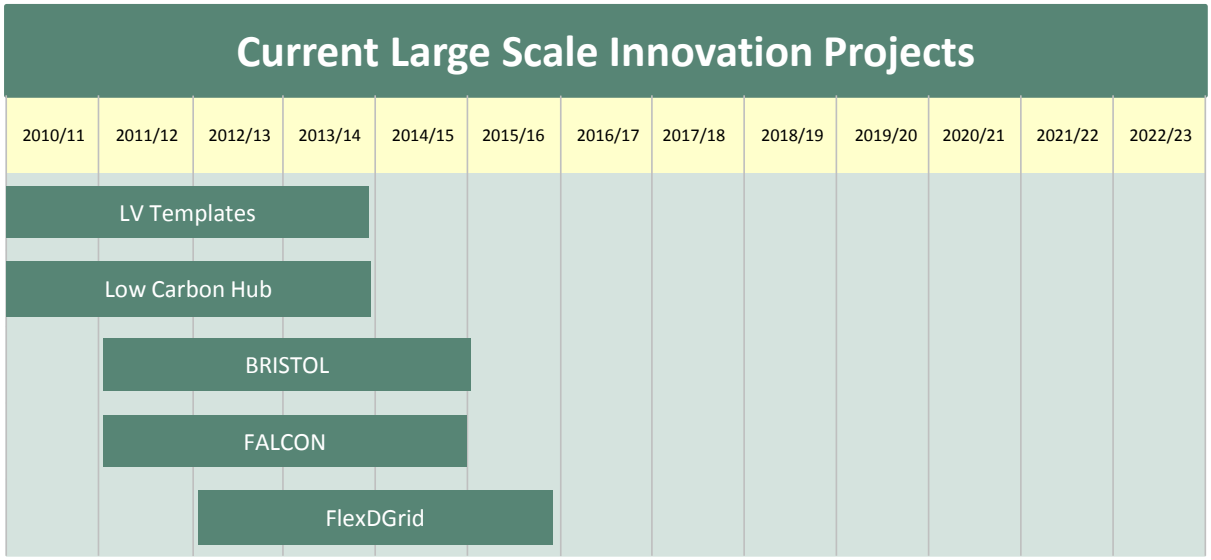
HV switchgear automation

2.69 It is likely that in the future we will need to move load from one part of the HV network to another to make the most use of network capacity. The most efficient way of moving load is to operate 11kV switches remotely. At this stage we do not have sufficient data to know specifically where this functionality will be required but we can plan ahead by purchasing switchgear which is prepared for automatic operation.

2.70 The actuators that drive operating mechanism are relatively expensive, but factory fitted wiring, CTs and connections to accept the actuators can be incorporated into switchgear units with a minimal cost increase. Installing switchgear that is prewired for automation avoids the need to change switchgear at a later date. The cost of the prewiring is low (1.5% of the total cost) and WPD has been specifying this arrangement since 2009 and will continue to do so.

Major DPCR5 low carbon and smart grid projects

2.71 During DPCR5 we have been successful in receiving funding for five Tier 2 projects. The projects investigate a range of network issues from 132kV active network management to rewiring of customer homes with DC systems (as opposed to standard AC).



LV Templates

2.72 The electricity network was designed to carry power from large, centralised power stations and major grid infeed points to distant load centres in town and villages. Historic load profiling data for network design used this basic operating model.

2.73 The shift to distributed low carbon generation such as from wind or solar sources has already moved a significant amount of generation closer to the customer load. At the same time homes are being made more energy efficient through better insulation. These changes require an overhaul of the basic planning assumptions that have been used when assessing power flows and energy consumption.

2.74 The LV Templates project was use to evaluate how low voltage (LV) electricity networks can best accommodate the low carbon future.

2.75 In 2011, 951 substation sites in South Wales were fitted with data monitors and communication equipment. The project also required voltage monitors to be fitted at the ends of the LV circuits that are fed from these substations. This required over 3,500 monitors to be installed to collect the data and send it remotely back to WPD.

2.76 The project monitored energy usage and used statistical clustering techniques to identify more accurate patterns in electricity consumption. This allowed us to develop new planning assumptions and embed them in templates that can be used to facilitate more accurate network planning.

2.77 This project ended in 2013 and has shown that low voltage solar generation normally generates onto the network at around 80% of its rating. We are now altering our design assumptions to reflect this, which will increase the volume of photo voltaic (PV or solar generation) that can be accepted onto the network.

2.78 We have also shown that voltage rise effects from PV are less than expected. Both these results will be used within the business and will influence national design policies and solar generation acceptance criteria.

2.79 We have already published network templates data making it available for all DNOs to use in planning LV network solutions. The final project reports published in the autumn of 2013 provide full template data and conclusions.

2.80 We will use the results from the LV Templates project to change the way we design networks. We are initially implementing a templates based planning approach in South Wales that will make relevant changes to network planning tools. Once successful we will roll this out to our other licence areas.

2.81 The templates will allow us to better predict the effect of low voltage generation and load and ultimately enable us to accept more on to our existing network. We will also incorporate the learning from SSE's 'Thames Valley Vision' project in our implementation. Furthermore we will use more detailed weather and climate simulations to improve our understanding and adjust the templates accordingly. Scottish Power's (SP) 'Flexible Networks for Low Carbon Future' project will also provide additional knowledge on the acceptance of low voltage generation and the design of flexible ratings.

2.82 Although the project is formally closed we are continuing to collect data and process it under business as usual. This will allow us to identify demand profile changes as customers adopt LCTs and we will re-model the templates accordingly. The data collection and network monitoring infrastructure will also be used to support new innovation projects without the need to recreate a monitored network.

2.83 We have also published a discussion paper on the possibility of harmonising statutory voltage limits with those in the rest of the EU. The paper has been presented to industry groups including DECC, the Welsh Assembly Government and Ofgem. The consequences and benefits have also been debated at the ENA and with National Grid. We are now progressing the design of controlled trials within the South Wales area. Findings of several Electricity North West (ENW) projects will also help determine next steps.

Lincolnshire Low Carbon Hub

2.84 The Lincolnshire Low Carbon Hub has been designed to test a variety of new and innovative techniques for integrating additional low carbon generation onto electricity networks with limited capacity. The aim is to avoid the costs that would normally be associated with more conventional reinforcement.

2.85 We are exploring how the existing electricity network can be better utilised to accommodate more generation than traditionally would be accepted. The outcome of the project will lead to solutions that can be applied on other parts of the network where a large amount of distributed generation would like to connect.

2.86 We will offer Dynamic Line Rating solutions and Flexible Generation Capacity Agreements on this project. Both of these will improve the utilisation of our assets. The cost of connections and time to connect for generation customers will also reduce as a result of these initiatives.

2.87 The ENW 'Capacity to Customers' project will consult on changes to the engineering recommendation P2/6, relating to security of supply, and we expect this to also lead to an increase in connected generation.

2.88 Using these techniques more widely will require generators to be coordinated so that adjacent systems can operate effectively together. We will develop the systems to achieve this using the knowledge gained from our project and the ENW project.

2.89 When the Lincolnshire Low Carbon Hub project was originally proposed it predicted that the solution would be replicable across the UK electricity industry in around two locations per DNO licence area. We now expect the solution to be deployed in more locations than originally predicted and we have already identified the following 11 additional sites in WPD where the solution will be deployed between 2015 and 2018. This will increase the amount of generation that can be connected at these sites.

- Lincoln and Horncastle
- Rame
- Northampton
- Truro / Fraddon
- Corby
- Fraddon / St Austell
- Swansea
- Landulph / St Germans
- Camarthen/Haverfordwest
- Hayle
- St Tudy

Project FALCON

2.90 Project FALCON is focused on providing an understanding of the dynamic nature of the utilisation of the 11kV network. The aims of FALCON are to facilitate the installation of low carbon technologies by delivering faster and cheaper connections on the 11kV network.

2.91 It will be used to assess a number of alternative solutions to conventional network reinforcement. Four technical and two commercial intervention techniques are being designed and tested to address network constraints.

2.92 The project will develop modelling tools that use real-time data to inform network planning decisions, rather than traditional indicators such as total demand and generic engineering guidelines.

2.93 The project will deliver a Scenario Investment Model (SIM) planning tool for both 11kV network design and strategic forecasting. The 11kV design tool will be developed into a production model and rolled out during the project. The strategic planning tool will be used for business planning and scenario analysis.

2.94 The FALCON telecommunications solution, based on mesh radio, will become our preferred standard for primary substation to distribution substation communications. It will be developed during RIIO-ED1 and will eventually replace the legacy analogue based systems.

2.95 The uptake of demand side response within the FALCON project has exceeded the planned 9MW target. This has been achieved through a mix of bilateral contracts and services provided through aggregators. Uniquely, the service is being offered as complementary to the National Grid STOR service, meaning that customers can engage with us and National Grid at different times. We are currently working with the other DNOs and National Grid on a common framework.

2.96 The outcomes from the FALCON project will produce an energy modelling simulator that will be used to design and operate the network in a more efficient way. Functionality from this simulator will be used to provide 11kV design templates for planners and provide more real time analysis for control engineers. UKPN's 'Flexible Plug and Play' project will also deliver tools to design and operate networks to allow cheaper and quicker generator connections, and we will incorporate these tools in our design templates.

2.97 The network management functionality trialled in FALCON will be implemented into WPD's ENMAC control system, and the prototype system subsequently decommissioned. The new functionality will become available to be implemented across the WPD networks from 2015, leading to the widespread rollout of load balancing automation schemes as loads grow with the increase in adoption of LCTs.

BRISTOL

2.98 The BRISTOL project aims to provide an innovative approach to operating networks utilising battery storage in a customer's premises. The battery will store output from PV generation and utilise it in many ways. A DC network for lighting and USB type charging, an inverter controlled by the customer and WPD and new tariffs will help manage the PV generation locally. The project will seek to address issues associated with the large-scale deployment of PV generation.

2.99 In this project WPD is working with:

- Bristol City Council which is deploying the technology at its sites;
- Knowle West Media Centre which is coordinating customer engagement;
- Siemens who are providing the technology; and
- University of Bath (working with RWE npower) who are our academic partner.

2.100 The technologies will be implemented in ten schools, one office and thirty homes; all connected to 13 distribution substations.

2.101 The project is testing the coordination of a local micro-grid but has also provided an excellent storage and DC power test bed. The BRISTOL solution will not immediately be ready for rollout by DNOs as it will require further refinement and standardisation, as a proportion of the installation is beyond the customer's meter.

FlexDGrid

2.102 The connection of generation to urban HV networks can lead to fault levels that exceed the design capability of existing networks. Traditionally, higher capacity assets would need to be installed to enable the generation to connect, but this project investigates alternative ways to accommodate the connection of generation.

2.103 The FlexDGrid project is based in Birmingham and seeks to explore the potential benefits from three complimentary methods:

- enhanced fault level assessment;
- real-time management of fault level; and
- fault level mitigation technologies.

2.104 Recent forecasts by National Grid and ETI point toward an increase in the use of Combined Heat and Power (CHP) in urban areas. This increase in distributed generation will lead to potentially higher fault levels in most of the larger cities in the WPD area during the latter part of RIIO-ED1.

2.105 Even though this project is less than 12 months old, it is already providing data which may change how we calculate fault level and allow us to accept more local generation and CHP onto our network. As this assessment work completes and reports, it will be used to alter design principles.

Low carbon and smart grid small project portfolio

2.106 In addition to the five large LCNF project, WPD has established a portfolio of smaller low carbon projects.

Isles of Scilly Smart Grid

2.107 We have installed advanced communications links between the islands (including power line carrier communications technology). This is used to remotely synchronise generators on each island with the main power station on St Mary's and the single cable link back to the mainland in Cornwall. The project has included community engagement and the development of an energy website for the islands. The project published a final report in December 2013.

National Grid Systems Integration & Security

2.108 Traditionally DNO control systems and those of National Grid have run in isolation. With the connection of more intermittent generation on the system it will become increasingly important for data to be exchanged. This needs to be done reliably and securely. This project has developed data links using "Inter Control Centre Protocol".

11kV Voltage Control

2.109 Working with Hitachi of Japan, we are testing large power electronic devices to control system voltage at remote ends of our networks where renewable generation is connected. The devices have previously been used in Japan and the Far East and we are adapting them for UK networks. We have demonstrated that Static VAR Compensators (SVCs) at 11kV are an effective way of smoothing voltage on rural networks to allow distributed generation to connect.

Early Learning

2.110 We have worked with Merlin Homes on a new housing development in Crickhowell, South Wales. The development of 30-40 homes has solar panels and other low carbon technologies. We installed three parallel low voltage cable networks (small, medium and large). This enabled us to switch between the networks and monitor their performance so that we could establish which one provides the best solution for customers. The project reported in November 2013.

Substation Sensor Trial & "best buy" report

2.111 Our Tier 2 LV Network Templates project involved installing retro fit monitoring equipment in older substations across South Wales. Traditional methods of installing the monitoring equipment require supplies to be switched off. This project developed a solution to substation monitoring, without the need for customers to be off supply. Equipment was tested in the field and in the laboratory. The work was supported by the National Physics Laboratory. At the end of the project we had shown that 98% accuracy is achievable on these units and produced an evaluation report for a range of sensors.

PVs in Suburbia

2.112 Several thousand social housing homes in Nottingham have solar panels and other energy efficiency measures fitted by the local council. We have taken the opportunity to carry out detailed monitoring of the local grid. The objective was to understand how resilient our system is to such a high concentration of LCTs, and identify how we need to adapt the network.

2.113 Our results showed that dense concentrations of solar panels will present some issues around harmonic content, power factor and when the limits of neutral current thermal limits are reached. These findings are helping to advise new planning principles in conjunction with the LV Templates and Early Learning projects.

Smart Hooky – Britain's Smartest Energy Community

2.114 Working with the residents of Hook Norton, and integrated into DECC's Low Carbon Community Challenge initiative, the project has transformed the local grid to a smart grid. All the substations are monitored with data made available to residents via a web portal. We have also developed a power line communications solution, which allows us to communicate to customers' homes directly and understand individual demand profiles. The project concluded in December 2013.

Seasonal Deployment of DG

2.115 This project recognised that network peaks occur generally for a few days per year. It attempted to develop the standards and commercial arrangements to "top up" the local grid with under-utilised mobile generation at times of forecast excess demand. Due to current market arrangements and the greater utilisation of generation than expected, it was found to be uneconomic to make use of mobile generation in this way. The project was therefore halted in the summer of 2013.

Active Fault Level Management

2.116 Generation connections are limited by three network factors; load carrying capability, voltage and fault level. Until now is has not been possible to measure the fault level, it could only be modelled on computer simulations. We have developed a tool, recently tested in Chicago, to solve this problem. The learning has already fed into our Tier 2 FlexDGrid project and a live measuring device was installed on a network in Birmingham in December 2013.

Community Energy Action

2.117 Working with 10 communities across WPD we will attempt to manage network constraints using demand side management (DSM). The project aims to identify the most effective arrangements to engage customers in the modification of their electricity demand and through these initiate practical DSM arrangements.

Electric Boulevards

2.118 Working with partner organisations including Arriva Buses, Wright Bus and ARUP we are transforming one bus route in Milton Keynes by replacing diesel buses with wirelessly charged electric units. WPD is installing and testing the charging equipment and laying the cables to charge the buses. We will move energy around the city to match the bus route. We expect to be able to show that LV connection of these charging units is possible in most urban areas using the existing network. This will assist in the deployment of electric buses in towns.

ECHO

2.119 The ECHO (Energy Control and Household Optimisation) project is testing the effect on household electricity demand from Demand Side Response (DSR) payments (customers receiving payment for modifying their electricity usage). Delivered in conjunction with the Energy Savings Trust the project will provide insight into the financial, technological and behavioural aspects of DSR.

LCNF Tier 1 Small Project Portfolio Budgets

2.120 The expenditure on many of the tier 1 projects is relatively modest, but we are generating a good understanding of many facets of future networks. We will continue to develop new small scale projects that will continue to benefit the industry.

LCNF Tier 1 Project Budgets (£m)	
T1 Isles of Scilly Smart Grid	1.27
T1 National Grid Systems Integration & Security	0.08
T1 11kV Voltage Control	1.07
T1 Early Learning	0.02
T1 Substation Sensor Trial & “best buy” report	0.28
T1 PV's in Suburbia	0.10
T1 Smart Hooky – Britain’s Smartest Energy Community	0.39
T1 Seasonal Deployment of DG	0.33
T1 Active Fault Level Management	0.80
T1 Community Energy Action	0.33
T1 Electric Boulevards	0.61
T1 ECHO	0.35

Smart Grid Forum

2.121 The Smart Grid Forum (SGF) was set up in 2011 to bring together key stakeholders in the development of a GB smart grid. The SGF helps network companies address future network challenges and ensures system benefits are considered in the development of smart grids.

2.122 Two key challenges to the operation of a smart grid have been identified as the use of DSM and the visibility of operating conditions on low voltage networks. To help address these challenges our early LCNF projects have focused on these areas. The FALCON project is demonstrating the effective use of Demand Side Management (DSM) and the LV Templates project has provided profile information on low voltage networks.

2.123 We are represented on the SGF at CEO level, and are active in many of the workstreams that have developed.

2.124 Workstream 3 led to the development of the 'Transform' model; an enhancement of the DECC scenarios developed under workstream 1. We have actively participated and supported the Transform model and have taken it further by including socio-economic and housing stock details to develop a view of future electricity usage specifically tailored to our areas of operation.

2.125 Workstream 5 has developed the Smarter Networks Knowledge Portal, which has recently been launched by the ENA and we are also represented on this group.

2.126 Workstream 6 deals with Commercial and Regulatory Matters. We have recently been involved in a DNO knowledge sharing event for this group, where we explained the experiences of customer engagement that we have seen on our projects.

2.127 A new workstream developed by the SGF is workstream 7 which will consider the future of distribution networks out to 2030.

Why do we innovate?

External factors and trends

2.128 The changing global attitude towards fossil fuels is driving customers towards greater electrical solutions for heating and transport. The generation sources which support this increased demand are more likely to be renewable and distributed.

2.129 Creating a network that supports this increased electricity usage would be expensive using purely conventional methods. Our innovation strategy seeks, investigates and evaluates affordable alternatives. The alternatives may include solutions that postpone expensive investment whilst there is uncertainty.

2.130 Innovative solutions can also improve the security of electricity supplies by ensuring generation matches demand in local areas. Solutions could enable sections of the electricity network to be run in isolation for short periods of time.

2.131 Distribution network technology will continue to advance and we can gain benefits by adopting it. Our experience shows that new solutions available today will become standard in the near future. For example, distribution substation monitoring was bespoke when our LV Templates project started in 2010. By 2012 we were able to test a variety of off the shelf products in a joint project with UK Power Networks.

2.132 The information, communications and technology sector will continue to grow in significance. The trend in "always online" devices is likely to accelerate leading to the vision of an "internet of things" where smart devices interact with one another without the need for human intervention. We will need to ensure that the distribution network can integrate with such devices to meet customer expectations.

2.133 There will also be an evolution in the capability of LCTs such as electric vehicles and heating solutions. Technology breakthroughs are also likely, for example, in the cost and density of energy storage devices. Network innovations we are developing today will need to adapt or be replaced with new solutions over time.

Responding to Government policy

2.134 Concerns about climate change have led the Government to produce the Carbon Plan setting out the UK's commitment to reducing greenhouse gases by 80% by 2050. New challenges will emerge for DNOs because the Carbon Plan seeks to drive down the levels of carbon released by both heating and transport activities thereby shifting demand from oil and gas to electricity.

2.135 The aspirations within the Government's Carbon Plan will increase demand on the network and there will also be more DG. The scale and pace of the changes are uncertain but we need to be ready to accommodate the changes when they arise.

2.136 We have already observed the effects that changes to Government policy can have. The feed-in-tariff for generation has led to a significant increase in the volume of applications for generation connections, with many applications being received just prior to when incentive strength is reduced as generator developers seek to maximise their returns from incentive mechanisms. As an example, in 2013 we connected 28 new large renewable generation connections. Another 90 are planned and have accepted connection offers from us.

2.137 Devolved Government policy in Wales may lead to specific demands and need for innovative solutions. Our plan is flexible and therefore able to accommodate these.

2.138 We expect that some LCTs will also see a high level of uptake which will be influenced by Government subsidies or incentives. The strength of incentives will alter the speed and volume of uptake.

2.139 In preparation for future changes we will engage with developers, local authorities and other expert groups to ensure that our preparation plans are targeted in the most beneficial areas.

2.140 Our work with the CSE has identified that heat pumps are only likely to be deployed in areas where the housing stock is suitable for them. Likewise, the numbers of electric vehicles are likely to grow in areas where the social demographic suits early adoption. This means that it is highly likely that LCTs will be clustered closely together leading to a compound effect on specific parts of the network.

2.141 In the future customers will use electricity in different ways. They will be more aware of their own generation and demand, with some customers becoming more self-sufficient. The existing passive use of electricity will turn into a more interactive and dynamic system.

2.142 The impact of new forms of generation and demand will become clearer during RIIO-ED1 and into RIIO-ED2 and our plans need to be flexible to respond to changing circumstances. We will accommodate any changing requirements into our Innovation Strategy as part of the annual review.

2.143 The rollout of smart meters will provide new data capture opportunities. We will develop systems to analyse the data that will become available to assist in understanding where issues are arising and enable the deployment of domestic Demand Side Response (DSR) where appropriate.

The need for innovation

2.144 DNOs will have to become more creative and develop new ways of delivering a network that can respond quickly to both the increased demands from LCTs, such as heat pumps and electric vehicle charging, but also to accommodate the connection of more locally based DG such as photo voltaic and wind.

2.145 Networks have evolved progressively since the major electrification of the UK in the 1950s and 1960s but the challenges arising from adoption of the Carbon Plan will require us to change the way we operate more quickly than has been necessary in the past.

2.146 Over the last fifty years our network has become far more sophisticated and responsive, but more change will be required during RIIO-ED1 for it to become 'Smart'.

Passive

2.147 Early electricity networks operated in a simple and passive way. All network switching actions required manual intervention and responses to a loss of supply required people to be on site to understand what had happened and make the changes. If a network required reconfiguration it was done manually.

Telecontrolled with remote operation

2.148 Advances in communication technology allowed us to provide a network that could in part be operated remotely. This was applied to the higher voltage levels and was predominantly limited to control of source circuit breakers at primary substations. Manual switching on site was replaced by remote control at a control centre. The communication systems also allowed more real time data about the loading of the network and configuration of running arrangements to be brought back to the control centre.

Semi-automatic / automatic response to specific events

2.149 Further advances in communication enabled remote control to be installed more widely on the networks. This allowed more operations to be conducted on the network without the need for manual switching.

2.150 Developments in control systems also allowed this equipment to be controlled automatically using logic sequences. Ever more sophisticated NMSs could check and reconfigure networks automatically to provide quick restoration of customers' supplies in a high proportion of HV faults.

Smart (present day onwards)

2.151 We are now developing networks that will be more autonomous in the future. The networks will use data from various sources to determine their state and respond accordingly. The data will include weather data, smart meter data and other information obtained from dedicated monitoring.

2.152 In addition to reconfiguring running arrangements in response to faults, the smart networks of the future will dynamically respond to network loading, output from distributed generators, weather conditions and other parameters to maximise the utilisation of available network capacity, enable the most amount of generation to be exported and reconfigure networks to minimise technical losses.

Consequences of innovation not occurring

2.153 The need for innovation has been set out in the section above. It shows the way that we expect the use of the network to change in the future. It is clear that the Carbon Plan will introduce significant challenges that increase the importance of maintaining reliability and customer service to customers during a time when customers change their electricity usage habits.

2.154 If innovations did not continue to be made, our overall performance would suffer and costs for customers would be higher as the volume of LCTs overwhelmed the capacity of the network and increased volumes of more expensive traditional solutions were used.

2.155 For our main output areas of safety, reliability, customer service, the environment and cost efficiency we have been a frontier performer for many years. This performance is founded on a strong belief in innovation and continual improvement in all the key output areas.

2.156 The consequence of innovation not occurring would be that our performance would not improve further and could potentially decline. Over time, all the output areas of safety, reliability, customer service, the environment and cost efficiency would suffer. If this were to continue over the long term, the work and funding required to restore performance levels would be immense.

2.157 For the future networks areas of innovation, the consequences relate directly back to the Carbon Plan and the targets set by Government. Achieving the Carbon Plan places a new set of demands on the electricity distribution network where the majority of LCTs will be connected. Without the innovative and flexible arrangements we are introducing, we would need to build a large passive network to accept the proposed volumes of LCTs.

2.158 The cost of a passive network to accept the level of LCTs that we expect within the RIIO-ED1 period would be £128m more than the innovative and flexible network we plan to build.

Dealing with uncertainty

2.159 A high degree of uncertainty exists with respect to the uptake of LCTs and it is therefore important that we seek and use key sources of external data and guidance to ensure that we have the best forecasts possible.

2.160 Whilst we are guided by scenarios developed by DECC we also employ organisations such as EA Technology Ltd (EATL) and the CSE to help model these scenarios further and to enhance the levels of detail.

2.161 The detailed understanding that we gain guides the development of our innovation projects to deliver solutions for the potential problems we expect to encounter.

2.162 Wherever possible we also ensure that our projects are capable of providing more generic solutions that can be adopted irrespective of the specific type and level of LCTs that drive increases in electricity usage in the future and can also be transferable to other DNOs.

Prioritising innovation topics

Scope of innovation

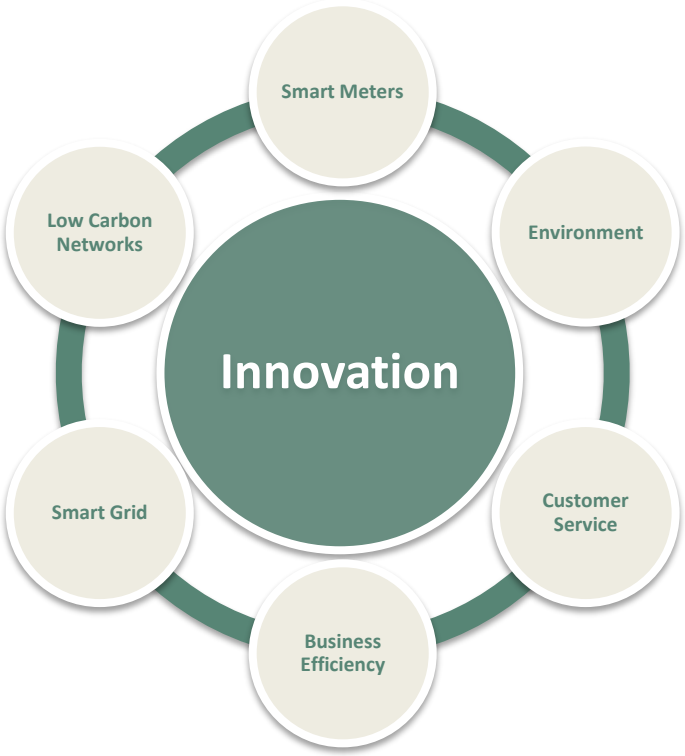
2.163 We always look for better ways of working. We have adopted many innovative ideas into day to day operations that improve the efficiency and effectiveness of the way we deliver our services to customers.

2.164 Our track record of innovation and change has been developed from the implementation of good innovative ad-hoc ideas from staff all the way through to formal innovation projects.

2.165 Our innovation developments can be described across six broad areas;

- low carbon networks – supporting future electricity demand and generation requirements;
- smart meters – maximising the benefits from more detailed network data;
- smart grids – developing new techniques and utilising enhanced data to help develop more dynamic network control;
- environment – reducing our business impact on the environment;
- customer service – developing smarter ways of delivering better customer service;
- business efficiency – searching out better processes, equipment and technology that ensures we continue to be efficient.

2.166 These areas of work are interdependent and progress in one area will often help to enhance innovation development in another.



2.167 Our existing portfolio of innovation projects is already shaping how we are thinking about the future. We will continue to innovate and carry out new projects that will build upon what we have already learnt from the projects we and other DNOs have carried out.

Innovation objectives

2.168 The objectives of WPD's innovation are to:

- develop new smart techniques that will accommodate increased load and generation at lower costs than conventional reinforcement;
- improve performance against one or more of our core goals of safety, customer service, reliability, the environment or cost effectiveness;
- ensure solutions are compatible with the existing network;
- deliver solutions so that they become business as usual;
- provide value for money.

Approach to innovation

2.169 The way that we approach innovation is fundamental to delivering the objectives efficiently. WPD's innovation strategy is to:

- actively involve staff from across the business in the generation of ideas, development of solutions and implementation of projects;
- work with our stakeholders to understand their needs;
- make use of innovation incentives and funding provided by the government, the regulator and other funding organisations;
- use a small core team to coordinate innovation projects;
- define clear objectives for each project so that delivery can be focused and progress can be tracked;
- avoid theoretical research or innovation which does not have clear objectives;
- incorporate innovative solutions into existing equipment and processes (e.g. the purchase of equipment that is ready for the retro fit of automation);
- share what we learn with other organisations and learn from others.

Generating ideas

2.170 Customers and stakeholders are a great source of ideas as they are directly affected by our performance.

2.171 New ideas also come from several other sources. They can come from within WPD and are based around improvements or recent experiences. They can also incorporate learning from other DNO projects. In some cases academia will approach us with a theoretical idea which we could develop into a solution. We also look for ideas in other sectors where there is the potential for technology developed outside of the electricity industry to be brought in and modified (e.g. application of gas sniffing technology to identify locations of faults).

Selecting and prioritising ideas

2.172 Ideas that are generated are grouped against the six broad areas of innovation development. They are then assessed against the innovation objectives and subsequently prioritised.

2.173 All potential projects are subject to a cost benefit assessment as part of our standard business approvals process.

2.174 The positive impact of projects on our customers is considered as part of the selection and prioritisation process. We also consider the possible negative impact to customers, for example the effect on short term network performance whilst the work to deliver a project is ongoing.

Developing plans for innovation

2.175 Innovation in smart solutions will help us to accommodate LCTs without the need for vast amounts of investment being required to reinforce the network in the latter years of RIIO-ED1 and into RIIO-ED2. We forecast that smart interventions have reduced our investment plans and will save around £128m across RIIO-ED1.

2.176 Our innovation plans will also be regularly reviewed against new information from UK industry, worldwide research, learning from LCNF projects and outputs from the Smart Grid Forum.

2.177 We take account of other ideas and initiatives external to the business which can be jointly developed with our ideas. In some cases this allows us to utilise funding from bodies such as TSB, ETI or EPSRC.

2.178 We also look for ideas which follow on from other LCNF or IFI projects to maximise the benefits of investments already made.

2.179 This includes building on successful projects delivered by other DNOs. One example of this was the research which underpins our FlexDGrid Tier 2 project. This was developed as an IFI research project by SP and was then further enhanced as a measurement technique by one of our own Tier 1 projects. Another example is where we have taken the demand side management customer contract documents from the UKPN Low Carbon London project and are using them in our own Community Energy Action project.

Stakeholder engagement for innovation

2.180 Our stakeholder engagement process for innovation is the same as for all other areas of our business. Innovation is a key theme of all stakeholder engagement sessions. Stakeholders understand that innovation cuts across all areas of our business and provides improvements and benefits to all the areas.

Stakeholder engagement in developing plans for RIIO-ED1

2.181 In phase 1 of our stakeholder engagement process we asked stakeholders if they supported our plans to facilitate increased volumes of LCTs. They formed the view that we should provide a level of "future proofing" to the network and that our steps should be taken in an incremental way in case the uptake of LCTs is slower than expected.

2.182 They also expressed the view that we should hold a "watching brief" on technologies such as electric vehicles, where the adoption is not yet established.

2.183 In phase 2 of our stakeholder engagement we presented our plans for the levels of "future proofing" that could be applied to our network. In this stage of the process our plans had a financial value so that stakeholders could establish their willingness to pay. Whilst there was high overall support for our plans, the most favoured option was to invest ahead of need in line with a medium level scenario of LCTs.

2.184 We consulted on our Business Plan in phase 3 of our stakeholder engagement process. At this stage our stakeholders asked us to scale back our assumptions for the take up of LCTs, which we did. Stakeholders also made it clear that they expected our levels of service and reliability to be maintained during the transition to LCTs.

2.185 74% of stakeholders agreed with WPD's draft plans and outputs to facilitate increased volumes of LCTs. 19% of stakeholders want WPD to do more to identify LCT hotspots to inform our decision making regarding network reinforcement.

Ongoing Stakeholder engagement

2.186 Stakeholder engagement will remain a core activity through the RIIO-ED1 period and innovation will remain a key element for consultation and feedback. Our latest engagement sessions in February 2014 included discussions on the process for DG connection queues where there are a number of DG customers wishing to connect to the same part of the network. This considered interactivity of connection offers, payments and reservation of capacity.

2.187 Innovation remains a key theme for our Customer Panel. At a recent Customer Panel meeting innovation options were presented. The panel prioritised the options for future projects. In addition to innovation projects the panel support our work to assist the distributed generation community.

2.188 In addition to our stakeholder engagement process, we look for feedback on innovation at other panels and groups wherever possible. We work closely with Regen South West, a renewable energy group in the south west of England, who are keen to support the introduction of renewable generation across their area.

2.189 We use the Distributed Generation forums, now run by the ENA, to seek other views and to compare our initiatives with those of other DNOs. We support the Major Energy Users Council (MEUC) and have presented our innovation proposals to them for comment and feedback.

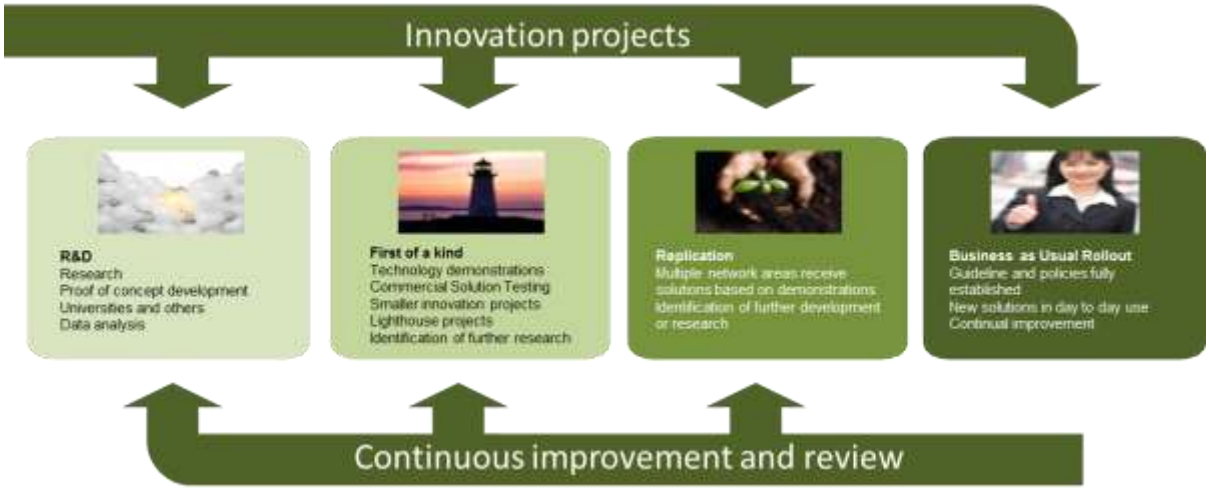
Innovation Priorities for RIIO-ED1

Stages of Innovation

2.191 During RIIO-ED1 projects will continue to deliver additional knowledge across all output areas. The project portfolio will remain balanced across multiple areas:

- working at various stages of development spanning higher Technology Readiness Levels (TRL) 3 to 8;
- exploring both technology and commercial solutions;
- covering the whole range of asset types and network voltages;
- assessing risk, with no projects carrying unnecessary risk;
- utilising a variety of external funding mechanisms (in addition to the NIA and NIC) to supplement our own R&D budget.

2.192 Lower TRL projects will generally be carried out by external research partners under limited supervision of WPD engineers. Higher TRL projects which, in the shorter term, are more likely to produce a solution for our network or processes will mostly be delivered in-house using business as usual teams.



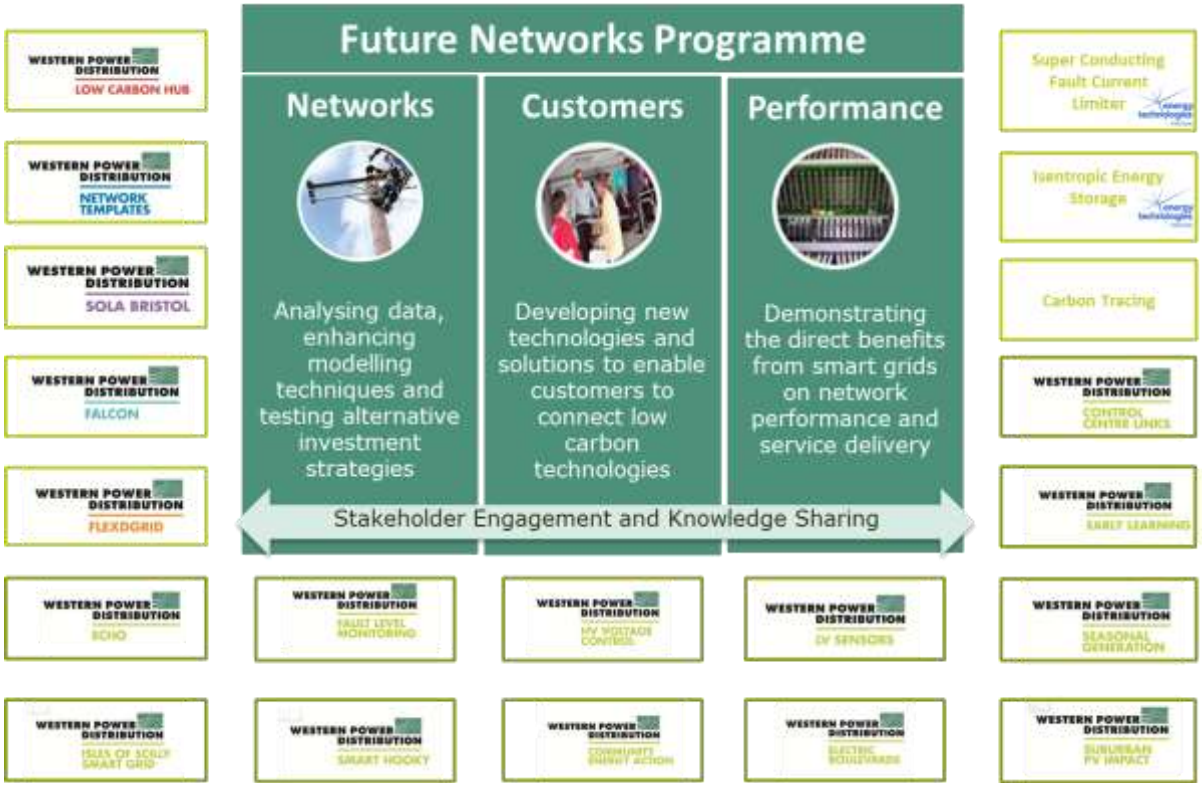
2.193 The full 'research to implementation' timescale can often take 5 to 10 years. That is why we focus internal teams on higher TRL stages, building on knowledge from earlier studies outside our own organisation. This will particularly be the case in RIIO-ED1 in order to rapidly develop new solutions to support delivery of the Carbon Plan.

Forming the innovation programme

2.194 Smart grid innovation projects are grouped into three main categories. These are:

- Networks – Projects in this category collect data from the network to enhance modelling. They also test alternative investment strategies that can postpone expensive investments.
- Customers – These projects develop new solutions to enable customers to connect low carbon technologies. For example the application of battery storage devices to provide additional capacity at peak times.
- Performance – This category of projects demonstrate direct benefits to network performance from the application of technology. For example, the use of phasor measurement units to maintain supplies using local generation in the event of a fault.

2.195 The projects within the innovation programme are constantly changing as new ones are initiated and existing ones completed. A snapshot of the programme is shown in the diagram below.



Funding the innovation programme

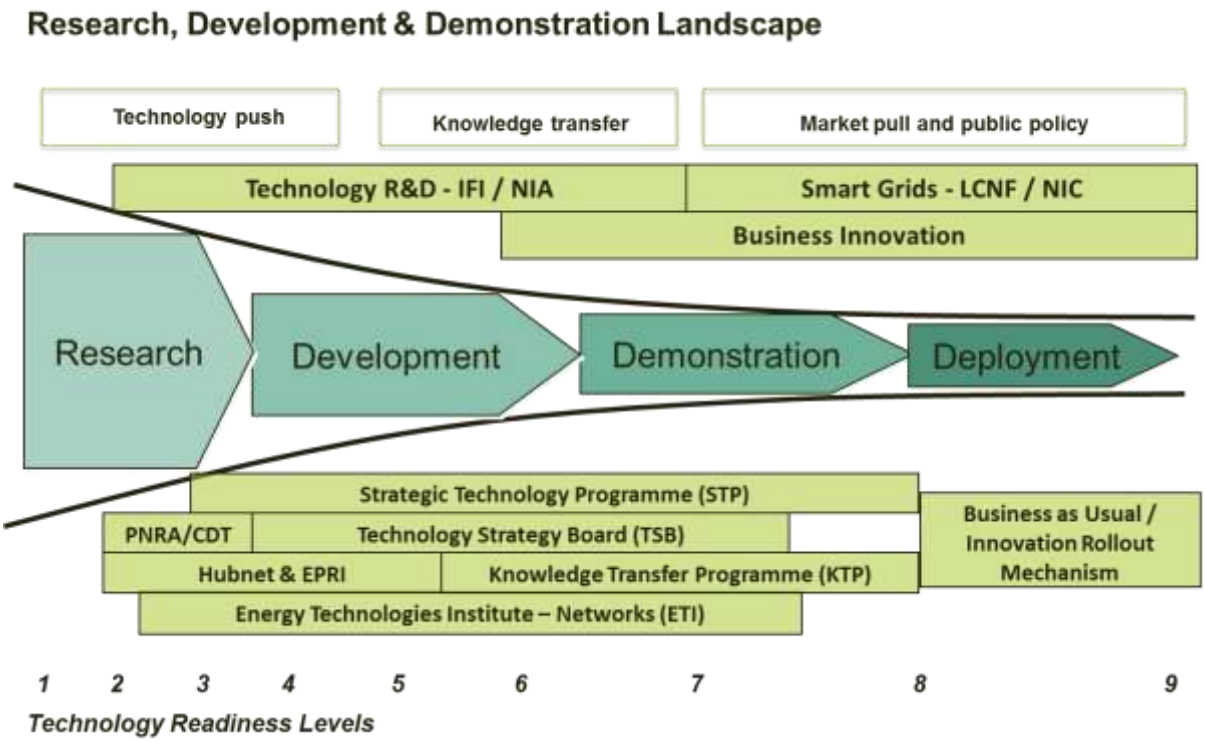
2.196 For RIIO-ED1 we have requested the minimum proposed Network Innovation Allowance (NIA) of 0.5% of total regulated revenue, around £67m throughout the period. We will also work with partners to provide innovative proposals for larger projects to be funded through the Network Innovation Competition (NIC). Together these projects will lead to investment of over £130m in innovation.

2.197 We will also continue to make use of any other available funding sources when appropriate.

2.198 In addition to NIA and NIC projects we will continue to support research and development in partnership with other DNOs. These include continuing to support academic research through Hubnet, the IET Power Network Research Academy (PNRA) and Centre for Doctoral Training (CDT).

2.199 To ensure knowledge is effectively shared with this sector we will continue to make use of the Knowledge Transfer Programme (KTP) initiative.

2.200 The targeting of innovation funding to appropriate TRL stages is illustrated in the diagram below:



Preparing for the future with smart enablers

2.201 We have been assessing the scale of future network investment requirements by modelling different scenarios. The EATL "Transform" model provides future load estimates and potential solutions based on the DECC scenarios using a range of generic network types. This model has enabled us to form a view of loading at distribution transformer level.

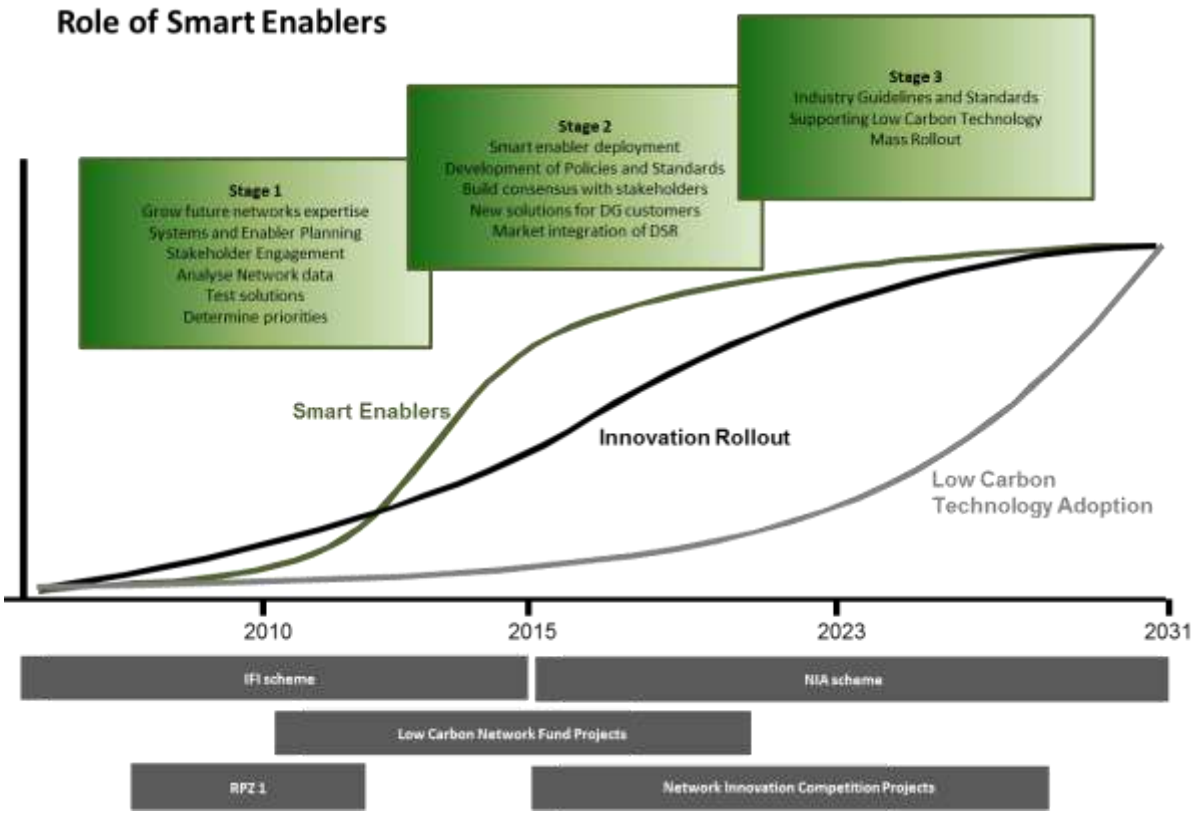
2.202 At our request, the CSE has compared the output from the Transform model to socio-economic and house stock information that they hold. This has refined our plans to make them more specific to local circumstances. For example, forecasts of heat pump installations have been reduced in areas where the housing stock is not suitable for their installation and electric vehicles demands have increased in those areas where early adoption is likely.

2.203 As we move into RIIO-ED1 we will compare the CSE forecasts with the activity levels that we are actually observing to update our forecasts and provide feedback into the CSE to refine forecasting techniques. This will allow us to more accurately forecast LCT uptake so we deliver the most efficient volume and mix of reinforcement.

2.204 Using this detailed analysis we plan to increase the size of selective transformers and cables where there is greatest likelihood of demand growth.

2.205 We also plan to invest in communication infrastructure to improve our understanding of the real time status of the distribution network, utilise smart meter data and enhance the sophistication of control of the network.

2.206 Investment in these enabling solutions will provide an essential foundation for the rollout of many smart solutions. Deploying such "smart enablers" and having individual innovative solutions fully developed will allow us to be ready for the mass adoption of LCTs by customers. This three step approach is illustrated in the diagram below, annotated with how we make use of regulatory innovation incentives.



Selectively increasing the size of distribution transformers

2.207 Once installed, transformers are a very simple asset with no moving parts and a long life span. It is more cost effective to increase sizes when transformers are initially placed. Installing increased capacity will avoid the expense and possible customer supply interruptions of transformer changes at a later date.

2.208 The additional purchase cost of the next largest transformer is around 12% for the transformer itself, but when all the costs of installation are taken into account the actual additional cost of oversizing is 6%.

2.209 The Centre for Sustainable Energy data forecasts high uptake of LCTs on around 7% of the WPD network. By targeting larger transformers at this 7% we will install around 109 units per year. This has led to an additional cost of £0.11m per year being included in the plan.

Selectively increasing the size of cables

2.210 The average cost of excavation in a footpath is around £70 per metre, whereas the additional cost of moving to the next size of cable may be less than £10 per metre. When these two items are taken together it makes economic sense to upgrade the cable at the time of installation rather than return at a later date. It also reduces the excavation waste and inconvenience to road users.

2.211 It is, however, not economic to do this everywhere and must be targeted at areas where we expect future load to increase.

2.212 Using the CSE forecasts we will design to the “next size up” on our cable installation and replacement works in these areas. By targeting this 7% we will install around 74km per year at an additional incremental cost of £0.3m per year.

2.213 Cables do not provide the same losses savings as transformers but installing oversized cables will reduce the need to revisit networks and replace cables. Using an average cable replacement cost of around £70 per metre the future cost savings are around £5.1m per year.

Expanding the communications infrastructure

2.214 We will establish communications networks as they are needed to support smarter control of the network. We will provide sufficient capacity to take into account future requirements informed by the clustering data we have for LCTs.

2.215 Our forecast of load growth will be supplemented by data that becomes available from smart meters. As the smart meter rollout progresses, we plan to make use of this data to model and operate our network. The smart meter data will show us where our network is being fully utilised and where interventions such as operating adjacent networks in parallel (meshing) and load transfers are required.

2.216 For instance where meshing or load transfers are required we will consider establishing our own communications links to bring back monitoring data and automation control information. This will only be applied where it is more cost effective and operationally effective than using the smart meter data. Wherever possible we will connect our links directly into our existing communications network via scanning or mesh radio systems.

2.217 Our FALCON project is providing a replicable radio solution which will be the way forward for our new communication systems. We are working with the industry, Joint Radio Company (JRC), Ofcom and the EU to identify an appropriate frequency spectrum for smart grid communications.

Identifying and delivering solutions from earlier LCNF projects

2.218 To ensure that we learn as much as possible from each of the innovation projects we have assigned specific individuals as points of contact for the other DNOs and their suite of projects. These staff are responsible for ensuring that we capture and apply the knowledge gained from other DNOs and assimilate it, with our own knowledge, into business as usual.

2.219 The suite of LCNF Tier 2 projects will provide an excellent source of knowledge to help develop future networks and applications. The timescales of these projects mean that the majority of the learning and outcomes will be provided in the next few years and into the RIIO-ED1 period.

Driving value from smart metering

2.220 The smart meter programme will provide every household with a smart meter. We will be able to use the data from these meters to provide us with a level of information and customer interaction that we have not previously seen. The meter will provide us with details of electricity usage that will assist in refining network planning templates.

2.221 The increased functionality of the smart meter over the conventional meter provides the potential for us to offer our own tariff signals to manage peaks on our network. The "last gasp" feature will also help us improve our customer service during supply interruptions.

Our plans for smaller scale new innovation projects

2.222 Our plans for smaller scale innovation will encompass all of the areas that we have developed in the past. We will continue to refine existing innovative solutions across the whole range of business areas and add new innovations as they arise.

2.223 We will continue to develop new ideas from a range of sources, including our own teams, our stakeholders, our customer panel, manufacturers, academia, other DNOs, other industries and international developments. As new ideas are developed, we will review and update our project plans.

2.224 The ideas we take forward are chosen to support and improve our performance in the broad areas shown on the table below. These areas feed into our main business output headings and will be used to improve our performance in these areas.

Future smaller scale innovation	Safety improvement	Cost efficiency improvement	Customer service improvement	Reliability improvement	Environmental improvement
SF6 alternatives	✓				✓
Metal theft	✓	✓	✓	✓	
Priority Service Register	✓		✓		
Templates		✓		✓	✓
Smart meter data		✓	✓	✓	✓
Power electronics	✓	✓		✓	
Modelling and state estimation	✓	✓		✓	

2.225 The subjects are detailed on the following pages.

SF6 alternatives

Safety improvement	Cost efficiency improvement	Customer service improvement	Reliability improvement	Environmental improvement
✓				✓

2.226 Sulphur Hexaflouride is a key gas used to provide insulation in high voltage switchgear. The excellent insulation properties of the gas have helped reduce the size of switchgear, but the environmental impact of the gas is significant as it is a potent greenhouse gas. Alternative insulation methods have been used, such as vacuum, and are now well established at higher voltages. Work continues to develop a solution for distribution voltages and we are very much supporting research. Most recently we have supplied a distribution switch unit for analysis at Cardiff University.

2.227 The development of an SF6 alternative will reduce the environmental risk by avoiding the use of SF6 in future switchgear designs. During our normal replacement works, designs using SF6 will be replaced in the same way as oil filled designs have been for many years.

Metal theft

Safety improvement	Cost efficiency improvement	Customer service improvement	Reliability improvement	Environmental improvement
✓	✓	✓	✓	

2.228 The theft of metal from our network continues to be a problem whilst the scrap value of metal is high. We are developing a range of initiatives to help prevent and detect theft. We are trialling the monitoring of neutral wire currents to detect theft as it occurs. We are also investigating the analysis of the verdigris on recovered copper to identify the theft location.

2.229 This work will help to deter theft, reduce the disruption caused to customers as a consequence and reduce the safety considerations of network assets being left in an unstable state. It will also lead to lower overall costs of repair, which benefits all customers through lower funding requirements.

Priority Service Register (PSR)

Safety improvement	Cost efficiency improvement	Customer service improvement	Reliability improvement	Environmental improvement
✓		✓		

2.230 WPD maintains a PSR of customers who are registered as being dependent on electricity due to age, disability or chronic illness. We are looking at further developing ways to help support these customers. We have plans to develop a simple notification system for PSR customers to contact us during a loss of supply. We are also developing a small alternative power supply system for customers who have a requirement to operate certain medical equipment during a loss of supply.

2.231 This helps us provide an excellent level of customer service to our PSR customers who, in times of loss of supply, have the greatest need for our help.

Templates

Safety improvement	Cost efficiency improvement	Customer service improvement	Reliability improvement	Environmental improvement
	✓		✓	✓

2.232 As new planning templates are developed through innovation projects like the WPD LV Templates projects, we will work to establish them as standard assumptions throughout our planning systems. With each new project completion or learning outcome, we will refine the templates we use.

2.233 Further development of templates will help us optimise the utilisation of our network without the need for expensive monitoring systems, which will reduce costs to customers.

Smart meter data

Safety improvement	Cost efficiency improvement	Customer service improvement	Reliability improvement	Environmental improvement
	✓	✓	✓	✓

2.234 The roll out of smart meters will bring about a step change in the level of data that is available in relation to the utilisation of LV networks. The status of the LV network will be known at all times. A system of data mining will be established to interrogate the raw smart meter data that will help to refine planning templates further.

2.235 Further developments will enable us to use the data directly creating bespoke solutions for different part of the network.

Power electronics

Safety improvement	Cost efficiency improvement	Customer service improvement	Reliability improvement	Environmental improvement
✓	✓			✓

2.236 The move to an active network with active power flow management has introduced a new range of power electronic devices onto the distribution network. Devices which are being trialled under LCNF projects will be developed into standard solutions. We will work to develop the standards and establish the rules for wider deployment of these solutions.

2.237 In all areas of new development, the generation of standards helps manufacturers design systems and products which are appropriate for our network and the other DNOs in the UK. This helps reduce costs through bulk manufacture as all DNOs purchase equipment built to the same UK standards.

Modelling and state estimation

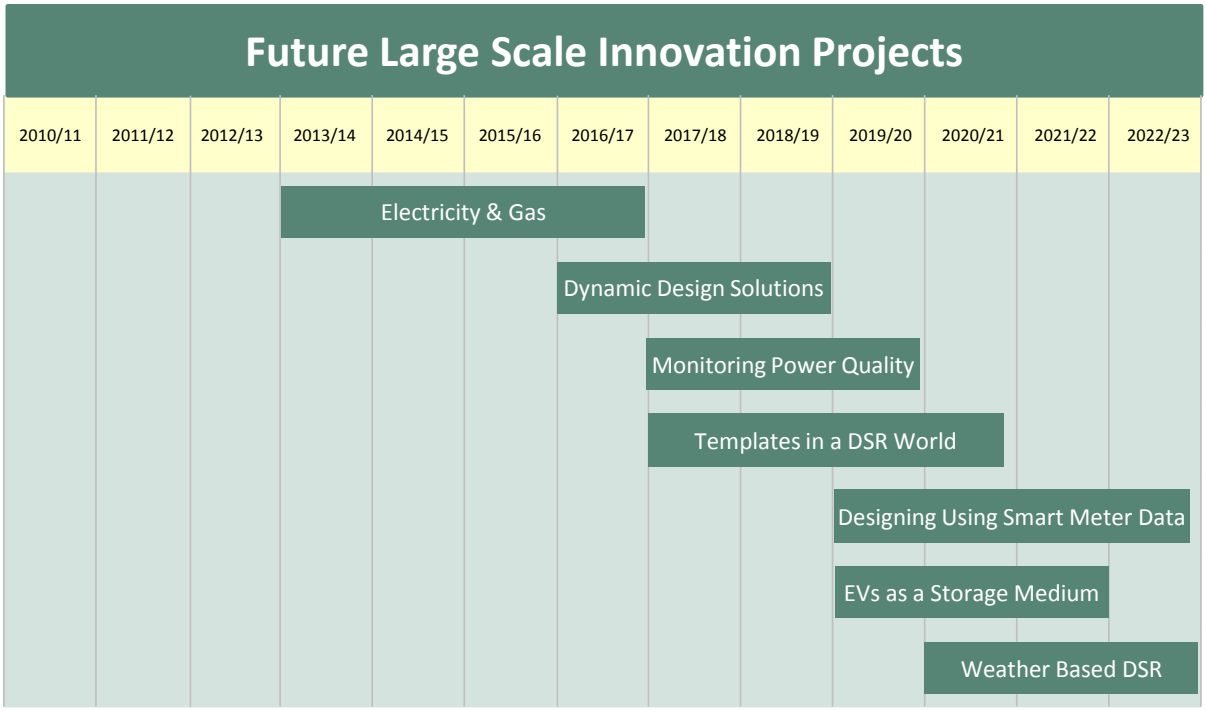
Safety improvement	Cost efficiency improvement	Customer service improvement	Reliability improvement	Environmental improvement
✓	✓			✓

2.238 In our smart grid strategy we explain the interdependencies of monitoring, state estimation and modelling. The estimated and modelled networks will help us develop flexible solutions without the need for specific monitoring points. We will develop the standards to use when applying state estimation and use the results from innovation projects to refine the state estimation assumptions.

2.239 Modelling and state estimation allow us more economically operate our network without the need for expensive monitoring systems, which will reduce costs to customers.

Large scale innovation and the Network Innovation Competition

2.240 The chart below shows the areas we will explore and develop through the NIC up to the end of RIIO-ED1. Many are still at a conceptual stage and build upon anticipated learning from existing projects. The scope of each project will become clearer as current knowledge learned in WPD and other DNOs is revealed. This may also lead to different projects that have not yet been conceived.



Electricity & Gas

2.241 The 'Electricity and Gas' project was been developed as our Tier 2 proposal for 2013. It was to investigate the use of hydrogen as a storage medium. There are parts of the network where there is more generation output than can be accommodated by the network. This means that the output of the generation has to be constrained, limiting the low carbon benefits of the generation capacity. Reinforcement of the network often requires the replacement of EHV or 132kV network at high cost.

2.242 This project sought to use the excess generation output to produce hydrogen which can either be used as fuel to produce electricity when the output from generation is lower or it can be injected as a source of additional gas into the local gas network. The project was not selected for funding in the 2013 LCNF competition. Discussions are now underway to review alternative approaches at a smaller scale and to identify an appropriate funding source for this cross energy sector project.

Dynamic Design Solutions

2.243 Our current methods of designing the network generally assume that the network will operate in a passive way. The move to smart networks and different operating methods means that the network planning tools will also need to evolve and be developed to exploit the new opportunities created. Our 'Dynamic Design Solutions' project will review and create new design solutions to be included in the standard options available to planners. This project will investigate how the existing planning design tools need to change and implement those changes.

Monitoring Power Quality

2.244 The increased range of power electronics and distributed generation that we will see on our network is likely to have a detrimental effect on power quality. The 'Monitoring Power Quality' project will ensure that we understand the impact and develop techniques to continue to operate the network within power quality requirements.

Templates is a DSR World

2.245 This project will build upon the existing LV Templates work. The project will refine the planning assumptions to accommodate the various combinations of DSR and DSM that we will begin to see on our networks.

Designing Using Smart Metering Data

2.246 Smart meter data will become available from all domestic properties by 2020. We will have already incorporated the full set of smart meter data into our business systems as it becomes available during the smart meter roll out. Through our 'Designing Using Smart Meter Data' project we will investigate how this data can be used to model, design and manage our network more effectively. We already plan to provide a geographically based dataset and this project will help develop the detail of that.

EV as a Storage Medium

2.247 More electric vehicles (EV) are also likely to be used in the latter years of RIIO-ED1. This project will investigate how electric vehicles can be used for energy storage when there is excess generation and used to release the stored energy at times of peak demand to smooth load profiles and potentially defer network reinforcement.

Weather Based DSR

2.248 By the end of the RIIO-ED1 period we expect DSR and DSM to be a key part of our network management processes. With this in place, additional weather data and forecasting tools will allow us to more proactively deploy DSR/DSM to smooth load profiles in response to weather conditions and our 'Weather Based DSR' project will develop appropriate design solutions to a variety of constraints.

Our plans for RIIO-ED2 and beyond

2.249 In recent years we have seen a growth of communication technology, taking communications further than our main substations and onto the local distribution networks. Future improvements to the communications networks will increase bandwidth and reliability enabling greater transfer of data and more dynamic operation of the network.

2.250 By RIIO-ED2 smart meters will have established a new communications link to each customer. Customers will have developed a deeper understanding of their energy consumption and will be more receptive to participating in initiatives that reduce their energy consumption. This will provide future options for more DSR when the volume of LCTs is anticipated to grow further.

2.251 By the end of RIIO-ED2 some of the domestic LCTs installed during RIIO-ED1 will be coming towards the end of their useful lives. Future generations of these technologies will provide additional services for customers and by working with manufacturers we will encourage the development of features that will also enhance our ability to manage the network.

2.252 Whilst no-one can be certain about the way that electricity usage will develop over this long period, we will continue to review our plans with our stakeholders to ensure that we have the best informed view available. Our plans will remain flexible and we will monitor developments and react appropriately to address changing requirements.

Innovation governance arrangements

Innovation governance

2.253 All smart grid innovation projects are delivered as part of the Future Networks Programme. The Programme is the delivery mechanism for the Innovation Strategy detailing ongoing and new projects.

2.254 All business innovation projects are delivered from the area of the business that has the specific expertise to also be able to develop the idea.

2.255 On an individual basis projects are approved in line with our financial approvals process. All projects and works are subject to the same controls and authorisations as other engineering projects in the business. Tier 1 LCNF projects are subject to project level approval by the Future Networks Manager. Projects registered in Tier 2 are subject to project level authorisation by the Chief Executive.

2.256 Project progress is tracked through normal monthly business reporting arrangements. For each LCNF Tier 2 project this includes the preparation of a balanced score card detailing progress against milestones, significant issues and summary financial reporting. All Tier 2 projects have a nominated senior management sponsor and progress review group.

2.257 Projects also undergo regular review by the progress review groups of each Tier 2 project and by the Future Networks Manager for Tier 1 projects. Reviews include an assessment of the risks that exist to the overall success of that project. These risk assessments allow appropriate decisions to be made to mitigate their impact.

2.258 LCNF projects are delivered in line with regulatory governance requirements and regular reports are provided to review the progress of individual projects against their targets. Six-monthly reviews are made publicly available for all our Tier 2 projects.

2.259 IFI projects are delivered in line with the G85/2 ENA standard as required by Ofgem. Projects are reported annually with copies available on WPD, ENA and Ofgem websites.

2.260 During RIIO-ED1, NIA projects will be reported against a new ENA standard and good practice guide as required by the Ofgem governance arrangements. NIC projects will be reported in line with requirements set out in the Ofgem Governance Document. Most of the requirements are similar to those currently required under LCNF.

2.261 Larger projects are managed in accordance with recognised project management methodologies. There is a suite of standard documents and templates which are tailored for the specific requirements of each project.

Research partners and supplier arrangements

2.262 We have links with a wide range of universities, research establishments and manufacturers, both in the UK and across the world (e.g. Hitachi in Japan and the Electric Power Research Institute in the USA).

2.263 We monitor UK and worldwide research to identify concepts and developments that may provide benefits to us in the future. We are active members of CIRED, the forum where the international electricity community meets. In 2011 we helped prepare papers for the annual conference and in 2013 we presented our own topics based on LCNF learning. WPD chairs session 4 (Distributed Energy Resources) of CIRED's technical committee.

2.264 To maximise the effect of research and innovation we actively participate in industry wide forums such as EA Technology's Strategic Technology Program (STP). This program brings together the best industry knowledge in a cost effective way to pool and manage research which is of use to all DNOs.

2.265 Through the ENA, the DNO trade body, we also actively participate in a variety of groups and panels which review and develop industry wide learning. The issues and challenges facing WPD are the same as those for other network operators and we share knowledge wherever possible.

2.266 We proactively support knowledge sharing and the development of best practice guides which can benefit the whole industry. It is important that we learn from others and do not spend time or energy duplicating effort on topics which have been well researched. Benefits for the industry and society can be more effectively applied when the specialist experience gained from running LCNF or IFI projects is shared.

2.267 Staff in our Innovation Team review other LCNF and IFI projects in tandem with their own work to deliver our projects. They become our key contact to other DNO dissemination events and ensure we learn as much as we can from the other projects which are being undertaken. We have allocated one person as the key contact to each other DNO group.

2.268 We support research that is led by suppliers and manufacturers and share our knowledge and experience to help them develop solutions. Providing this support enables us to influence the research so that it provides a benefit to us.

2.269 We work with UK based Small to Medium Enterprises (SMEs), who are playing an increasingly important role in the delivery of new technologies and solutions.

2.270 We also provide feedback on the limitations of existing products so that they can be improved. Partners can also trial products or solutions on our network which generates useful practical experience for the developer and allows WPD to understand how the products can be integrated into existing systems.

2.271 Our academic partners enable us to draw on the specific expertise which they have which enables us to cover a wide range of topics and specialisms with people who have in depth knowledge.

2.272 Some projects include technology which is not from the electricity industry and we work with partners who might not be obvious choices but provide us with the best resource.

2.273 We choose product suppliers using our well established procurement systems. We use the Utilities Vendor Database system, Achilles and have worked with Achilles to develop new product codes to cover elements of network innovation.

Managing risk and future uncertainty

2.274 We identify and control project specific and generic (programme wide) risks. Dedicated project management processes periodically review and control risks for individual projects.

2.275 Generic innovation risks such as the application of new technology to the distribution network are controlled through close liaison with our Policy Team. This means that new technologies either fit into existing policies and standards or the team develop new policies and standards as a part of the innovation process. The diligence of setting policies at this stage also ensures the long term operation of new technologies by ensuring that new innovations are ready for business as usual deployment at an early stage.

2.276 In some cases the risks are associated with uncertainties such as the take up of LCTs or the Low Carbon Transition. Future uncertainty risk is mitigated by regular review of forecasts and identification of tipping points for wider application or a commitment to higher volumes. An example of a tipping point for transport would be a motor manufacturing devoting a whole factory to the production of electric vehicles.

Tracking benefits

2.277 All smart grid projects are regularly reviewed to ensure the benefits they deliver are in line with those predicted at time of approval. Smaller projects such as those delivered under IFI are reported annually in our innovation report. Larger projects report progress including benefits delivery as part of their regular reporting regime.

2.278 All projects delivering against our key outputs have their benefit measured against those outputs. For example the benefits of further developing ENMAC mobile will be measured against the output headings of safety improvements, increased cost efficiency, improved customer service and reliability and also environmental improvements. Benefits tracking is carried out at all stages of the project, from initiation to completion.

Keeping the strategy up to date

2.279 Our innovation plan is subject to review to ensure that it continues to provide solutions in line with business requirements. We review our plans with our stakeholders to ensure that we allow them to challenge our proposals and shape what we do. Our plans will remain flexible so that we are able to address changing demands.

2.280 External factors will influence our plan and feature as part of the review process. We will take account of results from our trials and other DNO projects. Manufacturers will often develop products through DNO trials and we will assess their suitability for adoption as part of our review process.

2.281 Our review will also take into account existing Government incentives and potential changes which may impact on customer behaviour.

2.282 The Innovation Strategy is approved annually by the Chief Executive.

Innovation rollout and knowledge dissemination

Rolling out the learning from innovation projects

2.283 We deliver innovation through an in-sourced model with a small team of specialists using the resources of our operational teams to deliver tools or products onto the network. The Innovation Team is part of the company's Policy department where they interact with equipment specifiers and technical experts of the wider business. Once trials are successfully completed, the outputs are taken forward and replicated across our network.

2.284 As outputs are delivered, they are developed into new learning that can be taken forward and developed as business as usual. Outputs obtained from other DNO projects are fed into this process to ensure that we gain maximum benefit from LCNF projects.

2.285 All solutions rolled out from innovation follow the same route as our other policies and techniques introduced into the company. Policies are reviewed by the senior network managers before they are introduced. The rollout process includes implementation plans and, where appropriate, training and dissemination sessions.

2.286 We monitor all the LCNF projects as they develop and make use of learning and outcomes as they are reported. An example of learning that we have used can be seen in our Tier 1 Community Energy Action project where we are using smart commercial agreements from UKPN's Flexible Plug and Play project rather than developing our own agreements.

2.287 Our RPZ1 project has developed a practical application for Dynamic Line Ratings (DLR) on our 132kV overhead lines. The project results have been embedded into business as usual and are documented in a dynamic line rating policy. On the circuit where the dynamic solution was developed, we have identified 19MVA of capacity that can be offered using DLR. This is a 20% increase on the static capacity values. Similar values will be achieved on circuits which are operated in a dynamic way.

Knowledge sharing and dissemination

2.288 A key feature of the LCNF is the requirement for us, in common with all other DNOs, to share our learning on our projects.

2.289 The main annual event for knowledge sharing is the LCNF conference which we actively support, and which we hosted in 2012. We also host specific knowledge dissemination events for individual projects and for our whole portfolio of projects. The audiences for these events are always very broad and include academics, DNOs, Government departments, suppliers, manufacturers and research organisations.

2.290 Often the most important thing that we can share from our projects is data and results. We have two dedicated websites where interested parties can find out information on our projects. The www.westernpowerinnovation.co.uk site gives details of all our projects and the results they are producing. The www.lowcarbonuk.com site is aimed more at the research community and provides more details of the output data and results.

3 Smart grid strategy

Accommodating load on the network

3.1 A smart grid is an electricity network which uses a range of network management techniques to optimise network capacity in the most efficient way.

3.2 The techniques range in complexity from applying standard assumptions (or templates) through to fully automated active networks which respond to real time measurements. As the network becomes smarter, more of these solutions work together.

3.3 We have five options to choose from when deciding whether we can accommodate more load;

Passive accommodation of load

3.4 For many parts of our network, the existing network will be able to accommodate the new demands on it. Nothing more needs to be done for these areas.

Application of Templates

3.5 For some parts of the network, innovative templates and modelling data will allow us to revisit the traditional design assumptions. Using assessment techniques developed in LCNF projects, it will be possible to re-estimate the loadings on the network and model their effect. This more detailed level of understanding will allow us to accommodate additional demands without the need for physical alterations to the network. In addition, the use of dynamic thermal ratings can add flexibility to our design assumptions.

Monitoring and State Estimation

3.6 When templates are unable to accommodate all of the additional demands we will need to make a more detailed analysis of the network. We can use monitoring equipment to accurately measure the status of the network but will also use state estimation techniques to predict the status based on known measurements.

3.7 State estimation is a system which takes data from a measurement point and uses it to forecast conditions on similar networks or at similar points. In some cases the measurement point is not directly related to the estimated point. On our Lincolnshire Low Carbon Hub project we use wind turbine output as a pseudo measurement of wind speed. Such state estimated values will increasingly be used as pseudo measurement points within our control systems and automation controllers, since they are a cost effective alternative to widespread network monitoring via sensors.

3.8 The FALCON and FlexDGrid projects are developing state estimation tools which will be readily deployable within RIIO-ED1.

Active Network Management (ANM)

3.9 In the areas of the network where we see the highest demands and concentration of Low Carbon Technologies, we are likely to require more dynamic solutions.

3.10 In these areas the constraints are likely to be such that the templates and state estimation would still leave unacceptable risk. These areas will need in depth monitoring and coordination of generator control schemes.

3.11 Through an ANM Connections Tier 1 project we will be rolling out an ANM standard and training planners in how to assess solutions for LCT 'hot-spot' areas. The Lincolnshire Low Carbon Hub project is developing an intelligent and flexible control mechanism on the 33kV network which can be used in areas where constraint management is required. We are also developing demand management approaches to alleviate peaks and smooth load profiles by shifting demand to times of the day when the network has capacity

Reinforcement

3.12 Some areas of the network will be required to operate at levels which exceed the capacity offered by the solutions above. In these areas, conventional reinforcement will still be required.

Smart grid connection agreements

3.13 The alternative solutions described above can be applied to customer connections as well as general network reinforcement planning. Customers applying for load or DG connections will either be accommodated, offered an unconstrained reinforcement solution or offered a smart alternative solution in line with the following:

- **Passive –** If a connection can be accommodated without any further network reinforcement then this will be offered to customers in line with current processes.
- **Templates** – If a connection can be accommodated but it requires to be constrained to be able to operate within the parameters defined in the local network template design, then a variable capacity offer will be made. We will require the customer to implement an automated solution to ensure their connection does not affect other customers. In many cases this may be a simple timer based device. WPD will reserve the right to audit a customer installation, but compliance monitoring will largely be done retrospectively using metering data. We are currently negotiating the first such arrangement with a hydro generator based in the South West.
- **Monitoring & state estimation** – Network reinforcement is triggered by a forecast breach in a network constraint. This forecasting is generally done on a "worst case" basis. For this category of connection a customer will be made an offer on the basis of replacing the forecast with a physical or state estimated value. In the event the revised constraint is (or forecast to be) breached then the customer will automatically be limited to a lower capacity threshold. We are currently discussing such a solution with a wind generation customer in the East Midlands.
- **Active Network Management** – The most complex systems will be used mainly with larger new connections, and primarily for generation. Customer control equipment will be integrated into the WPD ANM solutions allowing full dynamic control of network, generation and demand. We are making use of learning from the SSE Orkney Smart Grid project to develop our own ANM solutions.
- **Reinforcement** – The customer will always be offered an unconstrained connection in addition to a smarter option (for comparison purposes)

Flexibility – application of different solutions

3.14 Our work with the CSE has allowed us to model the LCT impacts on our network to a more granual level of detail than the Transform model alone. However it is still not certain as to the overall uptake of LCTs.

3.15 For that reason it is essential that our plans remain flexible and we will deploy systems which can be re-used if the network changes. For example, a network which is experiencing load growth may be able to defer conventional reinforcement, such as the replacement of a transformer, by accommodating the load using Templates or Demand Side Management (DSM).

3.16 If the load continues to grow and the transformer is eventually changed, this network will also change from one at the highest level of smart grid intervention back to one which can be managed by template. The DSM systems which have been utilised can be switched off when they are not required. We will ensure that our agreements with customers include notice periods to cancel the agreements.

Templates and modelling

Low Voltage Networks

3.17 Data is being provided from our LV Templates LCNF project which shows us how low voltage networks operate and the effects that low carbon technologies can have on them. We will use this data in our design tools to ensure that the impact of LCTs is not over-stated in planning calculations and maximum use can be made of the available network capacity.

3.18 The collection and analysis of data from the LV Templates project and other monitoring initiatives will become a business as usual function. This will allow us to track changes after the completion of the LCNF project. As more customers adopt Low Carbon Technologies the data will be used to modify and create new templates which can be applied across WPD licence areas and the wider DNO community.

3.19 We will make use of smart meter data from all of our customers to build a detailed understanding of the LV network. The smart meter data will complement the data from the LV Templates project and provide a check that the templates correctly reflect network usage. Our work with the CSE has helped to develop a data mining system to allow us to extract pertinent network information from smart meter data.

3.20 Smart meter data is key for us as it will give us an indication of the status of low voltage feeders without requiring us to add monitoring systems. We can use this data when we make our planning decisions regarding the connection of distributed generation. When this data shows that the network is nearing capacity additional substation monitoring can then be added ensuring the efficient deployment of that equipment and resources.

3.21 At present a lot of network planning data in WPD is provided in a tabular form. Using smart meter data we will develop a diagrammatic representation of the data to allow our planners quicker interpretation of the data. We plan to continue the low voltage network connectivity modelling which was started in DPCR5. This will allow us to reference smart meter data to our network easily and automatically.

3.22 We will establish a ‘Smart Grid Planning Laboratory’ in conjunction with Bath University which will assist us in the research and development of new templates and models.

Higher voltage networks

3.23 We have already implemented learning from the RPZ1 project. This has allowed us to use dynamic thermal ratings on our 132kV overhead lines to allow us to operate the asset more flexibly.

3.24 Data from the Lincolnshire Low Carbon Hub project will show that we can extend dynamic thermal ratings onto our 33kV overhead network.

3.25 In both of these projects, multiple weather stations are used to collate data that can be correlated with load. As our knowledge of weather effects increases, we will reduce the number of weather stations we use on each project and develop weather templates.

3.26 FALCON is implementing a full nodal power flow model for the 11kV system across Milton Keynes. The project system (called the "SIM") will benefit strategic planners making long term investment decisions and 11kV planners carrying out more day to day and near term studies.

Network automation

3.27 Our LCNF projects include the investigation of network reconfiguration or meshing networks by operating adjacent networks in parallel. Meshing networks allows us to make use of capacity where adjacent networks have load profiles which are different and load can therefore be shared. The automated switching required to mesh networks is provided using the standard automation devices installed on our switchgear. Control of meshed systems is provided through our NMS using either automated algorithms or manual switching in response to trigger points.

3.28 We manage the network to provide supplies within the statutory limits for voltage and quality. Active voltage monitoring schemes can be used to allow generation to run when the voltage conditions allow it, or suppress the generation when voltages would exceed limits. Subject to commercial agreements with customers many forms of generation can also be used to control system voltage. In particular wind turbines and invertor fed PV are ideal sources of voltage control ancillary service. We are testing these arrangements as part of the Lincolnshire Low Carbon Hub project. We can also use static compensators (STATCOMs) to deal with situations where the reactive elements of the supply are approaching statutory limits, allowing generation to be online for longer. Our LCNF Tier 1 project with Hitachi is testing these solutions.

3.29 Demand Side Management and Demand Side Response will also be used to actively manage our network. The amount of response that can be provided varies for different groups of customers. Domestic customers are likely to provide scheduled demand shifting. Commercial customers will provide demand shifting but are also likely to provide targeted demand response, both at times of high load and when the network is being operated abnormally as a result of network fault.

Demand side management (DSM) and demand side response (DSR)

3.30 DSM is the generic term associated with energy management activity that customers connected to the distribution network can undertake. In Industrial and Commercial (I&C) organisations DSM measures include savings made as a result of improvements in the energy efficiency of processes, but can also include predetermined time of use tariffs that influence usage patterns and the scheduling of processes. In domestic households energy efficient appliances will reduce demand but time of use tariffs are likely to provide the bulk of DSM.

3.31 DSR is a term used for agreements designed to encourage customers to make short-term reductions in energy demand triggered by an instruction from a DNO. This could include I&C organisations turning off or deferring consumption for a period of time. Alternatively, they could start up on site generation to displace load and potentially export power back to the network. In domestic households DSR may become more prevalent as smart appliances that communicate with the smart meter are developed.

3.32 We will engage with domestic and I&C customers to test different commercial arrangements, determine the scope of terms and conditions and understand the practical implications of applying DSM and DSR. Different approaches will be required for domestic and business customers.

Domestic customers

3.33 Our experience suggests that domestic customers are more likely to engage with a supplier than a DNO. We will make use of suppliers or third parties to manage DSM at a domestic level. Working with the Energy Saving Trust (EST) we are already trialing a system of domestic demand side management which uses plug-in controllers connected to the customer's broadband router which receives the demand control signals. The EST are communicating with customers, arranging supply of the equipment, operating a helpdesk and delivering the demand response signals to the equipment. The trial will show how effective domestic DSR is, and what level of customer take up will be achieved.

3.34 Domestic DSM is also being trialed through the BRISTOL project where a battery is used to store energy and defer demand at peak times. In the RIIO-ED1 period we will investigate how this can be achieved through other methods. For example we may be able to use customers' hot water storage to defer demand by storing energy in hot water systems. As more electric vehicles are used, the batteries could also be used for DSM by charging when there is spare capacity in the network and using the batteries to provide energy to the network when demand is high.

3.35 For large scale domestic DSM to work effectively for a DNO, we will need a standard set of terms and conditions with suppliers, so that a customer's choice of supplier does not hinder the use of DSM.

Business customers

3.36 I&C customers are more likely to interact with their DNO. This has been evident on the FALCON project where we have found that they are willing to engage directly with us. These customers often already operate in the Short Term Operating Reserve (STOR) markets and are informed on the opportunities that DSR can bring them. In the FALCON project we will contract over 9MW of demand reduction to support capacity on our network.

3.37 Our requirement to call on these customers is less frequent than National Grid, as presently we only plan to call against two specific scenarios;

- "Pre-fault" scenarios are where the demand is growing to a level where there is potential for the network to trip;
- "Post-fault" scenarios are where the network is abnormal as a result of a fault and the demand needs to be reduced.

3.38 As these customers operate in STOR, they are already contracted to National Grid to provide a response which may conflict with the response we require. We are working with National Grid to amend their standard terms and conditions to allow customers to operate in both markets. We have set up the DSR Forum, where DNOs, Ofgem and National Grid are represented, to discuss this in more detail.

Demand Side Response requests

3.39 DSR is managed in two ways, depending on the requirement of the network.

3.40 For pre-fault scenarios we can schedule the response that we require. We will use load profiles to establish the time that DSR is required and request this in advance from participants. For I&C customers this will be done with a rolling two week notice period. Domestic customers will be scheduled in advance as part of predetermined time of use tariffs.

3.41 For post-fault scenarios the response will be called for directly from our Control Room. Requests will be made to targeted customers that have agreed to short term demand reductions.

3.42 We are at the early stages of DSR so we will initially develop standalone systems to manage requests that we make. For most pre-fault scenarios the requirement will be fulfilled with schedules and tariffs, needing no real time intervention. For post-fault scenarios we will begin with telephone requests and as we make more use of DSR will invest in automated systems. Our long term aim will be to take proven automated systems and merge them into our Network Management System.

Commercial framework for DSR and DSM

3.43 The commercial framework for DSR and DSM varies for different customer groups. We will not be in direct contact with domestic customers as they will generally be communicated with via suppliers or other third parties. It is likely that we will aggregate our requirements and trade with the third parties to achieve the required reductions. In our domestic trial we are offering units as low as 2.5p/kWh for agreed reductions (representing around a quarter of a standard tariff).

3.44 I&C customers are more likely to be directly contracted to WPD. We will set up a team to deal with I&C customers throughout our area. In our I&C trial we are offering a tariff of £300/MWh for reductions.

Agreement periods and terminations

3.45 To provide the security that we require from DSR & DSM systems, we will contract with customers for 12 month periods with the ability by mutual consent to then roll these periods on where there is an ongoing requirement for the service.

3.46 To allow customers the ability to opt out of the system, we will allow 3 month terminations at the end of the initial fixed period. We will make the termination available to either party so that we could also terminate if our network changes and the solution is no longer required in a specific area.

4 Smart meters

Introduction

4.1 The Government has mandated that by 2020 every home in Great Britain will have a smart electricity and gas meter. This vision represents the world's largest mandated dual fuel smart metering programme. The deployment of the meters is due to be undertaken by the electricity suppliers with a mass change programme that is due to commence in the autumn of 2015.

4.2 The majority of meters currently installed in properties require a manual reading to be obtained periodically by the site visit of a meter reader. In addition the existing meters have no capability to provide anything other than a total energy consumed reading. For that reason it is only ever possible to determine an average consumption over the time period between meter readings.

4.3 The new smart meters will have a whole host of additional functionality. As well as being capable of being read remotely via an independent communications path they are specified to be able to record the energy consumed for each 30 minute period and to store this data until it is periodically downloaded by a new organisation called the Data and Communications Company (DCC).

4.4 This 'time of actual use' data provides much better information with respect to the actual consumption behavior of each customer. This opens up many opportunities for Suppliers to provide new and innovative time of day tariffs for customers. Ultimately customers should be able to take advantage of cheaper electricity at times of the day where supply is high and demand is low.

4.5 This ability to provide this accurate 'time of actual use' consumption data also provides the mechanism for a number of benefits to be derived for DNOs.

4.6 The installation of smart meters allows WPD to gain much greater visibility of the operational state of the low voltage (LV) network compared to our current limited view. The LV system was designed to work passively with a level of spare capacity and inherent robustness. Our network planning is undertaken using established traditional operational assumptions.

4.7 However these assumptions are now being challenged with the introduction of low carbon technologies such as heat pumps and electric vehicles. These technologies have the potential to significantly increase the loading on parts of the LV network. In addition greater amounts of distributed generation need voltage regulation and management of two way power flows.

4.8 By taking information aggregated at the LV feeder level we are able to see actual LV network demands over each half hour. These can be used to make informed decisions as to the availability of capacity and the ability to connect new load or generation.

4.9 The additional functionality and information available from smart metering therefore represents a significant opportunity to deal with these challenges. We will be able to make use of the monitoring functionality embedded in each meter to increase understanding of the network and improve our service to customers in existing activities, while looking to more effectively facilitate the low carbon transition.

4.10 This opportunity however comes with its own set of challenges. In order to meet the mass rollout requirements within the agreed timescales (2015-2020) the Suppliers need to undertake an accelerated meter installation programme. This is approximately four times quicker than the current meter replacement and recertification program. In turn this is likely to result in an increase in associated WPD visits to properties in order to deal with issues associated with our equipment at customers' premises.

4.11 To ensure the data from smart meters can be used effectively, additional IT systems will be required. These will include systems to interface with new and amended industry processes,

along with connectivity models and data storage to allow network data to be collated and evaluated. Further costs will also be incurred through a mix of fixed and variable charges associated with provision of data via the DCC.

Benefits for WPD

4.12 For WPD, the Smart Meter programme has the potential to provide data to enhance existing core business activities such as fault management, network planning and asset management. There are also potential benefits which can lead to future applications that will help the deployment of low carbon technologies and move to actively managed networks. With many of these applications, the benefits increase as the density of smart meters on the system increases.

4.13 To take full advantage of the benefits we will need to ensure that we have established compliant interfaces with the DCC, established data storage systems and have created detailed network modelling tools with full LV connectivity.

Fault Management

4.14 Smart metering will provide a number of functions to support fault restoration and reporting activities. When there is a power cut, 'last gasp' functionality will trigger a message to notify a loss of supply. This will provide a level of visibility down to the individual premise that has not been available before.

4.15 Additional functionality will allow the 'energisation status' of meters to be checked remotely, gaining a clearer understanding of which customers are off supply and allowing us to determine what kind of fault has occurred (blown fuse, open circuit fault, single premise). This will help ensure that we dispatch the correct restoration response first time and improve our restoration times. In the case of a call regarding a 'single premise' it will also help to remotely identify if the issue is on the network or on the customer's own equipment.

4.16 On completion of the fault it will be possible to check that all supplies have been restored. This is particularly useful in storm scenarios where faults at High Voltage (HV) can mask additional issues at Low Voltage (LV). The ability to check will reduce the possibility of teams leaving the area whilst customers are still off supply.

4.17 The smart meters will record interruption and restoration times which could lead to automation of fault reporting. They will also allow additional visibility of short interruptions, power cuts lasting less than 3 minutes, to indicate developing issues on overhead networks, such as intermittent faults due to tree contact.

4.18 Fault management applications will become more effective over time as the density of installed smart meters increases and more information becomes available to provide a comprehensive view of the network.

Network Planning

4.19 Existing network planning assumptions are already becoming challenged due to the volume and type of distributed generation on the LV network.

4.20 At present the majority of load data is derived from measurements at source 11kV circuit breakers at primary substations. At LV, maximum demand indicators provide a limited view of loads at distribution substations but no load duration is collected. Smart meter data can provide increased visibility on aspects of network activity that inform load-related investment decisions. Data on half-hourly power flows (real, reactive, import, export) and maximum demand (both for

individual meters and aggregated for network sections) allow us to determine load profiles, which can be used to:

- check that loading is within operational and thermal capacities of network components;
- determine thermal capacity headroom to gauge the scope for accommodating additional (LCT) loads;
- inform the prioritisation of load-related network investments;
- avoid unnecessary reinforcements or network issues from demand over or underestimation;
- identify reverse power flows, which might require us to take measures;
- Identify where power factor correction is necessary or can act as an alternative to network reinforcement;

4.21 The data collected will provide a more comprehensive understanding of where there are issues on the network and where there is adequate capacity to accommodate additional connections or more LCTs without the need for network reinforcement.

Connections

4.22 As with load related network investment, increased visibility of voltage levels and power flows can help reduce the time to connect new loads and generation. It can also provide benefits to new connectees via lower connection charges and the ability to assess options for the use of smart solutions to reduce or avoid upstream reinforcement.

Asset Management

4.23 A wide range of data will be available from smart meters to support asset management activity. Each meter will be able to act as a voltage monitoring point and be capable of issuing alarms relating to voltage anomalies (under voltage, over voltage).

4.24 Aggregated load data will create a more detailed profile of the loads experienced at points on the network. This can support the identification of overloaded sections of network and aid in the prioritisation of network reinforcement where load issues have been identified.

4.25 Aggregated load data can also ensure that network reinforcement is avoided where it is not necessary. For example maximum demand indicators may suggest that a substation is overloaded based on a momentary high load whereas aggregated metering data may demonstrate that this this was of very short duration and in line with design parameters requiring no intervention.

Future Applications

4.26 It is recognised that electrification of heating and transportation, along with the adoption of distributed generation will present a number of challenges to the operation of the LV network.

4.27 Smart metering functionality has the potential to support future network operations through a number of applications. Increased amounts of data will help to identify where issues are appearing on the LV and 11kV system. Applications will be developed to support load shifting, scheduling using variable tariffs and other demand side management techniques. This will lead to a more active network management approach compared with the passive 'fit and forget' approach historically used by the industry.

4.28 It should be noted that functionality for load control does exist within the smart metering specification however this is currently unavailable to the DNOs due to security restrictions and access to critical commands.

4.29 Network losses are particularly difficult to identify and measure in part due to the current lack of visibility of the LV network. Two main types of losses are encountered;

- non-technical losses - smart metering data will help in the identification of non-technical losses as part of ongoing revenue protection activity where electricity is being extracted illegally.

- technical losses - as the volume of smart meters installed becomes significant the load profile and voltage data will be used to help model the LV network more accurately allowing an improved estimation of the technical system losses throughout the network. This can be used to support investment decisions to improve the efficiency of the system by installing assets that provide for lower losses.

4.30 We have used socio-economic information to predict where LCTs may connect and have then analysed the consequential impact on the network. During RIIO-ED1 we will use data from smart meters to build up a better view of areas that become LCT 'hotspots' i.e. those areas with a high probability of requiring additional capacity in the near future.

4.31 We will integrate knowledge of LCT hotspots into WPD network planning tools to ensure that the information is readily available for team planners dealing with customer load or generation enquiries or where developing routine asset replacement projects. This will ensure that planners are presented with timely information about hot-spots rather than having to access and interrogate separate data systems.

Quantification of benefits

4.32 The benefits from smart metering can broadly be split into two categories; existing business functions and future applications. From an existing business function perspective there are a number of benefits relating to outage management and capital investment. Future applications include functions relating to active network management and demand response.

4.33 In March 2012 the Energy Network Association (ENA) produced a smart metering benefits paper that outlined the DNO benefits associated with the smart meter roll-out programme. This has been revised by the industry and a summary report was published in June 2013. It details the expected benefits available based on the latest smart meter specification and the functionality available to DNOs. This also reflects the changes in availability of direct load control to DNOs that has been removed as part of the smart metering security review.

4.34 In summary, it is expected that over RIIO-ED1 the total gross benefit that WPD would expect to see from smart metering would be in the region of £9m to £12m, with £7.5m relating to benefits associated with applying smart metering to existing business functions.

Smart metering benefits for business as usual activities (£m)								
	15/16	16/17	17/18	18/19	19/20	20/21	21/22	22/23
Efficiency saving on load-related reinforcement	0.00	0.00	0.00	0.00	0.00	0.43	0.70	0.85
Efficiency saving on connections-related reinforcement	0.00	0.00	0.00	0.00	0.00	0.50	0.80	0.98
Savings from last gasp functionality	0.00	0.00	0.08	0.23	0.38	0.60	0.75	0.75
Savings from restoration confirmation	0.00	0.00	0.01	0.04	0.06	0.09	0.11	0.11
Total per annum	**0.00**	**0.00**	**0.09**	**0.26**	**0.43**	**1.62**	**2.36**	**2.69**

Smart metering benefits for demand side response and active network management (£m)								
	15/16	16/17	17/18	18/19	19/20	20/21	21/22	22/23
Total per annum	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.5-1.5**	**0.5-1.5**	**0.5-1.5**

4.35 A number of different techniques have been used to establish the scale of smart metering benefits, including the use of engineering assumptions and scenario analysis with the Transform model.

4.36 Smart metering data can greatly increase the visibility of the network, and in particular inform decision making processes related to load and connections related reinforcement. WPD will have access to half-hourly power flows (including real, reactive, import, export) along with detailed voltage data. This data can be used to check asset loading, thermal capabilities and voltage performance. Informed decisions can then be made as to the headroom for additional loads such as low carbon technologies and to set priorities for targeted network reinforcement. Such processes should also help avoid unnecessary reinforcement due to demand over or underestimation.

4.37 It has been assumed that improved knowledge will lead to an eventual 5% reduction in load and connection related reinforcement as the population of smart meters increases. This is based on current levels of activity and does not take into consideration the introduction of LCTs. Modelling the network with smart metering data improves with an increased density of meters, hence an increasing benefit as the programme completes.

4.38 The assessment of benefits associated with power management has focused on last gasp and restoration confirmation functionality. It has been estimated that last gasp functionality could reduce the duration of LV outages by 5% due to having a clearer picture of the fault at the time of dispatch. This has then been applied to the underlying value of a CML of £0.17 based on Ofgem's 'Willingness to Pay' valuation.

4.39 'Pinging' meters (sending a signal to the meter) on completion of fault restoration activities will ensure that no customers are inadvertently left off supply when teams leave site. The estimation of benefits has been calculated based on reducing the amount of GSOP payments due to improved energisation status information for customers.

4.40 The future network benefits associated with DSR and Active Network Management (ANM) have been developed by using the Transform model. A number of scenarios have been run by EA Technology as part of this work looking at a range of electric heating and transportation cases. A number of network techniques were then applied that relied on the smart metering data to instigate such as network reconfiguration and voltage regulation.

4.41 It should be noted that the values from this work are significantly less than the initial estimates produced by Imperial College in 2010. This is primarily down to the scaling back of LCT deployment rates and the removal of direct DNO control over loads from the smart metering programme. Whilst it is envisaged that load control signals could be produced by DNOs, the current market model would require messages to be passed through electricity suppliers. It is currently unclear as to how this would work in practice.

4.42 The benefits associated with DSR and ANM is intended to show the range of savings possible. There is some uncertainty around the scale of these benefits due to the uncertainty associated with the deployment of low carbon technologies and the consequent need for innovative network solutions.

Cost benefit analysis

4.43 Using the benefit analysis work undertaken by the ENA, a number of WPD specific scenarios have been established to complete cost benefit analysis for the smart metering programme. There are number of cost items that will be incurred as part of the smart metering rollout programme. In some circumstances these will be required to facilitate industry process and support the programme such as IT development and service position defect rectification.

4.44 The smart metering cost benefit analysis has been completed based on the costs related to receipt of data through the DCC. This approach has been adopted because WPD has some choice as to the level of data to be purchased and therefore costs.

4.45 The DCC costs can be broadly split into two categories, fixed costs and variable costs. The fixed costs are directly related to the establishment and running costs of the DCC and the infrastructure required for the communications. The variable costs are also included and relate to the amount of data that is purchased.

4.46 Three data cases have been considered for the cost benefit analysis:

- Base Case – Fixed data costs only and receipt of no data;
- Option 1 - Optimal Data Collection;
- Option 2 - Real Time Data Position.

4.47 The base case scenario is based on WPD satisfying industry requirements and gathering no further data to support network operations.

4.48 Option 1 represents an optimal level of smart metering data collection to support network planning and operations. This case has been created using data forecasting work that represents our best estimate as to data requirements and has previously been submitted to DECC to support the DCC procurement process. The requested data includes scheduled half hourly load profiles, and voltage data. It includes a small percentage of half hourly load profiles being returned in near real time. With this data set it is envisaged that WPD could achieve all of the forecast benefits including enhanced network planning, outage management and some level of active network management.

4.49 Option 2 is based on Option 1, but with an increased proportion in near real time data collection for half hourly load profile data. This scenario has been developed to represent enhanced active network management techniques and would be supported by voltage and load profile data being returned for 0.5% of our customer base in near real time. This would then allow operational decisions to be made on the network based on this data either through a control center or with system automation.

4.50 Individual cost benefit analyses have been undertaken for each of WPD's 4 licence areas. The table below shows the summary net present value (NPV) of Option 1 and Option 2 for the whole company.

Cost benefit analysis	Option 1	Option 2
Term (years from first out flow)	NPV (£m)	NPV (£m)
16	£8.62	£1.82
24	£16.47	£4.78
32	£25.16	£8.55
45	£38.97	£14.93

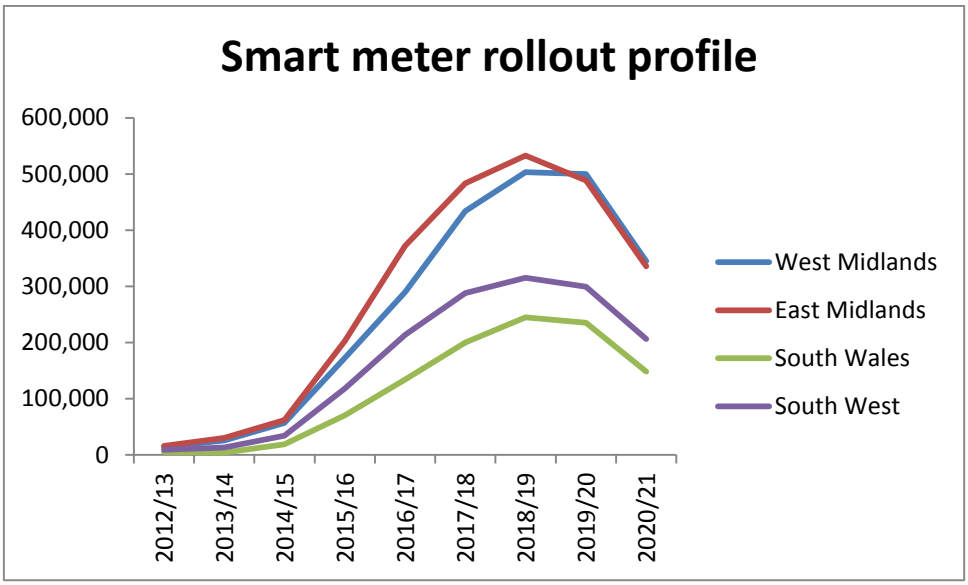
4.51 While Option2 delivers a positive NPV, this shows that Option 1 delivers a higher level of benefit over both medium and long term periods.

Service defect rectification

4.52 The installation programme for smart meters is being controlled by suppliers in liaison with their meter installers. Whilst in the majority of cases the meter operators will be able to proceed with the meter change, there will be situations where DNOs will need to carry out remedial work to service equipment to allow the installation of the smart meter.

4.53 At present, WPD already attends a number of premises in response to meter exchanges. This activity can be in response to a range of situations, including damaged or faulty cut-outs, damaged cut out boards or other defects relating to the service termination.

4.54 The graph below outlines the latest information available of the predicted rollout profile of smart meters across the four WPD licence areas. At its peak, this represents over 4 times the existing level of activity normally associated with the meter exchange programme.



4.55 At the peak of the rollout (in 2018/19), it is anticipated that over 1.6m meters per annum will be installed across the WPD licence areas.

4.56 The actual number of defects is unknown, but for the purposes of forecasting work volumes and resource requirements it has been assumed that remedial work will be required for 2% of smart meter installations. Over the roll out programme this equates to 148,000 service issues in total. It is calculated that 4,500 of these would have been identified ordinarily as 'business as usual' over the period and so there will be an additional 143,500 issues to resolve. The rectification costs are shown in the table below.

Smart meter related cut-out change expenditure in RIIO-ED1 (£m)					
	West Midlands	East Midlands	South Wales	South West	WPD Total
Cut-out changes	**8.4**	**9.1**	**3.9**	**5.4**	**26.8**

4.57 These costs will cover normal in-hours work where WPD attends site to rectify a defect. Any additional costs incurred out of hours or for wasted visits will be recovered directly from suppliers.

4.58 WPD systems have already been updated to cater for the anticipated workload and data flow requirements. This has included the functionality to receive new industry data flows including the information as to the type and classification of the faults. However processes to report on actual service levels and to charge suppliers for out of hours and abortive calls will need to be developed based on the outcome of on-going industry discussions.

4.59 A better indication of the likely volumes of defects will be derived during 2014/15. We will analyse the smart meter related work within the foundation phase to identify the actual percentage of meter operator visits where subsequent DNO visits are required. This will be possible by analysing new industry information as to the volumes of smart meters currently being installed that became available during 2014.

Installation visit - resource management

4.60 In order to support the additional site visits required within the accelerated roll out period approximately 60 FTE staff will be required to be assigned specifically to the smart meter programme.

Work-flow management

4.61 In order to process all installation defect requests in a timely way additional activity will be required to manage requests and programme work. This falls into two major areas of responsibility:

- Call centre indirect activity. An additional three staff at each of WPDs two call centres. Total cost of £200k per year
- Work scheduling indirect activity. Nil cost. The current assumption is that this activity would be absorbed by existing team support staff.

Establishing a cut out survey

4.62 As smart meters are installed in domestic and small commercial properties, we have an opportunity to gain information about the service position and cutout in the customer's premises. To install a meter the incoming service will be made dead by removing the cutout fuse. By working with the Suppliers we can make use of this visit and supply interruption to greatly improve the quality of our data on cut out population.

4.63 We will establish agreements with suppliers to capture information about the cut-out, its condition and location at the time when a meter is changed. This will help to influence condition based decisions.

4.64 We will establish a record of this data in our asset register and will supplement it with data provided when new cutouts are installed and when cutouts are visited as a part of our works. Our register will include details of cutout type, fuse size, age, service type and earthing.

4.65 We can start to establish the cutout condition using condition assessment points related to the fuse and the fuse holder. Working with EA Technology and the ENA we will establish a condition based replacement regime for cutouts which takes into account age, type and environment.

DCC charging arrangements

4.66 A new regulated organisation called the Data and Communications Company (DCC) will manage the systems for communications between the meters and users of smart meter services.

4.67 In order to fund and support the operation of the national smart meter infrastructure the DCC will levy charges for use of their network. These charges will cover the full end to end process covering the costs of three discrete elements:

- the communication network from the smart meters to the DCC - provided by the Communication Service Provider (CSP);
- internal DCC processing provided by the Data Service Provider (DSP);
- the communication network from the DCC to user's processing centres.

4.68 It should be noted that there is uncertainty about the level of charges since the DCC, DSP and CSP have not yet been appointed.

4.69 However DECC has produced indicative figures that have allowed an initial assessment of the fixed and variable cost elements of the smart metering communications charges. It is anticipated that these costs will be confirmed following the award of contracts for the different roles in August 2013.

Fixed costs

4.70 Following the award of the contract in August 2013 the DCC licensed entity will recover its own costs and governance costs via a fixed charge per meter. This will be levied at a rate of £0.02 per meter for all domestic premises irrespective of whether a smart meter is fitted.

4.71 From July 2015 the DSP and CSP can also begin to recover costs. The level of costs for these services is currently unclear but DECC has indicated the charges could rise to about £0.20 per meter.

4.72 During RIIO-ED1 Ofgem has determined that DNOs can pass through DCC fixed costs up to the end of 2019/20. This time period should be extended by Ofgem to reflect the one-year delay to the programme announced by DECC. At present we are unclear as to the level of the DCC fixed costs but fully expect, based on the indications from DECC, that these costs will be £0.20 per MPAN. It is currently assumed that the fixed charge element will encompass all the DCC licenced entity charges and smart meter alert notifications.

Variable costs

4.73 Through the ENA, a number of 'use' cases have been developed and used to generate a set of business process flows – currently defined within the DECC "Networks Framework Document" (NFD). This document lists the service request and a description of the service plus information on the typical volume of flows and usage over time.

4.74 In order to establish the potential volumes and costs incurred by the variable cost elements a review of the data flows was completed based on the NFD. Each flow was allocated to the appropriate WPD business processes and, from this, volumes and frequencies estimated. Indicative costs for small and medium message types have been supplied by DECC at 0.2p and 0.8p per message respectively.

4.75 Ofgem proposes that none of these variable data costs will be funded, stating that they should be covered by the benefits gained in network management.

4.76 The following table summarises the DCC related costs:

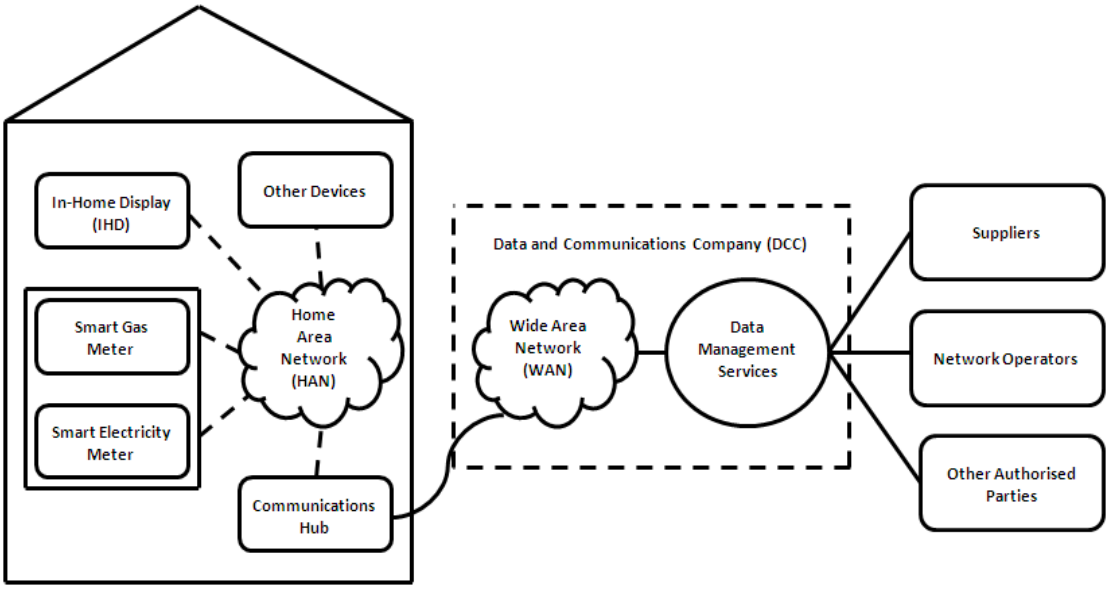
Smart meter related DCC expenditure in RIIO-ED1 (£m)					
	West Midlands	East Midlands	South Wales	South West	WPD Total
DCC licence fee	**2.4**	**2.4**	**1.2**	**2.0**	**8.0**
DCC fixed transaction costs	**5.4**	**5.7**	**2.6**	**3.9**	**17.6**
DCC variable costs	**1.0**	**1.1**	**0.5**	**0.6**	**3.2**

Development of WPD systems

4.77 In order to benefit from the services to be provided by smart meters the users, such as DNOs, will need to communicate to and receive updates from the meters on a regular basis.

4.78 The ownership and management of the communications to and from the meters to the various users of smart meter services will be managed via the DCC. The DCC will be responsible for all end to end communications from the meters at customer properties to the user's processing centres.

4.79 The diagram below provides a simple high level overview of the DCC communication environment and shows that users such as WPD access smart meter information via a link to the DCC.



Source DECC First annual progress report on the roll-out of smart meters (December 2012)

4.80 The DCC will provide a common framework through which users are able to communicate to smart meters. Users can include Suppliers, DNOs or other authorised parties. Each user group has a unique set of requirements that will need to be satisfied by the DCC.

4.81 WPD has been active in working groups that have been establishing the overall smart meter development programme. We have input into the smart metering specification, the user service catalogue which defines the flows to/from the smart meter and the Network Framework data volume assessment which defines, for each flow available to WPD, the potential volume and frequency of use. This has enabled us to start to develop the specification for data and IT systems requirements for smart metering.

Business processes and data flows

4.82 The scope of smart meter process and systems development work in WPD has been divided into the following key areas:

- business processes;
- alerts;
- common processes;
- legacy system changes;
- licence changes;
- industry testing.

4.83 From a business process perspective all smart meter flows available to DNOs have been reviewed and assigned to either amended or new WPD systems. We will build systems to receive meter installation set-up information, hold standard set up criteria and send appropriate flows to configure meters to meet WPD requirements. The ability to reconfigure meters will also be provided.

4.84 Routines to process meter readings, both scheduled and ad-hoc, will be developed along with data stores to hold this information for analysis purposes. This data will be used for day to day operations and network planning activities. Access to this data will be strictly limited to enquiries which comply with WPD data aggregation rules.

4.85 Ad-hoc enquiries will be made available to review the status of the meter. This will enable real-time checks to be made on energisation status to support off-supply processes and, where appropriate, to subsequently check successful restoration. In addition meter log/site details will be available for review so checks can be made on outage history and installed devices.

4.86 WPD will receive a number of alerts from meters which are generated by events within the meter that are relevant to DNOs. These alerts, such as last gasp (off supply), voltage fluctuations and tamper messages will be routed on a real time basis to allow prompt action to be taken. A final list of alerts and their volumes have yet to be defined so further analysis will be required once this information is available.

4.87 To support flows and alerts a number of common processes including data validation and security management will be required. This may be facilitated though joint development at an industry level and work is currently being undertaken by the ENA in this area. The output will be used to produce a standard set of requirements and used in detailed design discussions with the DSP. Regardless of how this functionality is developed WPD will have to ensure systems are in place and as such provision has been made to resource this work either on an internal or joint-development basis.

4.88 There are a number of existing core industry processes that will require amendment. These include Meter Point Registration Services (MPRS), reporting of meter technical details and receipt of installation information. Changes to cater for the smart meter programme are under development by the industry and will be available to support mass roll out. We will incorporate these changes into our legacy systems which will be updated accordingly. This work will also include the population of the Unique Property Reference Number (UPRN) into Meter Point Administration Service. Ultimately it is intended that MPRS will eventually migrate to the DCC during the later stages of the smart metering programme and a provision for the work to be undertaken to support this move has been included in the Business Plan costs.

4.89 At a licence level, smart metering will have an impact on a number of areas including Ofgem reporting, data aggregation and IIS reporting. Systems will be required to process data received from the additional smart meter data flows. In particular we will develop processes for data aggregation and for making sure that data is anonymous to meet the data privacy requirements as agreed with DECC/Ofgem. This will be in accordance with current best practice work that is being developed by the ENA.

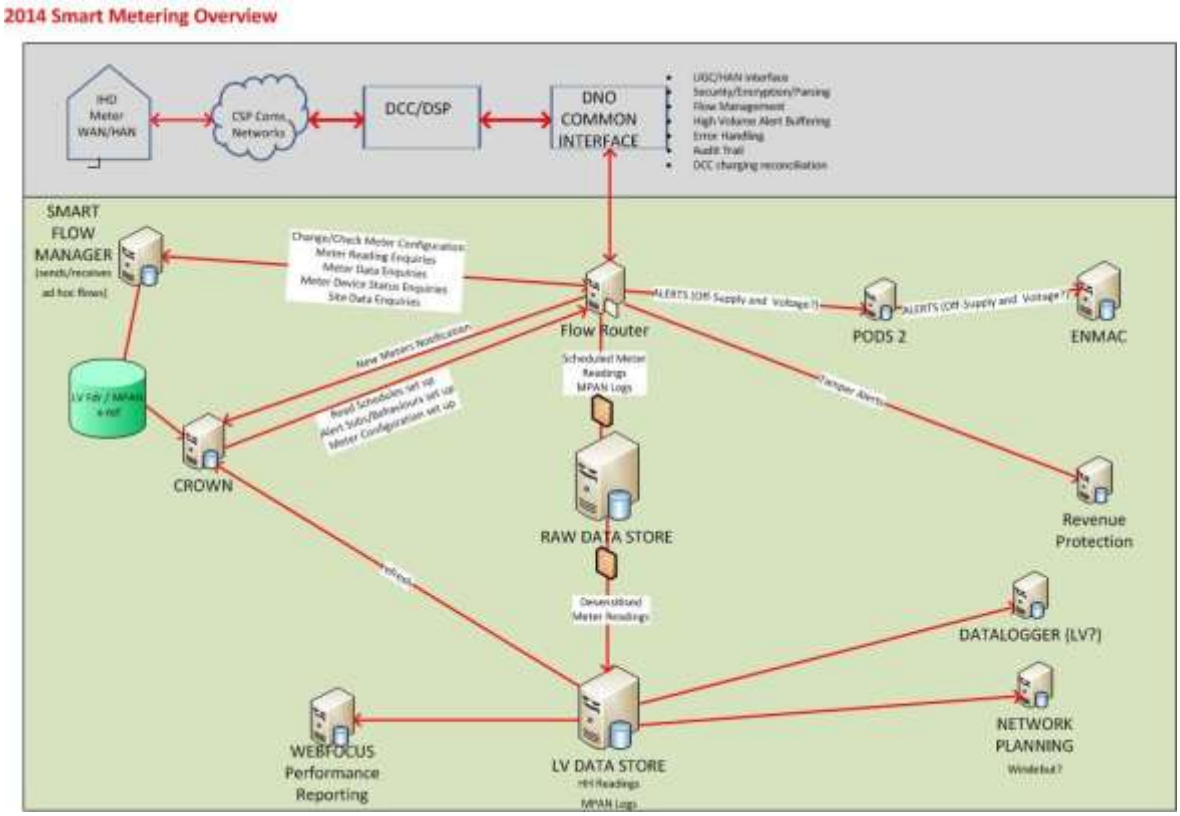
4.90 Before being able to implement the system changes we will have to undertake industry testing to verify that our systems and processes work correctly within the national arrangements. The exact makeup of the qualification and testing requirements necessary to prove this have yet to be defined, however provision for this effort has been made based on experience of previous industry implementations.

IT Environment

4.91 Each of the smart metering requirements have been analysed to estimate IT application and infrastructure costs. This includes costs for:

- servers;
- data storage (phased growth);
- 3rd party software (flow routing and management, reporting analytics);
- software licences (Oracle, Tivoli Storage Manager);
- implementation (consultancy, contractors);
- on-going hardware and software maintenance;
- hardware technology refresh costs .

4.92 The following diagram provides an overview of the current thoughts on the WPD computer environment required to support smart meter processing.



WPD Smart Meter Environment Diagram

4.93 In the diagram the grey area at the top represents the DCC environment and potential common processes with the green section being the WPD internal environment.

4.94 Communication with the DCC will be via a new flow routing system which will link to a communication path provided by the DCC. Details of this link have yet to be agreed however it is assumed that this will be via a standard communications media and as such will not provide any significant technical barriers. In addition resilient disaster recovery measures will be adopted to minimise the impact of any loss of the primary communications link to the DCC.

4.95 The DCC communications link will in turn be plugged in to an internal WPD flow routing system. This is likely to be an upgrade of the current "off the shelf" package employed within WPD. From the WPD flow routing system, smart meter information will be transferred to the systems required to support the new smart meter business processes. These systems can be broken down into three broad categories:

- systems supporting processes to configure, and request information from meters – Smart flow manager, CROWN;
- systems to hold data received from meters for on-going investigation and analysis – Raw Data Store, LV Data Store, Webfocus Performance reporting, Datalogger, Network Planning;
- systems to handle alerts raised by the meter – PODS, ENMAC and Revenue Protection.

4.96 Initial IT systems changes will be made to facilitate and test core industry processes prior to the start of mass rollout in autumn 2015. It is anticipated that initial IT capital costs in DPCR5 will amount to £2.7m with an additional £7.3m in RIIO-ED1.

5 Losses strategy

5.1 The WPD Losses Strategy is now available as a standalone document that can be found using the following hyperlink: http://www.westernpower.co.uk/docs/Innovation-and-Low-Carbon/Losses-Strategy-Final.aspx

5.2 For completeness the contents are reproduced on the following pages. Please be aware that the formats and page numbers may be different when comparing the Business Plan and the standalone Losses Strategy.

Background

What are losses?

5.3 The amount of energy that enters an electricity network is usually greater than the amount that is delivered to customers. The principal reason for this is that an electricity network uses energy in the process of delivering power to customers. This is known as a technical loss.

5.4 Another reason for electricity losses is where there is no meter or supplier at the final connection to record the usage. There are situations where a connection has been made to our system without authority. The energy used in these connections is not metered and does not feature in volumes that suppliers register. As a result it is shown as a loss on our network. This is known as theft in conveyance or illegal abstraction.

5.5 All Distribution Network Operations (DNOs) are obliged to run an efficient and economic system as a condition of their Distribution Licence. Losses are one measure of this efficiency. In addition to the requirements of the Licence, reducing losses is also a key part of the WPD strategy to help us manage our carbon footprint.

Technical losses

5.6 Of the amount lost a fixed amount is lost dependent upon the network itself, irrespective of the usage of the network and then a further amount is lost depending on the level of load on the network. The energy lost as a result of the network and its usage is usually called “technical losses”. This can further be categorised into fixed losses and variable losses. Variable losses will change as load alters on the network and is further impacted by the effect of network imbalance or power factor.

Fixed losses

5.7 The fixed element of losses is made up of the energy which is required when transformers are energised. As transformers require electrically produced magnetic fields to operate the energy used creating these fields is essentially fixed while they are switched on.

Variable losses

5.8 The variable element of losses is created due to the heating effect of energy passing through cables and wires. These conductors all have a small resistance and when currents are passed through they heat up. This heating effect is logarithmic and the effect of high load (when an item of equipment is running near or at full capacity) is very much more significant than in an item which has a low or part load.

5.9 The resistance of a cable reduces as its cross sectional area increases so the effect of losses is reduced in larger cable sizes.

5.10 There is a very similar variable element created through the wires and windings which are found in all transformers.

Imbalance

5.11 A network which is not balanced across all three phases will have higher currents than expected in at least one phase. Due to the logarithmic relationship to variable losses, these higher currents can have a significant effect on losses.

5.12 Imbalance is found on all parts of the network due to customers using one or two phases having different load consumptions. In order to rebalance the network there are physical actions that are required on the network. For example, a rural high voltage overhead network

could be rebalanced relatively simply by moving the overhead service connection to a different phase of the overhead main. This is more difficult on an urban underground low voltage network which requires existing service joints to be excavated and new joints made to move customer supplies to different phases.

Power factor

5.13 Another characteristic which will increase losses by increasing currents on the network is the power factor. Where the power factor is less than unity the current has to increase to deliver the required amount of power. This has historically been an issue for installations used by industrial and commercial customers where most motor loads or power electronic loads were seen. Developments in domestic power electronics and the adoption of heat pumps means we will start to see this issue on our domestic networks.

Theft in conveyance

5.14 The detection of situations where there is no registered supplier at a final connection point or no meter installed is very difficult. Often detection comes as a result of investigations for another reason. In many cases theft in conveyance is connected to other illegal activities, which prompt investigation and detection.

5.15 The normal routine of our visits to premises and the routine of supplier visits to collect meter readings will often expose cases of theft.

Which parts of the network produce the most losses?

5.16 The distribution of electricity at low voltage produces the most losses on our network. The local network supplying electricity to properties and the transformers which support it at 11,000 volts (11kV) account for around 50% of our total losses. The 33,000 volt network (33kV) which sits behind this accounts for another 44% of losses and the higher voltages (EHV) make up the remaining 6% of the total.

The benefits of reducing losses

Societal losses reduction benefits

5.17 Electricity losses for all elements of the electricity network; distribution, generation and transmission, are included in the settlement processes and form part of a customer's electricity bill. Distribution losses currently account for around 7% of an average domestic customer's bill. Therefore any initiatives that are taken to reduce losses will have a positive effect on these bills.

Cost benefit analysis (CBA)

5.18 We have undertaken cost benefit calculations for specific areas of our network. In section 5 we discuss the implementation of specific actions to help reduce losses and these are underpinned by CBA calculations. Our CBAs have been calculated using the Ofgem provided CBA value of losses of £48.42/MWh.

5.19 In general terms we have found that actions to reduce losses do not deliver favourable CBAs when considered in isolation. Actions taken in conjunction with other work tasks on the network do show a benefit. For example, whilst it is not beneficial to actively replace underground cables to reduce losses it can be beneficial to oversize them when they are replaced as a part of other works. To avoid stranded assets we have targeted these uprating actions in areas where there is a likelihood of early adoption of Low Carbon Technologies (LCTs).

5.20 The increasing impact of LCTs such as heat pumps and electric vehicles will affect our low voltage networks. These networks generally operate in a radial fashion and are sized to accommodate the load seen during normal running conditions. In this operational configuration the uprating of assets is beneficial and is unlikely to lead to stranded assets.

5.21 CBAs show this and have produced favourable outcomes for the following areas:

- Uprating existing low voltage underground cables in conjunction with other works
- Uprating existing 11kV/LV ground mounted distribution transformers in conjunction with other works

5.22 CBAs did not produce favourable outcomes for the uprating of pole mounted 11kV/LV transformers due to the relative replacement cost of these units.

5.23 When we consider the uprating of assets on the High voltage (HV) network (11KV and above) we do not see the same conditions of operation or LCT impact. The HV network cables are generally sized to accommodate the load seen during normal running conditions and also support adjacent networks in times of fault. The CBAs for the uprating of HV underground cables do not produce favourable outcomes.

5.24 33kV/11kV Transformers are generally sized and operated in pairs to provide the same level of fault support. With this configuration it is not possible to achieve the same level of benefits by replacing these transformers with uprated units. The CBAs for the uprating of these transformers do not produce favourable outcomes.

5.25 An extrapolation from the HV network can be made onto the EHV and higher voltage networks. In general terms these networks are sized for normal running and fault support and do not operate in a radial fashion. Whilst we have not completed specific CBAs, the costs also outweigh the benefits in following areas:

- Uprating of EHV transformers (33kV and above)
- Uprating of EHV cables (33kV and above)

Understanding losses

Analysis of the Impact of LCTs

5.26 We are working on a major study of network losses which builds on previous research. It will assess the impact of the changing power factor of LCTs on our losses. The outcomes of the project are likely to include the targeted replacement of some assets, the balancing of phases in areas where we see imbalance and the use of power electronics to improve power factor.

Modelling Power Flows and Losses

5.27 'Carbon Tracing' is a project that we are undertaking to model power flows and better understand the effect of different network configurations on losses. Variable losses will increase with the increased demand seen from LCTs and we are using the model to target where losses can be reduced. The Carbon Tracing project also researches the effect of customer engagement and behaviour on reducing losses.

Use of Monitoring and Automation

5.28 Where automation and monitoring is fitted to substations to accommodate the additional loads brought about by LCTs, these new data and control points can also be used to help target our plans for loss reduction.

Stakeholder input and review

Stakeholder engagement

5.29 Losses reduction activities will be reported annually as part of the WPD Stakeholder Report. This will set out improvements achieved in the year; actions planned for the following year and any longer term programmes.

Losses strategy review

5.30 Our losses strategy will be reviewed on an annual basis throughout the RIIO-ED1 period. We expect knowledge to be gained from the range of LCNF projects that will help us to better understand the profile of customers' load and the effect this has on peak demands and peak losses.

Present policy

Equipment selection

5.31 Distribution transformers are a major contributor to the overall level of losses on our network. When we tender for transformers we take into account the lifetime cost of the units. This cost includes the purchase price and the effect of losses during normal operation.

Design

5.32 Our design software takes account of losses when modelling network designs. The majority of losses on the network occur on the low voltage system, and our WinDebut LV design programme automatically designs with reference to losses.

Asset replacement

5.33 Our normal programme of asset replacement has an effect on losses. Changing older transformers for newer models will reduce overall losses as new transformers have lower losses than old ones.

5.34 Where overhead lines are replaced we aim, where possible, to replace small diameter aluminium conductors of smaller sizes first. The replacement conductors have a larger cross sectional area and therefore a lower level of variable losses.

Future changes

Ecodesign

5.35 We are aware that the EU is considering a regulation to implement Directive 2009/125/EC regarding the Ecodesign of electrical equipment and, if introduced, this would lead to an obligation for us to install more efficient transformers. The additional cost of these units is considerable and, at larger distribution substation level, can lead to a doubling of the cost of a transformer. We will continue to monitor changes to obligations, assess their impact on substation design and determine whether there is a cost benefit to adopt them early for loss reduction.

5.36 To comply with the Ecodesign directive manufacturers will have to find ways to reduce the level of losses inherent in their products. To reduce the variable losses in a transformer the resistance of the wires needs to be decreased, which can be done by increasing the cross sectional area of the wires or by using materials with a lower resistance. To reduce the fixed losses the efficiency of the magnetism needs to be improved, which can be done by using materials with better magnetic properties.

5.37 Improving both of these elements can often result in a transformer with a larger physical size. As many of the transformers that we use are installed as replacements for existing units it is not always feasible to make the sizes larger due to the size constraints of existing distribution substations and GRP housings. We have worked with manufacturers to develop more efficient transformers that retain the same footprint and dimensions as existing units.

Smart meter loads

5.38 The smart meter roll out will replace existing passive gas and electricity meters with more dynamic meters that will incorporate a communications device. This additional functionality, combined with domestic customer in-house displays, will increase the network load that is attributable to metering. It is likely that the load will increase by around 2W per customer. Taken across our customer base of 7.8 million customers this will increase the overall load by over 15MW.

Electrification of heating and transport

5.39 The Government Carbon Plan places more emphasis on using electricity to provide energy for heating and transportation. The effect of this is that our network will see a higher utilisation and, as a result, higher levels of losses. The electrical loads due to heat pumps and electric vehicles have the potential to be time managed. We may be able to schedule this demand to help with the control of the total load on our networks and therefore will have the effect of filling in gaps in our load profiles. However such technology will also increase the utilisation of our network and therefore increase losses.

Distributed generation (DG)

5.40 Traditional centralised generation sources are mostly connected to the National Grid network. This requires energy to be transported through both the transmission and distribution networks.

5.41 Distributed Generation sources are often connected directly to distributions networks. Whilst this eliminates transmission losses it can lead to higher losses on the distribution network. This occurs when the generation exceeds local demands and there is a need to move the energy across the distribution network.

5.42 Distributed Generation can create the opportunity to use the generation characteristics to manage losses through load balancing and power factor correction.

Our plans for losses reduction in RIIO-ED1

Improved understanding of losses

5.43 Most of the work undertaken on losses to date has been to better understand network losses rather than the practical options for reducing losses. During the RIIO-ED1 period we will reach a stage where we can apply this knowledge to ways that we can actively reduce losses. In order to see the effect of reducing losses we need to be able to set a baseline of current losses. We plan to do this by using the established highly monitored network in South Wales which supported the Low Carbon Network Fund (LCNF) LV Templates project.

5.44 The LV Templates project provides us with a monitored network covering a wide area of South Wales. It can measure the power supplied into this network at HV and also measure the power delivered from the LV substations. The losses in this section of network will be due to technical losses, as inaccuracies caused by illegal abstraction or meter data issues generally occur at LV. We will investigate ways of extrapolating this data to provide reliable loss baselines for different network types.

Transformer sizes

5.45 The variable losses in a transformer are much lower when the unit is partially loaded and increase greatly as a unit becomes fully loaded. It is therefore possible to reduce the overall losses by oversizing transformers when they are installed. Whilst it is not appropriate to do this in all cases, as not all transformers will become significantly loaded, there is a case for oversizing transformers in a targeted way.

5.46 Using data from the Centre for Sustainable Energy (CSE) we can forecast that there will be approximately 7% of our network where the up-take of LCTs would most likely occur and the investment in oversized transformers can be justified. We would aim to oversize on average 109 transformers per annum at a cost of around £0.11m per annum.

5.47 Older designs of ground mounted transformers have much higher losses than new designs. Whilst it is not efficient to replace transformers early simply to reduce losses, we do ensure that these older transformers are not refurbished for re-use when retired from the system.

5.48 Pole mounted transformers are relatively small size and there is little justification in replacing them to reduce losses.

5.49 We will install larger size transformers on targeted networks in the RIIO-ED1 period. At an additional cost of approximately £0.11m per year.

Cable sizes

5.50 To reduce the variable losses in a cable the cross sectional area of the conductor needs to be increased. Once a cable is laid and the ground is reinstated, it becomes expensive to make alterations to the cable. Our opportunity to reduce losses exists at the time that the cable is initially installed. The resistance of a 185mm² LV cable is around half that of its 95mm² equivalent. The additional cost of the cable is less than £10 per metre which is a marginal cost when compared to the excavation costs that can be between £50 and £100 per metre.

5.51 Whilst this cost is marginal, it is not appropriate to oversize cables in all cases. Using CSE data we would aim to uprate around 75km of network each year.

5.52 We will install the next size up for all our cable designs on targeted networks in the RIIO-ED1 period. This will add around £0.31m per year at current costs.

Network design

5.53 We have completed research into losses with Imperial College and SOHN Associates. The "Management of Losses on a Distribution Network" project will shortly be finalised. The early indications are that we can address losses on new developments by reducing the number of customers per substation and also by increasing the size of the service cables.

5.54 This will increase the total fixed losses by adding more transformers to the network, but this increase is outweighed by the reduction in copper losses achieved with the reduced loads per transformer.

Asset replacement

5.55 The majority of our network is already established and there is no cost benefit in replacing it wholesale purely as a method of reducing losses. When we add new assets to the network or replace existing ones we do have an opportunity to consider the effect of losses and take them into account. Using the Ofgem provided CBA value of losses of £48.42/MWh it is not possible to justify a blanket investment in larger assets to reduce losses alone, but when considered in areas where network demands are expected to increase the proposal has more merit. We have used research from the CSE to show us areas of our network that are highly likely to see an increase in demand as a result of LCTs.

Demand side management (DSM)

5.56 Due to the logarithmic nature of variable losses, assets working at their maximum capacity will lead to significantly more losses than those with a reduced loading. The scale of variable losses can therefore be reduced by simply reducing the demand on the network or by reconfiguring networks to transfer loads from highly loaded circuits to lower loaded circuits.

5.57 In our Lincolnshire Low Carbon Hub, FALCON and FlexDGrid LCNF projects we are demonstrating methods to monitor and automatically reconfigure networks. Where these networks can be meshed (operated in parallel) and loads transferred it will be possible to reduce the overall losses. We will identify areas of our network where the techniques can be replicated.

Imbalance and power factor

5.58 We are developing a project with a solar generation customer that will investigate the feasibility of addressing imbalance and power factor issues on the 33kV network. The project will use the customer's inverter equipment to alter the phase angle of the generated power. It will also use local storage to set the generated power per phase to reduce overall network imbalance. The storage can also be used to manage the overall utilisation of the network.

5.59 The Solar Storage project, which will shortly be registered under LCNF Tier1, will establish how a DNO can interact with a generator to improve overall network losses.

Theft in conveyance

5.60 Theft of electricity from our network adds to the level of recorded losses, but is difficult to detect exactly where it is occurring.

5.61 We are currently working with partners on an IFI project to establish if it is possible to fit monitoring equipment at a substation which can detect the presence of heat lamps used for the cultivation of drugs such as cannabis. The detectors look for the specific electrical harmonic signature created by the heat lamps. If this project is successful we will use it to assist with detection and share the findings with other DNOs.

5.62 The majority of methods available to detect theft in conveyance relied on visits to the premises to establish the theft. It has not been easy to complete a desktop office based survey of our network to establish which properties were connected to the network and had a registered electricity supplier and those which were not.

5.63 We plan to use the "addresspoint" standard which is provided by Ordnance Survey that applies a unique property reference number to all properties on the mapping background. Our records hold a reference for all known connections which include grid reference details. Comparison of these two systems will produce a list of premises which do not have an electricity supply registered to them. By starting from the assumption that most premises in the UK have an electricity supply, we can use this list to establish a subset of premises without a registered supply and which would require a physical inspection. This desktop analysis will make the targeting of potential theft a much more efficient system.

Options for losses reduction beyond RIIO-ED1

Superconductors

5.64 The variable losses in a network are directly related to the resistance of the current carrying conductors. A superconductor has a very low resistance which significantly reduces the losses generated. Most superconductor technology, which is available at present, relies on processes which cool the conductors as a method of reducing their resistance. There are no practical solutions available which can cool conductors in a low voltage distribution setting, but we will continue to monitor developments in this area.

Energy storage

5.65 Our LCNF project, BRISTOL, is showing the benefits of energy storage at a customer's premises. The project was designed to show the benefits of reducing the effect of local distributed generation on the LV network by managing the peaks of generation it creates. A secondary benefit of the energy being stored at the premises is that there are no losses created through the further use of the LV network.

Active network management for losses

5.66 One way to reduce the fixed losses on the network is to switch assets off. An asset on "hot standby" (energised but not actually supplying electricity) will continue to produce fixed losses. Disconnecting duplicate or reserve assets will reduce losses but will also affect supply security and therefore has to be carefully considered before being adopted.

5.67 Developments in network management systems beyond RIIO-ED1, and the increased level of monitoring and control will provide a platform for the reconfiguration of networks to reduce losses without the current concerns over supply security

6 Climate change adaptation

6.1 The Government's Carbon Plan has been developed to reduce greenhouse gas emissions which are believed to contribute to climate change. This proposes the electrification of heating and transport and the move to more distributed electricity generation.

6.2 The growth of these low carbon technologies poses a challenge for the electricity networks to accommodate them without significantly increasing costs to customers. To enable DNOs to develop and trial lower cost solutions Ofgem introduced the Low Carbon Network Fund to stimulate innovation.

6.3 In addition to the innovation being carried out by WPD and other DNOs to develop networks of the future, there is a requirement to ensure that the assets we use are suitable for the conditions that will arise due to climate change. The following sections describe the work WPD has done for climate change adaptation (CCA).

Risk assessment and reporting to DEFRA

6.4 In response to the Department for the Environment, Food and Rural Affairs (DEFRA) direction to report under the Climate Change Act 2008 WPD submitted the 'WPD Climate Change Adaptation' (CCA) report which contains details of WPD's risk management process and describes how this process identifies, assesses and manages the implementation of control measures for climate change adaptation.

6.5 Many risk and mitigation areas are common across the whole electricity industry and we reference the ENA Engineering Report 1 (ERep1) – May 2011, which identifies climate change impacts on electricity distribution and transmission network operators. The ENA report also proposes mechanisms for monitoring and actions to respond to these probable climate change impacts. Our CCA report describes our analysis of the risks associated with future climate change impacts and how we have used available projected climate data to assess these risks. It details how our risk management system leads to control measures being developed and implemented.

6.6 We are supporting research and development project work to gain a better understanding of the impact of climate change on our assets.

6.7 Our strategy for CCA is reviewed annually to take into account any changes and new climate risks. For example, as there has been an increased incidence of surface water flooding we are now working with the ENA and the Environment Agency to assess the risks posed by pluvial flooding.

Extreme weather events

6.8 We have used data from the UK Meteorological Office to assess the impact of severe weather events on our network. Lightning activity is predicted to increase across the WPD area. By the end of the RIIO-ED1 period we expect activity to increase by up to 11% in the South West and East Midland areas.

6.9 Lightning strikes can damage equipment, but the effects can be mitigated by adding lightning protection devices to the network. Arc gaps allow the lightning energy to bypass the equipment and surge arresters allow the lightning energy to be transferred to earth via a device that changes its resistance in response to high voltages.

6.10 We will continue to fit lightning protection to cable terminations and pole mounted automatic switchgear across the whole of our area. We will also fit protection to pole mounted 11kV

transformers, using surge arresters in the East Midlands and West Midlands and arc gaps in the South West and South Wales. With the increased reliability of surge arrestors, we are assessing the benefit of also adding surge arresters in the South West and South Wales.

Temperature increase impact on overhead lines

6.11 Predicted increases in ambient temperature will mean that additional thermal expansion of conductors will affect the overhead line clearances and that thermal loading limits will be reached more quickly.

6.12 In response we have introduced new overhead design requirements to increase ground clearance and have prepared new conductor ratings for our overhead lines. Our lines are now designed to a minimum rated temperature of 55C to take account of the effects of increases in ambient temperature.

6.13 The effect of this change means that, as a rough average, the height of every other pole used on a new line is increased by 0.5m. This is a good example of a situation where a climate change mitigation measure has translated into a simple change to design which has a very small incremental cost effect on our network.

Flooding

6.14 Using data provided by the Environment Agency we have developed site specific flood risk assessments for our sites. The risk assessments calculate the risks posed by Fluvial or Coastal flooding on our assets.

6.15 Depending on the flood risk assessment, mitigation measures have included the installation of pumping systems, protection of individual items of plant, protection of buildings or protection of the site as a whole.

6.16 Whilst most of our outdoor equipment can continue to operate when affected by flood water, problems arise when the water reaches a level where it threatens to affect wiring and terminations in cubicles which are not waterproof. In many cases the simplest mitigation is to move these cubicles to a higher level above the predicted flood depths.

6.17 Indoor equipment can also be affected and the mitigation here will normally include a system of bunding or protection of the building to prevent water ingress or to allow the water level inside to be maintained at a low level.

6.18 Our flood risk assessments include a site survey with an overlaid flood depth prediction so that we can identify the items at risk and the most prudent steps to take. By taking this approach it is very rare for us to have to protect a whole site or consider relocation.

6.19 This work will continue through RIIO-ED1 and we are now working with the Environment Agency to gain a better understanding of surface water flooding.

2015-2023

RIIO-ED1 **BUSINESS PLAN**

SA-04 Supplementary Annex - Outputs

June 2013 (updated April 2014)

WESTERN POWER DISTRIBUTION

Serving the Midlands, South West and Wales

SA-04 Outputs
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1 Introduction

1.1 This document is a supplementary annex to the Western Power Distribution (WPD) Business Plan for the eight year period from 1st April 2015 to 31st March 2023.

1.2 It sets out the outputs that will be delivered through investment and business processes.

1.3 It includes the outputs for the four WPD distribution licences of West Midlands, East Midlands, South Wales and South West.

1.4 The eight year period aligns with the next regulatory price control review period, known as RIIO-ED1; the first for electricity distribution to be determined using Ofgem's Revenue = Incentives, Innovation and Outputs framework. The Business Plan, supplementary annexes, detailed cost tables and financial models form the submission under RIIO-ED1 to the regulator Ofgem (Office for Gas and Electricity Markets), who will use the information to determine allowed revenues.

Structure of this document

1.5 We appreciate that the readers of the WPD Business Plan suite of documents will range from regulatory experts and well informed stakeholders through to new customers who may have had little previous knowledge of WPD.

1.6 This document is aimed at readers who require a more detailed understanding of the outputs that will be delivered. A less detailed description of the outputs can be found in the main Business Plan Overview document.

1.7 This document is subdivided into the following sections:

Chapter	Title	Content
2	**Overview of outputs**	A brief description of what outputs are and the regulatory framework that incentivises their delivery.
3	**Safety outputs**	The outputs that will be achieved in relation to health and safety and the indicators that will be used to measure our performance.
4	**Reliability outputs**	The outputs that will be achieved in relation to network performance and the service provided when faults occur and the indicators that will be used to measure our performance.
5	**Environmental outputs**	The outputs that will be achieved in relation to economically facilitating the growth of low carbon technology connecting to the network and reducing WPD's carbon footprint, along with the indicators that will be used to measure our performance.
6	**Connections outputs**	The actions that will improve service for customers connecting to the network and the indicators that will be used to measure our performance
7	**Customer satisfaction outputs**	The outputs that will be delivered to improve customer satisfaction and the indicators that will be used to measure our performance.
8	**Social obligation outputs**	The new and enhanced services that provide benefits for vulnerable customers and those that are fuel poor and the indicators that will be used to measure our performance.

2 Overview of outputs

Introduction

2.1 Outputs are delivered as a consequence of WPD's investment programmes, network management decisions and customer service initiatives.

2.2 The outputs are either primary outputs or secondary deliverables:

- primary outputs represent the service that customers receive such as network reliability.
- secondary deliverables contribute to the delivery of primary outputs and are generally associated with more detailed network management decisions. For example improving flood defences enhances the resilience of the network.

2.3 Extensive stakeholder engagement has provided useful feedback that has refined the outputs WPD has committed to deliver for the eight years of RIIO-ED1.

2.4 Outputs have been defined in each of the six categories of the regulatory RIIO framework and their main objectives are described below:

- **Safety** – to minimise the safety risks associated with operating the network;
- **Reliability** – to maintain a reliable supply of electricity and make the network more resilient to external events;
- **Environment** - to reduce WPD's impact on the environment and facilitate lower carbon energy use;
- **Connections** – to provide an excellent service for customers connecting to the network;
- **Customer satisfaction** – to provide excellent customer service;
- **Social obligations** – to meet the needs of vulnerable customers.

2.5 The following chapters cover each output category and provide:

- a description and explanation of the individual primary outputs and secondary deliverables for each of the six categories of outputs;
- a summary of stakeholder feedback on the output and an explanation of how this has been considered in setting future performance;
- future targets, where appropriate.

RIIO-ED1 regulatory outputs

2.6 Ofgem has prescribed a framework of outputs and incentives that it will use to monitor company performance. This provides the outline measures and requirements. In many instances WPD is proposing additional voluntary outputs and secondary deliverables.

2.7 The table below is an extract from Ofgem's Strategy Decision, published in March 2013.

Summary of the Ofgem RIIO-ED1 outputs framework	
Primary output category	**RIIO-ED1 outputs and incentives**
Safety	• Compliance with the legislative and regulatory framework regulated by the Health and Safety Executive (HSE).
Environmental impact	• Replace DPCR5 losses incentive with an obligation to reduce losses, ex ante funding for loss reduction activities and a discretionary reward for efficient and innovative loss reduction initiatives. • Maintain reputational incentive for business carbon footprint (BCF). • Maintain allowance for undergrounding overhead lines in areas of outstanding natural beauty and national parks. • Introduce a reputational reporting requirement on broad environmental impact.
Customer satisfaction	• Strengthen the Broad Measure of Customer Satisfaction (BMCS) introduced in DPCR5.

Social obligations	• Putting in place incentives to ensure DNOs play a full role in addressing consumer vulnerability, through:
	  • improving the information they hold on customers connected to their wires and identifying how they can improve the assistance they provide
	  • engaging with a wide range of other agencies to ensure customers get access to support that is available
	  • identifying opportunities to enable energy solutions for vulnerable households that might also reduce demands on the distribution network
	• The stakeholder engagement incentive rewards DNOs that demonstrate the delivery of benefits result from the above.

Connections	• For smaller connection types – increase in the incentive value associated with the customer satisfaction survey and introduce a new incentive relating to the average time taken to connect customers. • For larger connection types – introduce a new Incentive on Connections Engagement (ICE), requiring DNOs to engage with and understand the requirements of different customers. • Maintain underlying framework of licence conditions and guaranteed standards of performance to safeguard minimum levels of performance for all customers.
Reliability and availability	• Continue existing interruption incentive scheme (IIS) with small improvements. Improve the consistency of the asset health and loading indices secondary deliverables. • Reduced payment threshold under the guaranteed standards of reliability and uniform coverage. • Maintain the DPCR5 mechanism for worst served customers. • Introduce secondary deliverables on network resilience.

3 Outputs – safety

3.1 Safety is at the heart of everything we do and we will continue to target improvements in our overall safety performance.

3.2 The objective of safety outputs is to minimise the safety risks to people. This includes staff, contractors and members of the public.

3.3 During RIIO-ED1, we will deliver the following outputs and secondary deliverables:

Compliance with health and safety law

- Target zero improvement notices, prohibition notices and prosecutions from the Health and Safety Executive.
- Complete work programmes to achieve compliance with ESQCR statutory clearance to structures or the ground.
- Complete inspection and maintenance programmes every year.

Reducing accidents

- Reduce our overall accident frequency rate by 10%.
- Maintain our active participation in the ENA SHE 'Powering Improvement' initiatives that lead to improved safety performance.
- Work with our trade unions to enhance safety performance including the provision for additional 'Behavioural Safety' initiatives.
- Investigate all accidents involving members of the public, contractors or our own staff to ensure that learning points are quickly understood and communicated.

Substation security

- Enhance security measures at 50 substations sites to reduce the number of repeat break-ins.

Educating the public

- Organise and run over 1,000 educational sessions to provide safety information to over 400,000 school children.
- Continue to publish literature on maintaining safety around electricity apparatus and send more than 500,000 copies of this literature to targeted landowners, businesses or leisure operators.

Regulatory framework

3.4 Ofgem has decided that the appropriate primary output for health and safety is the compliance with the safety requirements set out in legislation and enforced by the Health and Safety Executive (HSE).

Compliance with health and safety law

3.5 The Government seeks to ensure the right safety behaviour of organisations and people through an extensive range of health and safety law. The HSE has the responsibility of enforcing health and safety legislation and its inspectors work with the industry to prevent incidents.

3.6 Compliance with health and safety law is dependent upon preventing accidents by developing and ensuring the application of safe working practices and by completing programmes of work that reduce safety risks.

3.7 We have created a strong safety culture throughout WPD and procedures will continue to be refined to improve upon the existing safety performance to minimise the need for intervention by the HSE.

Secondary deliverable: Improvement notices, prohibition notices and prosecutions from the HSE

3.8 We will work cooperatively with the Health and Safety Executive to ensure our practices and policies continue to be compliant with health and safety legislation but also to seek out and apply best practice in the management of safety.

3.9 Where there is a breach of the law, the HSE has the power to issue a formal Improvement Notice. If the HSE believes that there is a serious risk of harm it has the option to stop activities immediately using a Prohibition Notice. Where the conditions of any such notices are not met, the HSE can prosecute organisations or individuals.

3.10 The HSE is also allowed to levy a 'Fee for Intervention'. This fee is a charge to cover the cost of inspection visits, if a 'Material Breach' of health and safety legislation is discovered. Whilst these fees are not fines, they lead to additional costs for the business.

3.11 During RIIO-ED1 WPD will ensure that its working practices and work programmes comply with health and safety legislation and will adopt appropriate working practices where new or revised legislation is introduced.

☑ RIIO-ED1 measure – number of improvement notices, prohibition notices and prosecutions

3.12 The RIIO-ED1 target will be to have zero improvement notices, prohibition notices and prosecutions.

Secondary deliverable: Completed inspection and maintenance programmes

3.13 The requirement to carry out inspection and maintenance is prescribed in health and safety law, but DNOs have the choice to determine what actions are appropriate.

3.14 The main method of ensuring that the network remains safe is through regular and thorough inspection, defect rectification and maintenance.

3.15 WPD has evolved its inspection and maintenance standards and policies over time, refining them, and applying best practice, as new techniques are introduced.

3.16 WPD ensures that work programmes are completed through a number of key performance indicators. These are used by local teams and senior management to ensure the timely delivery of programmes and the avoidance of backlogs.

3.17 During RIIO-ED1, we will ensure that assets are regularly inspected and maintained in line with good asset management practice, carrying out appropriate remedial actions.

☑ RIIO-ED1 measure – completion of inspection and maintenance activity

3.18 Completion of work programmes will be demonstrated through a range of key performance indicators for each inspection and maintenance activity allowing easy review and management action as appropriate.

Secondary deliverable: Complete work programmes to meet the requirements for increased clearance to structures or the ground;

3.19 The Electricity Safety, Quality and Continuity Regulations 2002 (ESQCR) specify a wide range of obligations on DNOs.

3.20 Regulation 17 deals with the height of overhead lines and specifies the clearances to ground for roads and other situations. This allows safe operation of activities under the lines. Following the proactive measurement survey of the height of overhead lines, it has been found that approximately 20% of service lines to properties that cross roads are too low. The work to increase ground clearance will carry on during DPCR5, but some will need to be carried out in RIIO-ED1.

3.21 Regulation 18 requires that overhead lines are positioned away from buildings and structures to reduce the risk of inadvertent contact. This was a new obligation introduced in 2002 that required DNOs to identify locations where overhead lines were close to structures and remove the hazard by modifying, diverting or undergrounding the lines. WPD has been working on a programme that will remove the majority of these situations by the end of DPCR5. During RIIO-ED1 we will complete the original work programmes to provide sufficient clearance between overhead lines and structures.

☑ RIIO-ED1 measure – Completion of ESQCR regulation 17 programme

3.22 The completion of the ESQCR regulation 17 programme will be demonstrated by key performance indicators showing that identified height issues have been resolved.

☑ RIIO-ED1 measure – Completion of ESQCR regulation 18 programme

3.23 The completion of the ESQCR regulation 18 programme will be demonstrated by key performance indicators showing that identified proximity issues have been resolved.

Stakeholder views

3.24 WPD maintains regular contact with the HSE and is subject to periodic inspections. These interactions serve to identify areas where improvements can be made. WPD will respond to all observations to ensure that necessary corrective actions are taken.

3.25 Feedback confirms that other stakeholders regard safety as a 'given' requirement and therefore it remains a high priority for the way that work is carried out and how WPD interacts with customers, landowners and other parties.

Reducing accidents

3.26 Although the electricity distribution network and work upon it has many inherent hazards, the design standards, operational processes and working methods adopted by WPD minimise the risk of injury to staff, contractors and the public.

3.27 In addition to specific skills training, staff are trained in identifying risk and application of risk control and mitigation.

3.28 Staff are encouraged to take personal responsibility for the safety of themselves, colleagues and others who could be affected by their works and are given absolute authority to stop work where they cannot adequately control risks to an acceptable level.

3.29 Team Managers carry out regular site visits to inspect general site safety and working practices. Examining Officers periodically assess operational capability to ensure that every operational member of staff and contractor is competent to carry out their duties.

3.30 Contractors working on behalf of WPD on the distribution network are required to comply with WPD's operational safety policy and monitoring requirements. Contractors are required to establish and operate their own general safety monitoring processes as appropriate to their work activity but are still required to report to WPD any safety related incidents or issues that occur. This extends the culture of safety and enables additional learning to be shared.

3.31 The systems for managing safety are annually audited against the requirements of the international specification Occupational Health and Safety Assessment Series 18001.

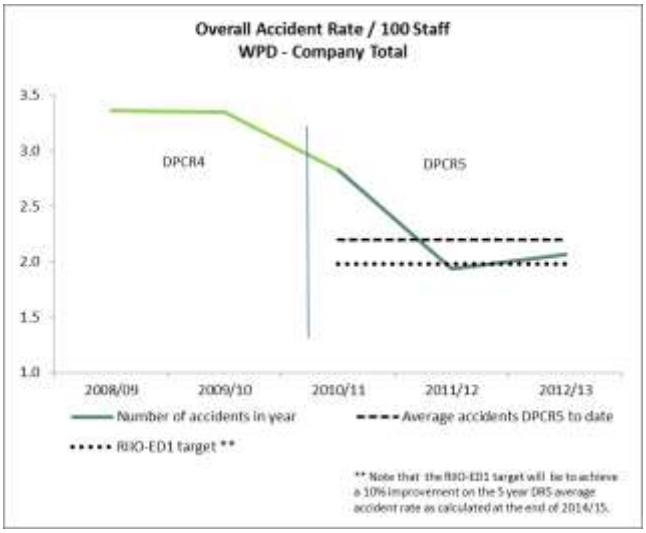
3.32 Although accidents are rare, when they do occur investigations are carried out quickly and learning is shared across all relevant teams and other DNOs if appropriate.

3.33 During RIIO-ED1 safe working will remain a high priority. We will seek to reduce the overall accident frequency rate involving our own staff by 10%. This will be achieved by working with staff, trade unions and the industry to understand the causes of accidents.

☑ RIIO-ED1 measure - Reduce our accident frequency rate by 10%;

3.34 The accident frequency rate is derived from the number of annual accidents and the number of staff, and is expressed as Accidents per 100 members of staff. This allows performance to be compared across differently sized teams and organisations.

3.35 Historical performance demonstrates that progressive improvements have been achieved overall through DPCR4 and DPCR5.



3.36 During RIIO-ED1 we will seek to continue this improvement by reducing the overall accident frequency rate achieved during DPCR5 by a further 10%.

Secondary deliverable: Maintain active participation in the 'Powering Improvement' health and safety strategy

3.37 Powering Improvement is the five-year industry strategy to bring about continuous improvement in safety and occupational health in the energy generation and networks sectors. It is supported by member companies of both the Energy Networks Association (the industry body for UK electricity transmission and distribution), member companies of the Association of Electricity Producers (the trade association for the UK generators), trade unions and the HSE.

3.38 The Powering Improvement initiative started in 2010 and each year has a specific theme, with the final year being dedicated to reviewing progress and lessons learned in order to set the health and safety priorities for the following five years to 2020.

3.39 WPD has been actively involved with the strategy and will continue to support the initiative throughout RIIO-ED1. This will allow learning from across the electricity sector to be shared and best practice to be adopted.

☑ RIIO-ED1 measure – active participation of Powering Improvement strategy

3.40 WPD will actively participate in the strategy and formally commit to the aims of the strategy.

Secondary deliverable: Working with trade unions and implementing the principles of 'Behavioural Safety'

3.41 Trade unions play an important role in working with WPD to improve the health and safety of staff. By working together, new procedures can be implemented, hazards can be highlighted and risks reduced.

3.42 Behavioural safety goes beyond setting rules and enforcing compliance. It seeks to change attitudes, so that staff assume responsibility for their own safety and the safety of others by acting on their training, following instructions and challenging others when they see safety rules about to be broken. This enhances safety culture with everyone being more vigilant and involved.

3.43 During RIIO-ED1 we will continue to work with trade unions and trade union appointed safety representatives within the business to ensure that industry best practices are shared and applied within WPD. We will look to further enhance the safety of our staff through additional training in the understanding of behavioural safety.

☑ RIIO-ED1 measure – Working with trade unions to improve safety performance

3.44 Meetings will be held with trade union representatives to identify safety issues and resolve them. The principles of behavioural safety will be implemented across the company.

Secondary deliverable: Investigating accidents to members of the public

3.45 Although incidents or accidents involving members of the public and the electricity network are rare, the majority of cases arise as a result of actions beyond the direct control of WPD (e.g. excavating near cables, erecting ladders near overhead lines, accidents involving vehicles and WPD assets such as poles).

3.46 The ESQCR require accidents involving the public to be reported to the HSE.

3.47 When accidents do occur we will continue to quickly investigate the causes and ensure any appropriate action is undertaken without delay.

☑ RIIO-ED1 measure – Investigation of accidents involving the public

3.48 We will monitor the number of accidents involving the public and the electricity network to determine whether additional safety literature and education are required to communicate the dangers of the distribution network.

3.49 We will report all accidents in line with legal requirements and provide assistance to the HSE in any investigations they carry out.

Substation security and theft of equipment

3.50 Increases in the value of metal have led to high levels of theft from the network. This has the potential for electricity supplies to be interrupted and intruders to substations often leave sites in a hazardous state potentially exposing WPD employees and members of the public to increased risks.

3.51 Financial forecasts indicate that the value of metal prices will remain high and so WPD will carry out actions to deter theft and help the police to catch thieves.

3.52 WPD has been proactively working with police forces to assist in crime prevention. We have provided guidance to improve the identification of recovered stolen materials. Furthermore we have facilitated meetings with neighbouring forces to ensure that intelligence is shared across police area boundaries. WPD will continue this work.

3.53 Enhanced substation security measures will be installed at locations where thieves are regularly attempting to break-in. This will reduce the potential for theft, by making access more difficult.

3.54 Wider use will be made of tagging systems that use unique codes that allow the identification of where equipment has been stolen from. This acts as a deterrent because thieves can be more easily linked to the locations of theft.

Secondary deliverable: Increasing substation security

3.55 During RIIO-ED1 WPD will upgrade security measures at all sites in the West Midlands and East Midlands to bring them up to the level of protection provided in the South West and South Wales. All primary and grid sites will get an intruder system as a minimum. Depending on risk some sites will also be fitted with CCTV, electric fences or both at high risk sites.

☑ RIIO-ED1 measure – Monitoring the number of break-ins to substations.

3.56 We will monitor the number of break-ins and the how access was gained to identify at-risk locations and install enhanced security measures. We forecast that we will enhance security measures at 50 substations sites to reduce the number of repeat break-ins.

Educating the public on electricity safety matters

3.57 Children and other members of the public may not always be aware of the potential dangers from the electricity distribution network. This lack of awareness can lead to them becoming exposed to more risk during certain play, leisure or work activities.

Secondary deliverable: Educating children about electricity

3.58 For many years we have developed and provided safety information to children. This has predominantly been delivered through practical demonstrations and explanations in schools of what our equipment looks like, what it does and how to stay safe around it.

3.59 School visits provide an opportunity to make children aware of the dangers, helping them to recognise overhead lines and substations and explaining what they should avoid doing near to electricity distribution equipment.

3.60 School visits are provided by dedicated community education safety advisers as part of WPD's corporate communications activity.

3.61 These visits supplement the resources available on WPD's Power Discovery Zone – an interactive, curriculum-linked website for schools that relates to electricity and safety. It was launched in September 2012 and provides resources for teachers and educational games for children. The site contains over 35 curriculum-based resources, enabling teachers to easily plan lessons that incorporate WPD's important safety messages.

☑ RIIO-ED1 measure – The number of children educated on electricity safety matters.

3.62 During RIIO-ED1 we will provide education sessions to 400,000 school children about the potential dangers of electricity through our on-going programme. These sessions will take place through school visits and our crucial crew / lifeskills initiatives where WPD team up with the emergency services to provide safety information for children.

Secondary deliverable: Providing safety information

3.63 People engaged in work or taking part in recreational activities near network assets are usually focussed on what they are doing and can be unaware of the potential hazards around them.

3.64 WPD produces a range of information leaflets describing the dangers from overhead lines, electricity substations and underground cables. We have also identified those work or leisure activities that are more likely to give rise to potential risks when occurring in the vicinity of our assets.

3.65 Since the introduction of the ESQCR in 2003 we have sent our safety literature to over 500,000 relevant businesses and landowners. This information provides an explanation of our equipment and how safety can be ensured for those involved in the work or leisure activities taking place around it.

☑ RIIO-ED1 measure – Production and communication of safety literature.

3.66 During RIIO-ED1 we will continue to develop and improve our safety literature and develop and update our knowledge of those organisations conducting activities that we believe to be most at risk if taking place around our equipment.

3.67 We will continue our practice of targeted mailshots of our safety literature. We will send out a further 500,000 copies to specific landowners, businesses or leisure activity providers whose activities could be higher risk if undertaken near to our equipment.

4 Outputs – reliability

4.1 Customers have indicated that network reliability is a high priority.

4.2 The objectives of our network reliability and availability outputs are to deliver improvements in our performance so that our customers have fewer and shorter power cuts.

4.3 During RIIO-ED1, we will deliver the following outputs and secondary deliverables:

Network performance

- Improve network performance by the end of RIIO-ED1 so that on average customers will have 16% fewer power cuts and have their electricity supplies restored 23% quicker.
- Ensure that a minimum of 85% of customers have their power restored within an hour of an HV fault occurring.

Guaranteed Standards of Performance (GSOPs)

- Reduce by 20% the number of customers experiencing a power cut lasting 12 hours or more.
- Target zero failures on all other GSOPs.

Worst served customers

- Reduce by 20% the number of customers classified as worst served.

Enhancing network resilience

- Apply flood defences to 75 substations; reducing the risk of both damage to equipment and power cuts due to flooding.
- Accelerate the programme of tree clearance for resilience by 40% with the objective to deliver the programme five years earlier than suggested by Government guidelines, clearing 700km of overhead lines per annum.
- Enhance substation battery life to be resilient for 72 hours in the event of major power losses.

Regulatory framework

4.4 Ofgem has decided to continue with the DPCR5 package of outputs and incentives for network reliability. This package consists of:

- Interruptions Incentive Scheme (IIS) – DNOs are incentivised on the number and duration of network supply interruptions versus a target derived from benchmark industry performance;
- guaranteed standards of performance – customers are eligible for direct payment of specific fixed amounts where a DNO fails to deliver specified minimum levels of performance;
- worst served customers – DNOs have access to funding to improve the reliability performance experienced by a small number of customers who endure a level of interruptions over and above a determined threshold. This funding is given on the condition that the those customers experience a specified improvement in service following the improvement works undertaken;
- health and load indices – these are secondary deliverables designed to tie specific network investment to specific risk reduction associated with the condition and loading of assets. These metrics encourage longer-term strategies by linking the reliability benefits of having assets in a better condition and having less highly-loaded assets to a measurable deliverable within the price control;

- resilience – this refers to the ability of the electricity distribution networks to continue to supply electricity to customers during disruptive events, such as severe storms or floods. DNOs are required to design and operate their networks in accordance with relevant statutes, codes and standards (such as Engineering Recommendation P2/6). For RIIO-ED1 Ofgem will monitor and publish each DNO's performance for each of the areas of flooding, Black Start (which refers to actions necessary to restore electricity supplies following total or widespread shutdown of the transmission system) and overhead line reliability under the overall banner of 'Network Resilience'.

4.5 The following sections describe the outputs that WPD will deliver and the targets that are being proposed. Some of the activities go beyond the framework specified by Ofgem, so we explain the justification for the target level in terms of benefits to network users.

Improving network performance

4.6 Customers expect power to be available all of the time because many household activities and business processes rely on electricity. As a low carbon future becomes reality there will be a greater requirement and reliance on electricity as a source of energy. This will mean that reliability and availability become ever more important.

4.7 Since 2002, Ofgem has incentivised distribution companies to improve network performance through the Interruptions Incentive Scheme (IIS) where rewards are available for outperformance and penalties applied where targets are not met. IIS measures the average number of interruptions per 100 customers and the average length of time in minutes each customer is without power (it excludes power cuts that are under three minutes).

4.8 The introduction of the IIS has influenced WPD to identify a mix of initiatives that together provide performance improvements for least cost.

4.9 The measures can be subdivided into three main controllable factors:

- Fault rate – the number of faults that occur;
- Customers interrupted per fault – the average number of customers that go off supply when a fault occurs;
- Duration of a fault – the average length of time it takes to restore supplies.

4.10 A reduction in the number of faults is influenced by a range of activities (described under RIIO-ED1 as 'secondary deliverables'). During RIIO-ED1, we will:

- replace the assets where the assessment of condition and the assessment of the consequence of failure creates the highest overall risk;
- reinforce the network using both smart and traditional solutions to provide enough network capacity to prevent assets overloading and failing;
- remove defective poles from the network within one year of being assessed as being defective so as to prevent in-service failures (particularly during high winds, snow or icy conditions);
- complete 100% of the tree clearance programmes to reduce the likelihood of branches and windborne debris affecting overhead lines;
- complete maintenance programmes to ensure equipment will last for its expected life.

4.11 We will also install additional network protection and automatic network switching devices to reduce the number of customers affected by power cuts.

4.12 The duration of interruptions will be minimised through a clear business focus on restoring supplies quickly using technology, the effective deployment of resources and the installation of mobile generation.

RIIO-ED1 measure – Reduction in Customer Interruptions (CIs) and Customer Minutes Lost (CMLs)

4.13 As a result of these actions we will improve network performance for unplanned interruptions so that customers across the whole of WPD on average experience no more than 6 electricity supply interruptions in ten years and on average are interrupted for no more than 38 minutes a year.

4.14 The table below shows the performance improvements proposed by WPD for each of the four WPD Licenced areas for the remainder of DPCR5 and for each year of RIIO-ED1. The current underlying performance figure is based on results up to 2011/12 in line with our stakeholder engagement. Figures for 2012/13 have been used in the Business Plan data tables and cost benefit analyses.

WPD proposed Customer Interruptions improvements												
	Current underlying performance	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	Percentage improvement
West Midlands	93.7	89.9	88.5	86.7	85.0	83.3	81.7	80.0	78.3	76.7	75.1	20%
East Midlands	58.8	56.0	55.7	55.3	54.9	54.6	54.2	53.8	53.5	53.1	52.7	10%
South Wales	55.5	52.6	52.5	52.3	52.2	52.1	52.0	51.8	51.7	51.6	51.5	7%
South West	57.4	57.1	56.8	56.4	56.0	55.6	55.2	54.9	54.5	54.1	53.7	6%
WPD Total	69.1	66.5	65.9	65.1	64.3	63.6	62.8	62.1	61.3	60.6	59.9	13%

WPD proposed Customer Minutes Lost improvements												
	Current underlying performance	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	Percentage improvement
West Midlands	66.7	52.5	51.9	51.1	50.3	49.5	48.7	47.9	47.1	46.4	45.6	32%
East Midlands	45.2	38.2	38.0	37.8	37.6	37.4	37.2	37.0	36.8	36.6	36.4	19%
South Wales	28.7	27.6	27.6	27.5	27.5	27.4	27.4	27.3	27.3	27.2	27.1	6%
South West	35.1	36.1	35.9	35.8	35.6	35.4	35.2	35.0	34.8	34.6	34.4	2%
WPD Total	47.7	40.8	40.5	40.1	39.8	39.4	39.0	38.7	38.3	37.9	37.6	20%

4.15 During the supplementary question process for fast track assessment, WPD confirmed to Ofgem that the proposed CI and CML targets (above) represented WPDs view of targets for RIIO-ED1 and where these were tighter than the Ofgem targets, then the tighter of the two targets would form the agreed targets for RIIO-ED1.

4.16 Ofgem calculated the following values using an established disaggregated benchmarking process.

Ofgem CI targets								
	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
West Midlands	87.0	85.7	84.4	83.2	81.9	80.7	79.5	78.3
East Midlands	51.9	51.1	50.4	50.1	49.9	49.6	49.4	49.1
South Wales	50.1	49.9	49.6	49.4	49.1	48.9	48.6	48.4
South West	55.7	55.4	55.1	54.8	54.6	54.3	54.0	53.8

Ofgem CML targets								
	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
West Midlands	58.0	56.7	55.5	54.3	53.1	51.9	50.8	49.7
East Midlands	39.0	38.2	37.3	36.5	35.7	34.9	34.2	33.5
South Wales	38.4	38.4	38.4	37.6	36.8	35.9	35.1	34.3
South West	46.8	46.8	46.6	45.6	44.6	43.7	42.7	41.8

4.17 In a number of instances the proposed WPD targets are tighter than the Ofgem targets. The final agreed targets for RIIO-ED1 are based on the lower of the WPD or the Ofgem targets. These are shown below (the shaded values represent those that are lower than Ofgem's).

Agreed RIIO-ED1 CI targets								
	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
West Midlands	86.7	85.0	83.3	81.7	80.0	78.3	76.7	75.1
East Midlands	51.9	51.1	50.4	50.1	49.9	49.6	49.4	49.1
South Wales	50.1	49.9	49.6	49.4	49.1	48.9	48.6	48.4
South West	55.7	55.4	55.1	54.8	54.6	54.3	54.0	53.7

Agreed RIIO-ED1 CML targets								
	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
West Midlands	51.1	50.3	49.5	48.7	47.9	47.1	46.4	45.6
East Midlands	37.8	37.6	37.3	36.5	35.7	34.9	34.2	33.5
South Wales	27.5	27.5	27.4	27.4	27.3	27.3	27.2	27.1
South West	35.8	35.6	35.4	35.2	35.0	34.8	34.6	34.4

4.18 These tougher targets will lead to an overall improvement of 16% in CIs and 23% improvement in CMLs.

4.19 The opportunity to outperform these targets will provide rewards that generate a return on investing in performance improvement.

Secondary deliverable – Asset health, criticality and risk

4.20 WPD has a comprehensive and extensive programme of asset replacement and refurbishment that renews approximately 2% of the overhead lines, switchgear and transformers, 0.2% of underground cables and 0.1% of services every year.

4.21 This work is primarily carried out to maintain the reliability of the network but it also delivers safety and environmental benefits.

4.22 The volume of work is determined by the condition of assets, the risks that they pose to network reliability, safety and the environment and the longer term forecasts of replacement need.

4.23 The programmes developed for RIIO-ED1 are established by using condition based risk assessment and cost benefit analysis. The risk assessment considers both the health of assets and the consequences of failure.

Health Indices (HIs)

4.24 Asset condition degrades over time eventually, at the end of their predicted life, leading to situations where the likelihood of failure increases.

4.25 The condition information collected during inspection and maintenance of assets is used to define a health value for each asset.

4.26 WPD uses the following health index definitions to categorise the condition of assets:

- HI1 – new or as new
- HI2 – good or serviceable condition
- HI3 – deterioration requires assessment and monitoring
- HI4 – material deterioration, intervention requires consideration
- HI5 – end of serviceable life, intervention required

4.27 The Health Indices determined by WPD can be directly related to the probability of failure of each asset. Therefore the Health Indices, themselves, can be considered as a proxy for probability of failure.

Criticality Indices (CIs)

4.28 The consequence of failure of each asset is different. It is determined by the number of connected customers, cost of repair and the asset's location which affects safety and environmental factors.

4.29 WPD has contributed to the development of an industry wide Criticality Index that enables the different consequences of failure to be categorised. It uses the average consequences of failure as a reference as shown below:

- C1 – lower than average consequence of failure (less than 75%)
- C2 – average consequences of failure (75% to 125%)
- C3 – higher than average consequences of failure (125% to 200%)
- C4 – very high consequences of failure (greater than 200%)

Risk Indices (RIs)

4.30 The risk associated with failure of assets is evaluated by combining the consequences of failure (criticality index) with the probability of failure (health index).

4.31 These can be represented in a matrix as shown in the table below. This is consistent with proposals in Ofgem's Strategy Decision.

	HI1	HI2	HI3	HI4	HI5
C1	RI1	RI1	RI1	RI2	RI3
C2	RI1	RI1	RI2	RI2	RI3
C3	RI1	RI1	RI2	RI3	RI4
C4	RI1	RI1	RI2	RI4	RI5

4.32 The risk index is highest for poorest condition assets with greatest consequences of failure. The risk index values correspond to the following definitions:

- R1 – very low risk
- R2 – low risk
- R3 – medium risk
- R4 – high risk
- R5 – very high risk.

4.33 Ofgem has indicated that it would like to continue to develop this concept to be able to create an overall risk score for the network. This work will be carried out after the submission of RIIO-ED1 Business Plans.

☑ RIIO-ED1 measure – Impact of intervention on the risk matrix

4.34 We have used the risk matrix to define the position of each health index category for five situations:

- the start of RIIO-ED1;
- the end of RIIO-ED1 without any intervention (showing the impact on future asset degradation);
- the end of RIIO-ED1 with the WPD proposed intervention (illustrating the change achieved by the planned work programmes);
- the midpoint of RIIO-ED1 without any intervention (to enable midpoint review of degradation);
- the midpoint of RIIO-ED1 with the WPD proposed intervention (to enable midpoint review of progress).

4.35 The outputs we will deliver over the RIIO-ED1 period are the net positions between the end of RIIO-ED1 with intervention and the end of RIIO-ED1 without intervention.

4.36 An illustrative matrix is shown below. It shows that the replacement programme changes 125 assets. Thirty of these are C4, five of which are HI5, 23 are HI4 and 2 are HI3. All thirty C4 assets are replaced with new assets that are HI1.

		Heath Index (Probability of failure)				
		HI1	HI2	HI3	HI4	HI5
Criticality	C1	+13	0	0	-1	-12
	C2	+37	0	0	-3	-34
	C3	+45	0	-5	-20	-20
	C4	+30	0	-2	-23	-5

4.37 All the net output matrices for all relevant asset categories are shown in Appendix A1.

Secondary deliverable – Primary network capacity

4.38 The capacity of the network is limited by the size (rating) and configuration of existing assets. As more connections are made to the network or customers use more electricity (for example to charge electric vehicles) spare capacity is used up and intervention is required to prevent assets overloading and failing. This intervention can be by the reinforcement of the network or load management to reduce the maximum demand on the network.

4.39 Reinforcement of the network has traditionally involved installing additional assets or larger assets. The extensive innovation programme being carried out by WPD and learning from other DNOs is expected to yield a range of new cheaper smart alternatives. WPD will use the most appropriate and cost effective interventions to provide additional network capacity.

4.40 The delivery of the primary network reinforcement programme will be assessed using the load indices introduced in DPCR5. These indices subdivide substations into defined bands of utilisation calculated by comparing the maximum demand to the firm capacity (load rating of the asset). Load forecasts predict future utilisation and identify the heavily loaded sites.

4.41 As RIIO-ED1 progresses actual load will be assessed in more detail and where appropriate intervention will take the form of the provision of additional capacity or greater control of the demand.

☑ RIIO-ED1 measure – Primary network loading risk

4.42 The utilisation at each substation has been used to derive a load index for each site. This is based upon the common load index bandings proposed by Ofgem and shown in the table below.

LI rank	Definition	Loading
LI1	Significant spare capacity	0-80%
LI2	Adequate spare capacity	80%-95%
LI3	Highly utilised	95%-99%
LI4	Fully utilised, mitigation requires consideration	100% for <9 hours per year
LI5	Fully utilised, mitigation required	100% for >9 hours per year

4.43 The load indices for all sites in each licence area have been combined to generate an overall loading risk score.

4.44 The following tables illustrate how the load indices will change over the RIIO-ED1 period with and without intervention.

West Midlands – Load Index Positions			
Load Index ranking	**Start of RIIO-ED1**	**End of RIIO-ED1 without intervention**	**End of RIIO-ED1 with intervention**
LI1	166	153	180
LI2	42	43	42
LI3	7	4	2
LI4	7	13	4
LI5	6	15	0

East Midlands – Load Index Positions			
Load Index ranking	**Start of RIIO-ED1**	**End of RIIO-ED1 without intervention**	**End of RIIO-ED1 with intervention**
LI1	309	258	281
LI2	108	112	119
LI3	11	31	33
LI4	13	19	14
LI5	8	29	2

South Wales – Load Index Positions			
Load Index ranking	**Start of RIIO-ED1**	**End of RIIO-ED1 without intervention**	**End of RIIO-ED1 with intervention**
LI1	150	129	129
LI2	32	45	45
LI3	0	7	7
LI4	1	2	2
LI5	0	0	0

South West – Load Index Positions			
Load Index ranking	**Start of RIIO-ED1**	**End of RIIO-ED1 without intervention**	**End of RIIO-ED1 with intervention**
LI1	267	233	243
LI2	54	67	69
LI3	9	12	13
LI4	2	9	7
LI5	0	11	0

4.45 The load index data has been converted to a risk score using weighting proposed by Ofgem within Business Plan Data Tables. A second risk score is provided using an alternative weighting proposed by WPD which reduces the difference between LI4 and LI5 to reduce the dominance of LI5 substations within the risk measure.

4.46 The different weightings used are shown in the table below.

Weighting of LIs for conversion to loading risk					
	LI1	LI2	LI3	LI4	LI5
Ofgem weighting	1	1	1	20	100
Alternative WPD weighting	1	1	1	20	50

4.47 Applying these weightings to the LIs and multiplying by the number of customers at each substation gives the following risk positions.

Loading risk – using Ofgem weightings			
Licence Area	**Start of RIIO-ED1**	**End of RIIO-ED1 without intervention**	**End of RIIO-ED1 with intervention**
West Midlands	8,338,896	25,115,535	3,452,548
East Midlands	11,503,853	37,680,797	11,150,822
South Wales	1,589,608	1,676,286	1,676,286
South West	3,061,322	22,514,386	4,302,630

Loading risk – using alternative WPD weightings			
Licence Area	**Start of RIIO-ED1**	**End of RIIO-ED1 without intervention**	**End of RIIO-ED1 with intervention**
West Midlands	6,843,442	15,745,861	3,488,204
East Midlands	9,921,677	25,565,255	11,897,058
South Wales	1,589,608	2,145,902	2,145,902
South West	3,569,310	14,466,438	5,524,186

4.48 An interpretation of these risk positions is given in the 'General Reinforcement' section of supplementary annex (SA-05) Expenditure .

Secondary deliverable – Removal of defective poles

4.49 Within WPD, a very high priority is placed on the replacement of poor condition wooden poles. Overhead lines are regularly inspected and poles found in poor condition are removed from the network within a year.

4.50 This activity provides safety, reliability and resilience benefits. It removes weak points from overhead line networks; reducing the likelihood of failure, especially during severe weather conditions.

☑ RIIO-ED1 measure – Number of poor condition poles remaining on the network

4.51 During RIIO-ED1 WPD will continue to replace poor condition poles within one year of being identified. The targets will continue to be zero failures against the measure.

Secondary deliverable – Reducing tree related incidents

4.52 Trees can cause interruptions by falling into overhead lines or by branches coming into contact with conductors. Routine cyclical tree clearance is carried out to provide sufficient clearance to prevent faults and keep the public safe.

4.53 During the current price control we propose to move to proactive programmes across all network voltages. This practice will continue into RIIO-ED1 and will lead to improved network performance as clearance cycles are established at all voltages and clearance is completed.

☑ RIIO-ED1 measure – Number of tree related faults

4.54 During RIIO-ED1 WPD will continue to routinely clear trees, seeking methods to improve effectiveness. The target will be to reduce the number of faults (across LV and HV networks) in line with the tables below.

HV Tree related faults					
	West Midlands	East Midlands	South Wales	South West	WPD Total
Underlying performance (4 year average from 2009/10 to 2012/13)	266	55	46	78	445
Target - end RIIO-ED1	168	55	46	78	347
Percentage improvement	37%	0%	0%	0%	22%

LV Tree related faults					
	West Midlands	East Midlands	South Wales	South West	WPD Total
Underlying performance (4 year average from 2009/10 to 2012/13)	270	229	94	369	962
Target - end RIIO-ED1	218	184	94	297	793
Percentage improvement	19%	20%	0%	20%	18%

Secondary deliverable: Completing inspection and maintenance programmes

4.55 Whilst primarily providing a safety output, inspection and maintenance work programmes also provide benefits for network reliability by enabling assets to last for their expected lives.

4.56 Maintenance limits degradation and replaces worn components that would otherwise lead to premature failures.

4.57 WPD has been routinely carrying out maintenance and therefore this activity is not anticipated to lead to any further improvements in reliability. The completion of programmes will assist in preventing an increase in failures.

☑ RIIO-ED1 measure – Completion of inspection and maintenance activity

4.58 Ensuring that programmes are completed will assist in limiting the number of faults. The completion of work programmes will be demonstrated through a range of key performance indicators for each inspection and maintenance activity.

Secondary deliverable – Increasing the amount of network automation

4.59 Remotely controlled devices provide the benefit of being able to quickly reconfigure network running arrangements, allowing supplies to be rerouted without the need to send a person to site. In addition, automatic reclosers enable circuits to be subdivided into smaller protection zones reducing the number of customers that are affected by a fault.

4.60 The installation of these devices has improved network performance and it is proposed to continue to install further devices on the network.

4.61 Furthermore, WPD has developed automatic switching algorithms that carry out switching actions without the intervention of a Control Engineer. The algorithms use information provided by fault passage sensors to indicate which section of the network contains the fault and then communicate with remotely controlled devices to confirm the existing running arrangement. The algorithms then work out a sequence of switching to restore supplies to the maximum number of customers possible. These algorithms allow restoration to the majority of supplies very quickly limiting the duration of power cuts and minimising the impact on customers.

4.62 The algorithms require network status data to be very reliable and we have therefore proposed enhancements to our operational IT and telecoms systems.

☑ RIIO-ED1 measure – Average number of customer interrupted on unplanned HV incidents

4.63 Both additional protection stages and rerouting supplies have the effect of reducing the number of customers affected per fault. The overall impact of installing additional devices can be demonstrated by the reduction in average number of customers interrupted per HV fault.

4.64 The current performance (based upon the average of the last four years) and our target performance for RIIO-ED1 are shown in the table below:

Average number of customers interrupted per unplanned HV incident				
	West Midlands	East Midlands	South Wales	South West
Current performance (four year average)	617	531	304	253
Target performance - end of RIIO-ED1	480	487	295	228
% reduction (rounded)	22%	8%	3%	10%

Secondary deliverable – Improving response to faults ('Target 60')

4.65 Significant performance improvements have been achieved by providing managerial focus on speedy restoration of electricity supplies in the event of a fault.

4.66 Target 60 is a WPD initiative that measures the percentage of customers who are restored within one hour when a HV fault occurs. Challenging targets have led to many process refinements such as improvements to response from control centres, better procedures for dispatching staff and more interactive communication with field teams.

4.67 Most importantly it has changed the attitude and culture of staff to one where 'getting customers back on supply' is a clear priority.

☑ RIIO-ED1 measure – Percentage of customers restored in an hour

4.68 During RIIO-ED1 WPD will continue to target restoration performance to ensure our 'Target 60' restoration performance exceeds 85%.

Guaranteed Standards of Performance (GSOPs)

4.69 The Electricity (Standards of Performance) Regulations 2010 define the guaranteed standards. These cover a range of different network reliability circumstances, where customers are entitled to payments where DNOs fail to meet the standards.

4.70 These are established measures of performance that will be continued into RIIO-ED1, but some changes will be made:

- the standard for restoration of supplies under normal weather conditions will be reduced from 18 to 12 hours;
- payments for failures will be increased in line with inflation forecasts.

4.71 WPD has an excellent track record against the existing standards, but the change to the supply restoration standard will pose a new challenge.

4.72 We will voluntarily double the value of payments for failures against guaranteed standards. Although we do not anticipate that the provision of these enhanced compensation levels will have a significant financial impact on WPD, we feel there is a need to ensure customers feel adequately recompensed should our service standards fail to meet minimum expectations.

Secondary deliverable - Improving performance for supply restoration under normal weather conditions (EGS2)

4.73 GSOP EGS2 currently requires supplies to be restored within 18 hours and power cuts that last longer are subject to penalty payments to customers. WPD has virtually eliminated failures against the 18 hour standard across all licence areas.

4.74 The most significant change to the GSOPs for RIIO-ED1 will require a payment to customers when they have been off supply for more than 12 hours.

4.75 This change will require DNOs to respond even more quickly to power cuts. WPD has already introduced internal key performance indicators (KPIs) as a result of the proposal in Ofgem's initial consultation document for RIIO-ED1. These KPIs allow the business to develop processes, procedures and creative solutions to work towards meeting the new requirements by the start of RIIO-ED1.

4.76 WPD proposes to reduce by 20% on average the number of customers experiencing interruptions lasting 12 hours or more when compared to performance in 2012/13. This proposal has been supported by our stakeholders and will be achieved through further improvements to fault management processes, the increased use of mobile generation and the development of more flexible and bespoke generation solutions.

☑ RIIO-ED1 measure – Number of ESG2 failures

4.77 During RIIO-ED1 WPD will reduce the number of customers not restored within 12 hours by 20% on 2012/13 levels. The table below specifies the reference performance (based upon performance in 2012/13) and RIIO-ED1 targets. The reference excludes exceptional events because different GSOPs and time durations apply.

Performance against GSOP ESG2 (Customers off supply for over 12 hours)					
	West Midlands	East Midlands	South Wales	South West	WPD Total
Reference performance in 2012/13	5,080	3,367	272	2,029	10,748
Target performance – end of RIIO-ED1	4,064	2,694	218	1,623	8,599

Secondary deliverable - Meeting other network performance GSOPs

4.78 We target zero failures against other network performance GSOPs.

☑ RIIO-ED1 measure – ESG1 Responding to failure of a distribution fuse

4.79 Standard ESG1 aims to drive DNOs to respond quickly to loss of supply caused by failure of a distributor's fuse installed at the incoming supply to a property. On a working day attendance is required within 3 hours during the hours of 7am and 7pm, and within 4 hours on other days between 9am and 5pm.

☑ RIIO-ED1 measure – ESG2A Supply restoration multiple interruptions

4.80 This standard recognises the inconvenience of going off supply frequently and for a substantive amount of time. Customers are entitled to claim a compensation payment where four or more interruptions occur, each lasting three hours or longer, within a twelve month period (April to March).

☑ RIIO-ED1 measure – ESG2B Supply restoration more than 5000 customers

4.81 There are rare occasions when a single fault can have a large scale impact. Guaranteed Standard ESG2B recognises that under these circumstances, DNOs may require additional time to restore supplies and therefore extends the time before a payment is due to 24 hours when more than 5,000 customers are affected by a single incident.

☑ RIIO-ED1 measure – ESG2C Supply restoration rota disconnections

4.82 Under extremely rare circumstances, such as an incident occurring at a large grid supply point affecting supplies into a large part of a city, it may be necessary to share the remaining available supply across different customers by rota disconnections. Where customers are left without power for 24 hours or longer, in aggregate, they would be entitled to a payment.

☑ RIIO-ED1 measure – ESG4 Notice of planned interruption to supply

4.83 When planned work is undertaken on the network, customers must be given at least two days' notice, otherwise the customer is entitled to a payment.

☑ RIIO-ED1 measure – ESG5 Investigation of voltage complaints

4.84 When customers raise concerns about the voltage of their supply, DNOs must visit the customer's premises within seven days or dispatch an explanation of the probable reason within five working days.

☑ RIIO-ED1 measure – ESG8 Making and keeping appointments

4.85 Certain issues are dealt with best by having direct contact with customers. DNOs must offer and keep timed appointments to minimise the inconvenience for customers.

☑ RIIO-ED1 measure – ESG9 Making GSOP failure payments

4.86 When the conditions of GSOPs are not met, the payments to customers should be made within ten working days. Further payments are due if DNOs fail to make prompt payments.

☑ RIIO-ED1 measure – ESG11 Supply restoration during severe weather

4.87 Severe winds or heavy snowfall can cause widespread disruption to electricity supplies. There are rare occasions when a single event can have a large scale impact. Guaranteed Standard ESG11 recognises that under these circumstances, DNOs may require additional time to restore supplies and therefore extends the time before a payment is due to 24 hours, 48 hours or longer depending on the impact of the severe weather conditions.

Making improvements for worst served customers

4.88 The worst served customer mechanism is designed to reduce the number of interruptions for customers who experienced an unusually poor level of service. Often these customers are connected to remote parts of the network that are predominantly overhead.

4.89 The mechanism was introduced in DPCR5 and recovery of expenditure is conditional upon delivering a 25% performance improvement and is capped at £1,000 per worst served customer benefitting from the improvement.

4.90 For RIIO-ED1, Ofgem has decided to change the definition of worst served customers to those that experience 12 or more higher voltage interruptions over a three year period. This redefinition, from the current criteria of 15 or more, widens the scope of who is defined as a worst served customer.

4.91 Stakeholders recognise that some customers receive a poorer level of service and that living in remote areas can make power cuts more likely. WPD's stakeholder consultation was primarily carried out using the existing definition and suggested that the number of worst served customers should be reduced by 20% from 10,000 to 8,000. Engagement on WPD's draft Business Plan during April 2013 provided an opportunity to review the proposals with the new definition. This concluded that the same percentage improvement should be sought, where the number of worst served customers is reduced from 20,000 to 16,000.

4.92 For RIIO-ED1, Ofgem has also removed the prescribed 25% improvement criteria and cost recovery cap of £1,000 per customer, expecting DNOs to use stakeholder engagement to define appropriate levels. Stakeholders have indicated that the improvement should be 20% and the amount that can be spent per customer is £800. The change in the definition of a worst served customer has widened the scope for improvements and therefore there will be a greater opportunity to apply lower cost solutions, so a limit of £800 per customer should be adequate.

4.93 Improvements to performance will be achieved by using additional protection devices, remote control or traditional refurbishment as appropriate.

☑ RIIO-ED1 measure – Reduction in the number of faults affecting specific WSC

4.94 WPD has invested to make improvements for worst served customers. Improvements will be made during RIIO-ED1 to reduce the number of worst served customers by 20%.

Worst served customer numbers					
	West Midlands	East Midlands	South Wales	South West	WPD Total
Reference performance in 2012/13	6,000	6,000	2,000	6,000	20,000
Target performance – end of RIIO-ED1	4,800	4,800	1,600	4,800	16,000

Enhancing network resilience

4.95 Resilience refers to the ability of the network to continue to supply electricity during severe weather and to have the capacity to recover from widespread system shutdowns.

4.96 Ofgem has decided that it will monitor network resilience in three areas:

- flooding;
- black start;
- overhead lines.

4.97 Regulatory measures will assess the amount of risk reduction achieved compared to the amount proposed by DNO Business Plans.

Secondary deliverable - Reduction in flooding risk at substations

4.98 Climate change predictions suggest that widespread flooding will become a more regular occurrence.

4.99 Although flooding can often be limited to relatively small areas of ground, substations often supply customers across much wider areas. Inconvenience can therefore be caused for customers who may not be directly affected by flood water themselves.

4.100 Stakeholders are fully aware of the disturbance flooding can cause and flood defences are becoming increasingly important for them. They have indicated that the installation of flood defences is a high priority and they support our proposals.

4.101 The risk of power cuts can be reduced by erecting temporary barriers in response to floods, constructing permanent barrier walls around the perimeter of sites or critical equipment, or installing equipment higher up on structures.

4.102 WPD has been working with the Environment Agency to identify the substations at greatest risk and during DPCR5 120 substations will be protected. This includes bringing forward some projects that were previously planned to be carried out after DPCR5. As a result, there are approximately 75 sites that will require flood defences to be constructed in RIIO-ED1.

☑ RIIO-ED1 measure – Number of sites with flood defences installed

4.103 Flooding risk is derived from the probability that flooding will affect electricity supplies and the number of customers impacted. Data for the probability of pluvial flooding (known as 'flash' flooding) is not available and therefore the output can only be assessed by monitoring the number of sites where flood defences have been installed.

4.104 The table below shows the number of sites to be protected.

Number of sites where flood defences are to be installed during RIIO-ED1					
	West Midlands	East Midlands	South Wales	South West	WPD Total
Number of sites to be protected - fluvial	0	14	12	1	27
Number of sites to be protected - pluvial	13	16	8	11	48
Total	**13**	**30**	**20**	**12**	**75**

Secondary deliverable - Enhancing Black Start capability

4.105 Although they are extremely rare, a number of blackouts across the world (in the USA, Europe and across India) have highlighted that very widespread supply interruptions can occur. Events can be triggered by a coincidence of circumstances, which due to network running arrangements cause disconnection of customers to cascade as each alternative network reacts to the situation. Recovery from the blackout - a 'Black Start' - can take a number of days as generation stations return online and network loads are balanced with the output of generation.

4.106 The electricity industry has developed a standard which requires major substations to have the resilience to remain operational for 72 hours. The main consideration is the length of time that control, communication and protection batteries will last.

4.107 WPD proposes to make all substation battery systems at major substations resilient to 72 hours. This shall be achieved by increasing the capacity of telecommunications batteries and/or installing load disconnection schemes to manage the drain on batteries used for tripping of switchgear and protection.

☑ RIIO-ED1 measure – Compliance with the industry standard

4.108 The recovery from a black start will take place in stages. For the process of balancing load with generation to be effective, the whole chain from grid supply point, bulk supply substations to primary substation need to be resilient.

4.109 During RIIO-ED1, WPD proposes to make the whole network compliant with the electricity industry standard. These works shall be undertaken to address the substation resilience needs of grid groups, in sequence. This shall maximise the benefits achieved as the works progress.

4.110 The delivery of outputs shall be assessed by measuring the volume of activity against the required program of works.

Secondary deliverable – Overhead line resilience

4.111 Ofgem has introduced a new measure of resilience for overhead lines, proposing that risk reduction will be based upon fault rates.

4.112 Overhead line fault rates are influenced by a number of factors including:

- the condition of overhead lines;
- the design strength of overhead lines;
- routine tree clearance;
- resilience tree clearance.

Condition of overhead lines

4.113 The condition of overhead lines will be addressed through inspection, refurbishment and replacement programmes (including a focus on poor condition pole replacement).

4.114 These programmes contribute to safety and general network reliability outputs, as well as providing a resilience benefit. RIIO-ED1 plans are a continuation of DPCR5 programmes and they will broadly keep fault rates at the same level as the replacement activity removes deteriorated assets.

Design strength of overhead lines

4.115 Overhead lines are designed to support the conductors and withstand certain wind loading.

4.116 Although constructing lines to more robust standards would provide resilience benefits, there are more cost effective ways of making overhead lines resilient. WPD does not propose to introduce a programme to rebuild lines with a stronger design.

Routine tree clearance

4.117 Routine tree clearance is carried out to maintain safety clearance distances and prevent interruptions under normal weather conditions.

4.118 WPD proposes to have proactive tree clearance programmes across all voltage levels that will reduce the number of tree related faults during RIIO-ED1. The programme will deliver 20% improvement on LV networks in West Midlands, East Midlands and South West and 37% improvement on HV faults in West Midlands.

Resilience tree clearance

4.119 Severe storms can cause network faults and lead to interruptions in supply for large numbers of customers. In particular strong winds can lead to overhead lines being damaged by trees.

4.120 Following storms in 2002 new legislation was introduced that requires DNOs to clear trees from overhead lines to a resilient standard that prevents damage should a tree be blown over. Regulatory documentation supporting the legislation changes indicated that programmes should seek to progressively clear trees to make 20% of the network resilient within 25 years. The industry has therefore adopted a clearance rate of 0.8% per annum during DPCR5.

4.121 Following stakeholder engagement, where there was strong support for more clearance work, the rate of resilience tree clearance will be accelerated by 40% to complete the programme five years earlier than had been planned in DPCR5.

☑ RIIO-ED1 measure – Overhead line fault volumes

4.122 The main contributor to reducing overhead line fault rates will be tree clearance. It is anticipated that the routine tree clearance programmes will lead to an overall reduction of 7% in LV overhead line fault rates in West Midlands, East Midlands and South West and a reduction of 11% of HV overhead line faults in West Midlands.

4.123 The following table compares current and forecast overhead line fault volume.

LV overhead line faults					
	West Midlands	East Midlands	South Wales	South West	WPD Total
Underlying performance (4 year average from 2009/10 to 2012/13)	777	654	471	1,055	2,957
Target - end RIIO-ED1	723	609	471	983	2,786
Percentage improvement	7%	7%	0%	7%	6%

HV overhead line faults					
	West Midlands	East Midlands	South Wales	South West	WPD Total
Underlying performance (4 year average from 2009/10 to 2012/13)	888	553	102	783	2,326
Target - end RIIO-ED1	790	553	102	783	2,228
Percentage improvement	11%	0%	0%	0%	4%

5 Outputs – environment

5.1 Outputs for the environment can be subdivided into two broad categories: those that help broader environmental objectives by increasing the amount of low carbon technology (LCT) connected to our network and those that reduce WPD's environmental impact.

Regulatory framework

5.2 Ofgem has separated outputs for wider environmental objectives and the impact of DNO's activities on the environment by capturing wider objectives under 'driving sustainable networks' and the impact of DNO activities under 'environmental impacts'.

Driving sustainable networks

5.3 Ofgem recognises that a key challenge for RIIO-ED1 is how DNOs accommodate and facilitate the increase in low carbon technologies.

5.4 Even so, Ofgem has concluded that a specific output is not required, citing that other proposed outputs and incentives (for reliability, connection, efficiency and innovation) are sufficient to drive the behaviours required to facilitate a transition to a low carbon economy.

5.5 Ofgem state that the delivery of other outputs at an efficient cost drives DNOs to develop smarter solutions and develop plans for smart grids using data available from smart meters and new techniques established through innovation projects.

Environmental Impacts

5.6 The environmental impacts of DNO activities broadly covers four areas: network losses, business carbon footprint, leakage from equipment and visual amenity.

5.7 Difficulties in accurately measuring network losses have led Ofgem to move away from providing financial incentives for loss reduction. As an alternative Ofgem will introduce a new licence obligation for DNOs to reduce losses that will operate alongside the existing obligation to develop an efficient, co-ordinated and economical network. This will ensure that the most cost effective approach to reducing losses is followed. Ofgem will also provide a discretionary financial reward where DNOs adopt innovative ways of reducing losses.

5.8 A reputational system will continue to be used to demonstrate the management of business carbon footprint. League tables of reported data will show relative positions of DNOs along with narratives describing the actions being taken to reduce emissions.

5.9 The leakage of SF_6 (a potent greenhouse gas) from switchgear and oil from fluid filled cables will continue to be included in business carbon footprint reporting, but the scope of reporting will be expanded.

5.10 Undergrounding of overhead lines in Areas of Outstanding Natural Beauty (AONBs) and National Parks will remain non-compulsory. DNOs will be expected to work with representatives of the AONBs and National Parks to determine which lines should be undergrounded.

Helping to increase the volume of low carbon technologies

5.11 The Government has committed to undertake positive action on climate change by reducing the emission of greenhouse gases.

5.12 For DNOs the major impact is in respect of the increasing number of LCTs used for electricity generation, transportation and heating for buildings. Part of WPD's role is to enable cost effective and timely connection of distributed generation (such as solar panels) and to provide sufficient capacity in the network to accommodate the increased loads from electric vehicle charging and domestic heat pump heating systems.

5.13 Although Ofgem does not propose to use an output for driving sustainable networks, WPD sees value in using a range of secondary deliverables to demonstrate the actions being taken to facilitate the increase in LCTs.

5.14 LCT related secondary deliverables facilitate the connection of low carbon generation and provide network capacity to accommodate the increased use of low carbon technologies. During RIIO-ED1 we will:

Facilitate increased volumes of low carbon technologies (LCTs)

- Improve the time to provide a response to customers wanting to use LCTs by 20%.
- Identify LCT hotspots using data from smart meters, expert organisations and local authorities and use this to inform decision making.
- Selectively carry out asset replacement using larger sized assets.
- Reduce costs for future customers by developing smart solutions to provide alternative and innovative techniques for network management.
- Provide additional network capacity through utilising traditional methods or smart intervention.

Secondary deliverable - Providing a faster response to customers

5.15 Customers wanting to install LCTs should provide technical details of their installations to DNOs so that the impact on the network and other customers can be assessed. Depending on the circumstances, this assessment process can result in simply granting permission for the installation or restricting the connection of the device until the network is reinforced.

5.16 The volume of LCTs connecting to the network is expected to grow significantly. This will lead to a corresponding increase in the number of assessments. As more devices are installed, the ability to easily accommodate others will reduce and the assessments will grow in complexity and detail. Nevertheless, customers will expect a timely response to their enquiries.

☑ RIIO-ED1 measure – Time to provide a response to customers

5.17 We will improve the processing of requests during RIIO-ED1 to ensure a 20% reduction in response time. This level of improvement was supported by stakeholder because it will be delivered without adding significant costs. As current volumes are low we propose to establish a benchmark based upon the response provided in the last year of DPCR5.

Secondary deliverable - Identifying LCTs hotspots

5.18 DECC has published forecasts for the uptake of LCTs that will require the distribution networks to increase capacity and be more operationally agile in order to deal with fluctuations in generation and demand.

5.19 We have used socio-economic information to predict where LCTs may connect and have then analysed the consequential impact on the network. During RIIO-ED1 we will continue to use expert organisations, information from local councils and data from smart meters to build up a better view of areas that become LCT 'hotspots' i.e. those areas with a high probability of requiring additional capacity in the near future.

5.20 We will integrate this knowledge into WPD network planning tools to ensure that the information is readily available for team planners dealing with customer load enquiries or developing replacement projects. This will ensure that planners are presented with timely information about hotspots rather than having to access and interrogate separate data systems.

☑ RIIO-ED1 measure – Integrating LCT hotspot data into planning systems

5.21 The development of these systems will enable planners to design projects that more effectively accommodate LCTs. Since these systems do not exist, their development can be viewed as a secondary deliverable. Progress towards their development will be reported annually.

Secondary deliverable - Using larger capacity equipment when replacing assets

5.22 When assets reach the end of their useful lives they are normally replaced on a like-for-like basis. In areas identified as LCT hotspots, it may be prudent to install larger capacity cables and transformers to provide adequate capacity for load growth, especially where there is high confidence that the load will increase. This will provide a lower overall cost of running the network as it will avoid the need to reinforce assets again.

5.23 We will use the information about LCT hotspots to selectively install larger assets during asset replacement work.

☑ RIIO-ED1 measure – Replacing assets with larger capacity equipment

5.24 Forecasts suggest that approximately 7% of the asset replacement activity will occur in LCT hotspot areas. Although this provides a guide for high level cost forecasting, it is not appropriate to use this value as a target. Using a target could create a perverse incentive to install larger capacity equipment where it was not needed (should the number of LCT hotspots be lower than forecast).

5.25 It is therefore proposed to report the proportion of asset replacement projects that use larger capacity assets. This will provide stakeholders will an indication of the coincidence of LCT hotspots with asset replacement and will demonstrate that accommodating LCTs is being considered as part of routine replacement work.

Secondary deliverable - Developing smart solutions

5.26 Where increases in load cause the maximum demand to exceed the capacity of the equipment, the traditional approach to reinforcement has been to either increase the size of equipment or install additional equipment.

5.27 Smart solutions is a generic term used for techniques that can utilise existing networks more effectively or actively manage the load on the networks by constraining demand or generation.

5.28 Smarter ways of operating the network and providing capacity are being researched, trialled and tested. WPD's existing extensive innovation programme will continue into RIIO-ED1 and new techniques will be adopted to become 'business as usual'.

☑ RIIO-ED1 measure – The availability of smart solutions

5.29 Success in the development of smart solutions will be demonstrated by the number and range of options available to network planners as part of their planning 'tool box'.

5.30 By the end of RIIO-ED1 we will have a range of solutions adopted as business as usual. Our Innovation Annex describes the projects that we are undertaking and typical applications derived from early LCNF projects will be:

- using dynamic line ratings for EHV lines;
- providing more accurate estimates of the load profile of customers and the effect on the LV network from results of the LV Templates project;
- providing voltage control and commercial arrangements for load management to better accommodate generation onto the 33kV network using techniques developed in the Lincolnshire Low Carbon Hub project;
- managing network fault level in a more innovative way using the techniques developed in the Birmingham FlexDgrid project;
- managing 11kV and LV networks using active techniques developed in Project FALCON.

Secondary deliverable - Reinforcing the network using smart solutions

5.31 Future network development will incorporate both traditional and smart network reinforcement. The solution used will be dependent upon the rate of load growth and the local circumstances. It will be chosen to ensure that adequate network capacity is provided whilst minimising costs for future customers.

☑ RIIO-ED1 measure – Demonstrating the use of smart solutions

5.32 Cost effective reinforcement of the network requires the use of smart solutions where appropriate. The actual amount of reinforcement will be determined by many factors outside of the control of WPD and so it is not appropriate to specify a target.

5.33 WPD will demonstrate the adoption of smart solutions by reporting the proportion of reinforcement projects where they are used. It is anticipated that this proportion will be low at the start of RIIO-ED1 and grow as more smart solutions are developed into cost effective alternatives to traditional reinforcement.

Reducing the overall impact of WPD operations on the environment

5.34 The second area of WPD's Environmental Outputs has the objective to reduce the impact of business operations on the environment.

5.35 Our business can have an adverse impact on the environment and, as a minimum, we ensure that it meets legal obligations. Wherever possible we aim to exceed those requirements and seek to adopt best practice where legal requirements do not exist.

5.36 During RIIO-ED1 WPD will:

Reduce technical network losses

- Install oversize transformers when replacing assets at highly loaded locations.
- Use larger sized cables when installing new network in LCT hotspots.

Reduce the carbon footprint of the business

- Ensure all replacement vehicles have lower CO_2 emissions than those they are replacing.
- Ensure all new or substantially refurbished buildings meet, as a minimum, the 'excellent' standard under the Building Research Establishment Environmental Assessment Method (BREEAM).
- Reduce the amount of waste sent to landfill by 20% over the first two years of RIIO-ED1 and 5% per annum thereafter.
- Reduce the carbon footprint of the business by 5%.

Reduce the environmental risk of leaks from equipment

- Reduce by 75% the volume of oil lost through leaks from oil filled cables.
- Reduce by 17% the volume of SF_6 gas that is lost from switchgear.
- Install effective oil containment 'bunds' around plant containing high volumes of oil.

Improve visual amenity in National Parks and Areas of Outstanding Natural Beauty (AONBs)

- Underground 55km of overhead lines in National Parks and AONBs.

Reducing technical network losses

5.37 The process of distributing electricity results in approximately 5% of the electricity entering the network being lost in 'technical network losses'.

5.38 Some of the losses relate to transformers requiring electrical energy to produce the magnetic fields to operate. The majority of losses result from the heating effect of energy passing through cables and wires.

5.39 Losses can be reduced by using lower loss transformers, installing lower resistance cables or reducing the load, but the extensive nature of the network means that uprating equipment to reduce losses is a long term objective.

5.40 We have worked with the Centre for Sustainable Energy to identify that LCT hotspots will develop on 7% of the WPD network. The volumes of loss reduction investment are derived from this work.

Secondary deliverable – Installing oversize transformers

5.41 The losses in a transformer are much lower when the unit is partially loaded and increase greatly as a unit becomes fully loaded. It is therefore possible to reduce the overall losses by oversizing transformers.

5.42 Applying this approach in all cases is not efficient and therefore will only be adopted where there is a strong indication of likely load growth.

5.43 Data derived from the Centre for Sustainable Energy (CSE) forecasts that there is around 7% of our network where the up-take of LCTs will lead to LCT hotspots. When work is carried out to replace assets or reinforce the network in these locations, the transformers used will be oversized to provide a losses benefit and also provide greater headroom for future load growth.

☑ RIIO-ED1 measure – Demonstrating the use of oversized transformers

5.44 It is forecast that on average 109 oversized transformers will be installed each year dependent upon the development of LCT hotspots.

5.45 Progress will be monitored through the reporting of the number of oversized transformers being installed.

Average number of oversized transformers to be installed per annum					
	West Midlands	East Midlands	South Wales	South West	WPD Total
Number of oversized transformers to be installed per annum	27	35	23	24	109

Secondary deliverable – Using larger sized cables

5.46 To reduce the losses in cable requires the cross sectional area of the conductors to be increased (which reduce the resistance to current flowing through them). Once a cable is laid and the ground is reinstated, there is very little opportunity to make changes. The most cost effective opportunity to reduce losses exists at the time that the cable is initially installed.

5.47 The incremental cost of increasing the size of cables is small when compared to the cost of excavation and reinstatement.

5.48 In a similar way to oversizing transformers, larger cables will be used where LCT hotspots develop.

☑ RIIO-ED1 measure – Demonstrating the use of oversized cables

5.49 It is forecast that on average 75km of oversized cable will be installed each year dependent upon the development of LCT hotspots.

5.50 Progress will be monitored through the reporting of the length of oversized cable installed.

Average length of oversized cable to be installed per annum					
	West Midlands	East Midlands	South Wales	South West	WPD Total
Length of oversized cable to be installed per annum	19	24	16	16	75

Reducing business carbon footprint

5.51 Business Carbon Footprint (BCF) represents the impact on the environment from operational activities and is measured and reported using equivalent tonnes of carbon dioxide. It takes account of the energy usage from offices, emissions from vehicles and release of greenhouse gases.

5.52 Ofgem uses reported information to publish league tables that aim to provide reputational incentives to make improvements.

5.53 Within WPD there are a range of activities that will be carried out to reduce the carbon footprint of the business. These secondary deliverables will contribute to the overall reduction of BCF.

☑ RIIO-ED1 measure – Measurement of business carbon footprint

5.54 Reduction in BCF will be demonstrated through the regulatory reporting framework. As well as showing performance against the measures, the reports will describe the actions taken to make improvements.

5.55 During RIIO-ED1 we propose to reduce the business carbon footprint by 5% compared to the 2012/13 position.

Secondary deliverable - Reducing emissions from vehicles

5.56 Our network is spread over an area of 55,500 km^2 and consequently we need to operate a significant fleet of vehicles to allow our staff to serve this territory effectively.

5.57 When our vehicles reach the end of their useful lives they are replaced with modern vehicles. We always ensure that the opportunity is taken to replace them with more fuel efficient engines.

5.58 As an alternative we have also been trialling the use of electric commercial vehicles for some years and we will consider adopting them where they are commercially available and can be deployed effectively.

5.59 The cumulative effect of this fleet replacement is a progressive reduction in greenhouse gas emissions and carbon footprint.

5.60 In addition WPD will provide additional driver training to staff to teach them how to use driving techniques that will reduce fuel consumption with a consequent lowering of carbon emissions and noxious exhaust gases.

☑ RIIO-ED1 measure – Monitor emissions from vehicles

5.61 Our target is to ensure that every new vehicle utilised on our fleet will have lower CO_2 emissions than the like for like vehicle it replaced. This applies equally to using approved Government measures for the 'equivalent tailpipe CO_2 emissions' for any electric vehicles adopted.

5.62 During RIIO-ED1 WPD proposes to monitor the emissions from vehicles to demonstrate the progressive reduction arising from vehicle renewal.

Secondary deliverable – Saving energy following redevelopment of offices

5.63 WPD operates from 59 offices that vary in age and construction. There are opportunities to refurbish some buildings and improve their energy efficiency coincident with when building refurbishment takes place.

5.64 In the West Midlands and East Midlands, many offices were refurbished when facilities were being developed for the WPD local team based operational structure. This work was carried out to the Building Research Establishment Environmental Assessment Method (BREEAM) "good" or "excellent" standards and there is only limited scope to provide further energy savings.

5.65 In the South West and South Wales the properties are older, with more scope to implement energy savings measures. Whenever refurbishment work is planned we will ensure, where appropriate, that it will be carried out to the 'excellent' standard under the BREEAM to reduce energy consumption.

☑ RIIO-ED1 measure – Redevelopment of buildings to 'excellent' standard under BREEAM

5.66 WPD will demonstrate through regulatory reporting that any building refurbishment undertaken will have met the 'excellent' standard under BREEAM.

5.67 This redevelopment will lead to energy saved that will be evident in electricity usage in overall BCF reporting. We propose to save around 5% of electricity used in offices and depot over the RIIO-ED1 period.

Secondary deliverable – Improved management of residual waste

5.68 WPD's business activities create waste. This includes metal from overhead lines, cables and redundant switchgear, wood from wooden poles, packaging from new components, paper from offices and various forms of plastic.

5.69 Many of the items can be recycled and therefore WPD has, for a number of years, segregated and recycled waste to limit the amount being sent to landfill. Whilst we will continue to do this we will also investigate the opportunities to reduce the waste being produced in the first place.

☑ RIIO-ED1 measure – Reduce residual waste sent to landfill

5.70 During RIIO-ED1 further efforts will be made to reduce the amount of residual waste being sent to landfill by 20% over the first two years and 5% per annum thereafter.

Reducing leakage from electrical equipment

5.71 Electrical equipment may contain oil or gas that is used to improve insulation properties or enhance cooling. Under normal conditions the oils and gases are contained within the equipment, but leaks can occur from time to time when equipment is damaged or seals deteriorate.

5.72 The main options available to reduce the environmental impact of any leaks are quick repairs when damage occurs and replacement of the equipment in poorest condition with the highest leakage rates. The environmental impact of leaks from equipment containing high volumes of oil can also be limited by building walls around equipment to contain any leaks within a small designated area allowing the contained oil to be cleaned up in a controlled and effective manner.

☑ RIIO-ED1 measure – Reducing leakage from electrical equipment

5.73 Leakage will be reported for each secondary deliverable with information being reported under the regulatory BCF reporting requirements and included in relevant reputational league tables.

Secondary deliverable - Reducing oil leakage from fluid filled cables

5.74 Older types of higher voltage cables (33kV and above) contain oil based fluids to assist in the insulation and cooling of the cables. These cables sometimes leak, as a result of third party damage or age related degradation. New cable designs do not use this technology, so the problems associated with these cables will reduce over time.

5.75 Fluid levels in all our cables are monitored remotely and loss of pressure triggers alarms within control centres. This allows us to react quickly to a leak event.

5.76 Traditional leak location methods require numerous points of excavation and the use of liquid nitrogen to freeze the fluid to determine which part of the cable is leaking. This process can be lengthy whilst the exact location of the leak is being found. Furthermore, during the leak location process the cable requires to be "topped up" to retain its integrity and consequently where leaks take a long time to locate more fluid is lost to the environment.

5.77 As an alternative, we have begun using a tagging system which uses a small amount of Perflurocarbon tracer (PFT) chemical that can be readily detected above ground that helps to pinpoint leaks quickly and speeds up the repair process. This reduces costs, inconvenience to customers and the volume of oil lost to the environment.

5.78 PFT tagging will be introduced into cables across the WPD area. It will be applied to cables which have a history of leakage.

5.79 Stakeholder engagement sought to identify the scale of replacement programmes, with options for 1%, 5% or 10% being considered. There was strong support for action being taken and stakeholders favoured the extension of the use of chemical tracers for leak location and the replacement of 1% of the poorest condition cables which have the highest leak rates.

☑ RIIO-ED1 measure – Reduction in cable fluid lost to the environment

5.80 During RIIO-ED1 the cables with the highest leak rates, caused by poor condition, will be replaced. In addition, the chemical tracer tagging system will be applied to speed up the location of leaks due to damage or degradation. Together this will reduce the volume of oil escaping and affecting the environment by 75%.

5.81 Data on the volume of oil lost to the environment will be reported under regulatory BCF reporting.

Secondary deliverable – Installing oil containment 'bunds'

5.82 Large transformers and some items of switchgear contain large volumes of oil. This poses a risk of contamination should a leak arise, especially where the equipment is near water courses, water tables or drainage ditches.

5.83 Containment walls or 'bunds' can be constructed around the equipment to prevent oil leaking into the environment. These are designed to be able to contain the full volume of oil that is in the equipment. Bund pumps are installed to keep the bunds clear of water. These pumps can discriminate between oil and water and stop pumping when oil is detected.

☑ RIIO-ED1 measure – Avoiding large scale oil contamination from switchgear and transformers

5.84 During RIIO-ED1 we will ensure that all 33kV transformers and above and any bulk storage sites (those with equipment containing oil in excess of 1,500 litres) will have an effective bund. This will require both new bunds to be established and for the refurbishment of existing bunds that are in poor condition.

5.85 This will prevent large scale oil contamination from switchgear and transformers, avoiding action by the Environment Agency.

Secondary deliverable – Reducing the leakage of SF_6

5.86 SF_6 gas is used throughout the industry as an insulating medium in switchgear. Although it provides many benefits, it is a potent greenhouse gas. There are no current alternatives to SF_6 equipment and so it is replaced when necessary on a 'like-for-like' basis. When switchgear containing SF_6 is retired from the network, the gas is recovered in a similar way to the recovery of gas from old fridges, limiting the amount released to the environment.

5.87 When replacing switchgear, priority is given to switchgear with the highest leak rates.

5.88 During DPCR5 we have been replacing items of switchgear which have proven to be prone to leaks. This includes specific types of pole mounted switchgear with small amounts of gas and larger 132kV substation equipment with large volumes of gas. As this type-specific replacement programme comes to an end, there is currently no next make or model of switchgear that requires a specific targeted replacement programme. In RIIO-ED1 we plan to replace any 11kV distribution assets that leak and for higher voltage assets they will be replaced if they have leaked 3 times.

☑ RIIO-ED1 measure – SF_6 leak reduction

5.89 During RIIO-ED1 WPD will target the replacement of 1% of switchgear with the highest leak rates to reduce the volume of SF_6 lost by 17%.

5.90 Data on the volume of SF_6 lost to the environment will be reported under regulatory BCF reporting.

Improving visual amenity

5.91 WPD operates 92,000km of overhead lines predominantly in rural locations. Whilst overhead lines are widely accepted as being part of the countryside, there are a number of National Parks and AONBs across the WPD geographical footprint containing iconic sites where the removal of WPD overhead lines would improve the visual amenity.

Secondary deliverable - Undergrounding in AONBs and National Parks

5.92 The main method of improving visual amenity whilst maintaining supplies is to replace the overhead lines with underground cables.

5.93 Within WPD the undergrounding of overhead lines is co-ordinated with established steering groups. These are made up from representatives from AONBs and National Parks who assist in identifying and prioritising where the work will take place. We intend to adopt the same approach in RIIO-ED1.

5.94 Stakeholder opinion on this work has been divided and throughout the engagement process some stakeholders have wanted more activity and others less. AONB representatives have also informed WPD that they have limited resources to assist in the process. Having considered the range of views we are proposing to increase the amount of undergrounding carried out.

☑ RIIO-ED1 measure – Length of line undergrounded in National Parks and AONBs

5.95 During RIIO-ED1 WPD will continue to underground overhead lines, working with the National Parks and AONB representatives to determine the lines that provide greatest amenity benefit.

5.96 The length of overhead line to be undergrounded has been informed by stakeholder engagement. It is proposed to underground 55km which equates to an annual volume that is around 35% more than current levels.

Undergrounding in National Parks and AONBs (km)					
	West Midlands	East Midlands	South Wales	South West	WPD Total
RIIO-ED1 Total (8 years)	**14.0**	**10.0**	**10.0**	**21.0**	**55.0**

6 Outputs - connections

6.1 Customers who require a new electricity supply need to obtain a new connection to the network. This includes all demand connections (customers who use electricity), generation connections (customers who generate electricity and may need to export it into the network) and unmetered connections (customers with equipment that does not have its own meter - such as street lighting)

6.2 The objective of connections outputs is to provide an excellent service for customers connecting to the network whilst facilitating competition in the connections market.

6.3 During RIIO-ED1 we will:

Provide a faster and more efficient connections service

- Improve the overall time to deliver a connection by 20%.
- Provide excellent customer service so that customers continue to rank WPD as the top performing DNO group in customer satisfaction surveys.
- Conduct surveys with distributed generation customers to gauge their satisfaction and identify improvements to the service provided.

Improve communication with customers

- Develop and enhance online connections processing and progress tracking.
- Ensure information provided in documentation and online is effective.

Enhance engagement with major customers

- Host quarterly 'surgeries' for connection customers to better understand processes.
- Work with major customers to identify where processes can be improved and quickly implement changes.

Guaranteed Standards of Performance

- Target zero failures of the connection GSOPs.

Facilitation of competitive market

- Improve customer awareness of third party connection providers and carry out regular checks with customers that they understand the options available to them.
- Work with third party connection providers to extend the scope of contestable work to HV and reinforcement work.

Regulatory framework

6.4 Ofgem remains concerned about the service provided by the industry for customers requiring connections. As a result it is strengthening the obligations during RIIO-ED1.

6.5 There will be a package of incentives to promote improvements in the connections service. This package includes:

- a customer satisfaction survey (for minor connection customers);
- a new 'Time to Connect' incentive (for minor connection customers);
- a new 'Incentive on Connection Engagement' (ICE) (for major connection customers).

6.6 In addition, the majority of existing licence condition obligations will be retained. This will include:

- Connections Guaranteed Standards of Performance;
- publication of a Long Term Development Statement;
- publication of a Distributed Generation Connections Guide.

6.7 The range of outputs and secondary deliverables being proposed by WPD shall address all of these areas and in many cases will exceed the requirements.

Providing a faster and more efficient connections service

6.8 WPD already has high levels of customer satisfaction for the provision of connections, but we recognise that further improvements can be made.

6.9 This includes providing a faster response, delivering excellent customer service and understanding customer satisfaction in areas not covered by regulatory measures.

Secondary deliverable - Improve the overall time to deliver a connection

6.10 The overall time to deliver a connection is a combination of the time to provide a quotation and, once the offer is accepted, the time taken to complete the necessary connection works.

6.11 The 'time to quote' covers the process from the customer first requesting a connection to the date on which the quotation is sent to the customer.

6.12 The 'time to connect' covers the process from the customer accepting the quote to the point when the work is completed on site.

6.13 WPD produces over 16,000 quotations and completes connection work to around 10,000 schemes each year connecting some 30,000 new premises.

6.14 Although we endeavour to keep timescales as short as possible for the customer to receive our quotation and for us to complete our works there are a number of factors that can influence the timescale;

- fluctuations in volumes of requests received;
- the need to undertake site visits in a number of cases to fully understand the works required;
- making sure we have been provided with all of the necessary information;
- understanding third party issues such as the costs of permissions for land access and consents;
- the degree of complexity and requirements for detailed network analysis or modelling;
- processing legal documentation for consents;
- arranging resources and materials;
- co-ordinating with on-site construction;
- co-ordinating with highways authorities for street-works notices and permissions;
- outage requests and shut downs (for HV work).

6.15 Some of these factors are outside of our direct control but we accept that customers hold us fully accountable for the end to end delivery. We will therefore complete regular reviews and analysis to understand where improvements can be made. As part of this review we will consult with our customers and continue to refine our processes, incorporating where possible the feedback and suggestions.

☑ RIIO-ED1 measure – Improving the overall time to connect

6.16 Within its strategy document, Ofgem proposes that targets for time to connect will be set and these will decrease as RIIO-ED1 progresses. Ofgem has not yet specified what these targets will be.

6.17 WPD proposes to improve the overall time to connect by 20%. This improvement will be derived from reference performance in 2014/15 once IT systems have been changed to monitor the timescales in line with new regulatory requirements that differ from the data currently being collected.

6.18 Although the Ofgem decision document states that the new overall time to deliver a connection will only apply to certain categories of connection (small developments of typically 1-4 properties), WPD will apply this measure across all market segments, so that all connection customers benefit from process improvements.

6.19 Furthermore, at the mid-point of RIIO-ED1, we will review the progress made and determine whether further improvement can be achieved.

Secondary deliverable – Providing excellent customer service

6.20 WPD recognises that customer satisfaction is very important to the success of the business.

6.21 This applies to the whole connections process, from initial application processing through to final work on site. During the process customers interact with different WPD staff and all interactions should be of an equally excellent standard.

6.22 This requires a strong culture of customer service to be embedded throughout the organisation.

☑ RIIO-ED1 measure – Broad Measure of Customer Satisfaction (BMCS)

6.23 Part of the BMCS assesses customer satisfaction specifically for connection customers. Ofgem is proposing to increase the financial reward and penalty in this area to strengthen the incentive on companies to seek improvements. It will also set targets based upon industry performance in DPCR5.

6.24 WPD will seek to improve all of the interactions with its customers so that customers continue to rank WPD as the top performing DNO group and so that we continue to exceed regulatory targets.

Secondary deliverable – Extending satisfaction surveys to distributed generation customers

6.25 During DPCR5 the BMCS has surveyed mainly demand customers. Because increasing volumes of distributed generation are being connected to the network there is a growing number of customers who do not contribute to the satisfaction surveys.

6.26 WPD wants to understand better how these customers view the service that they receive. We will therefore extend the customer survey principles to include more distributed generation customers. This will allow us to monitor our performance in this area and ensure that we deliver high levels of customer satisfaction.

☑ RIIO-ED1 measure – Extended BMCS for generation customers

6.27 We will carry out surveys with generation connection customers, replicating the questions asked to demand connection customers. This will provide information that we will use to identify areas for improvement.

6.28 Each year, we will publish the results in our stakeholder report.

Improve communication with customers

6.29 In the majority of cases good customer satisfaction is only possible with good communication.

6.30 Customers seeking a connection require clear information on their options, the process for connection and what they need to do. This information is provided in leaflets, online via our website, by customers making telephone contact with contact centre staff or by direct contact with locally based planners. The amount of information required by customers differs depending on the complexity of the connection and the knowledge of the customer. It can range from simplified process explanations to provision of detailed network parameters.

Secondary deliverable – Provision of information

6.31 The information provided in leaflets and online will be regularly reviewed and updated to ensure it reflects improvements to business processes and incorporates feedback from customers.

6.32 Recent improvements to the WPD website www.westernpower.co.uk already make it easier for connection customers to find, understand and download relevant information. A dedicated connections area can now be accessed directly from the main screen. However we can always improve and feedback from customers will be used to continue to refine the website to improve ease of use and information availability.

6.33 Third party connection providers have on-line access to relevant WPD policies and specifications which are required for the design and construction of connection assets that will subsequently be adopted by WPD. This provision will be continued and enhanced based on feedback from those providers.

6.34 We will continue to provide network information. This is currently obtained either on request (via an online map) or through a subscription service for customers who require regular access to our data.

6.35 Assistance is provided for distributed generation customers in the West Midlands and East Midlands through a 'Generation Capacity Map' that gives an indication of the potential capacity for large generators connecting to the 11kV network. This will be extended across the whole of WPD.

6.36 A range of leaflets are available on connections processes, competition in connection or legal permissions. We will seek feedback from users to allow us to simplify or clarify the literature which will be regularly reviewed and updated.

6.37 The Long Term Development Statement will be produced annually for each licence area and made available via the website.

6.38 WPD will contribute to updating the industry wide Distributed Generation Connection Guide, coordinated through the ENA.

6.39 Contact centre staff will be provided with on-going training and up to date information to allow them to answer key questions that customers may ask.

6.40 In summary, WPD will continue to listen and respond to the requirements of customers, developing new information resources that make it easier and clearer for customers to connect to the network.

☑ RIIO-ED1 measure – Review of available information sources

6.41 Each year, WPD will report on the changes made to information systems for connecting customers. This will allow customers and stakeholder to see what information sources have changed and identify any new systems that have been introduced.

6.42 Each year, we will publish the results in our stakeholder report.

Secondary deliverable –Online tracking

6.43 Some customers have indicated they prefer to carry out transactions and track progress online. This includes facilities for applications, payments and tracking of progress.

6.44 On-line progress tracking (called CIRT) has already been introduced for third party connection providers. The next development will allow this to be extended to larger developers and finally to all customers.

6.45 The scope of online tracking will be enhanced and new facilities provided in response to customer feedback.

☑ RIIO-ED1 measure – Review of available information sources

6.46 The facilities available for on-line connection application and tracking will be published in the annual stakeholder report.

Engagement with 'Major Connection' customers

6.47 Major Connection customers (generally large developers, Distributed Generation (DG) customers and multiple site developers) have a wide range of requirements for their connections and the connection arrangements can be complicated. Whilst generic information is available, these customers usually require additional details and a more interactive communications process.

6.48 WPD will build on the existing engagement that has been established with DG connection customers where feedback has already led to the implementation of improvements. Typical examples are:

- an internal standard where customers are contacted within two days of initial application to discuss requirements;
- re-launch of a distributed generation map in the Midlands and extension to coverage of South West and South Wales in 2013;
- development of the CIRT online tracking system for independent connection providers (ICPs) and independent distribution network operators (IDNOs) which is to be extended to the wider customer base;
- improved and more detailed breakdown of connection charges in quotations to provide more transparency of prices.

6.49 Future engagement will seek to understand better the requirements of Major Connection customers so that information provision, communication processes and work delivery can be improved.

6.50 To achieve this we will implement an annual programme of stakeholder engagement for Major Connection customers across all non-competitive market segments.

6.51 We propose to extend the use of local 'surgeries' where connection customers can attend events hosted at local offices to learn about the connections process, discuss issues and meet the WPD staff they interact with. Each year there will be four local surgeries across the company and they will be held at different offices in successive years to allow different local customers to attend.

6.52 In addition there will be two Major Connection customer workshops: one for the Midlands and another for South West and South Wales. These will look at the issues facing the wide range of Major Connection customers and identify potential solutions or improvements.

6.53 Following the workshops a work plan will be developed defining proposed improvements, timescales and targets.

6.54 The WPD Customer Panel will be used to sign off on the work plan and progress will be reported to the panel members every quarter.

6.55 Where appropriate, we will work with individual customers on trials of any initiatives to ensure that the 'business-as-usual' rollout is successful for both the end customers and WPD. An example of this is the testing of a new online applications system with a selection of volunteers across the range of customer types.

6.56 To keep Major Connections customers informed, we will publish an agreed plan of action and any changes resulting from the engagement.

6.57 We propose to implement some of these changes prior to the start of RIIO-ED1 so that we can gain a better understanding of the issues and start to work on solutions.

☑ RIIO-ED1 measure – ICE Incentive

6.58 Every two years WPD will submit to Ofgem evidence of Major Customer engagement for each market segment. This will identify how we have identified, engaged with and responded to the needs of customers.

6.59 Ofgem will assess the submissions against minimum requirements. There are no rewards available, but Ofgem can apply penalties where engagement is deemed to be inadequate.

6.60 We will ensure that the engagement we carry out meets all the criteria, thus avoiding any penalties.

Meeting connections Guaranteed Standards of Performance

6.61 The final proposals for DPCR5 introduced new standards to establish minimum levels of service and to set out the level of compensation to customers where these standards are not met.

6.62 There are thirty guaranteed standards of performance covering all the aspects of connection provision including:

- providing budget estimates;
- providing quotations for connections;
- contacting customers to schedule work;
- commencing works on site;
- completing work on site;
- completing energisation;
- repairing faults on unmetered connections;
- providing quotations for unmetered supplies;
- quotation accuracy;
- failure to make a payment against one of the standards.

6.63 Each failure of a standard results in a payment to the customer with the majority of connections standards having a per day cumulative penalty.

6.64 We will voluntarily double the value of payments for failures against guaranteed standards. The provision of these enhanced compensation levels will not have a significant financial impact on WPD but we feel there is a need to ensure customers are adequately recompensed should our service standards fail to meet minimum expectations.

☑ RIIO-ED1 measure – Number of Guaranteed Standard failures

6.65 WPD will continue to target zero failures against all the standards throughout RIIO-ED1.

Facilitation of competition

6.66 Providing choice for customers drives companies to improve service and become more efficient.

6.67 Prior to the introduction of competition for the provision of connections, customers could only request a connection from the incumbent DNO. Customers now have the choice of two alternatives: Independent Connection Providers (ICPs) (who construct the network and pass on ownership of that network to WPD) or Independent Distribution Network Operators (IDNOs) (who construct the network and retain ownership and operation of that network).

6.68 Competition has developed in the WPD area and was recognised by Ofgem in their assessment of WPD's first Competition Test submission. Ofgem's determination in February 2013 concluded that 12 market segments are competitive. These are:

- Unmetered connections, Private Finance Initiative work – in all 4 licence areas;
- Unmetered connections, local authority work – in all 4 licence areas;
- Metered demand connections HV and EHV work – in East Midlands and West Midlands;
- Metered demand connections EHV and above work – in East Midlands and West Midlands.

6.69 We will continue to promote competition and identify opportunities to inform customers that they have a choice. An annual survey will be used to gauge the level of customer awareness.

6.70 Although third parties can provide new connections, they cannot carry out all aspects of connections work. WPD has been actively assisting competition, developing new processes and systems to allow third parties to extend the scope of what they can do. In 2011, live LV jointing trails were conducted. As a result, agreements have been developed that allow third parties to have access to the LV networks which makes the majority of LV work open to competition. Many third party connection providers have signed up to these agreements and are now making their own connections to the WPD network.

6.71 During 2013, the scope of these agreements is being extended to HV jointing although facilitation of competition will not stop there and we anticipate that this will soon include interconnection to the HV network and reinforcement work. Further extension will be considered in response to the requests from third party connection providers.

6.72 We are proposing to provide faster response to connection requests, improve the data we provide and improve connection processes. We will ensure that all general improvements made to connections processes and timescales apply equally to the service provided to third party connection providers.

Secondary deliverable – Customer awareness of alternative providers

6.73 Competition in connections is still evolving and so it is important that connection customers are made aware that alternative providers exist.

6.74 We provide clear links to competition in connection information on the main connections page of the WPD website and our connection process flowcharts include the option of using third party connection providers. We also include information about the availability of alternative connection providers in connection packs sent to customers.

6.75 One way of demonstrating awareness of alternative providers is to measure the market share lost. This may not give a true reflection of awareness because connection customers, who are aware they have a choice, may still elect to obtain connections from WPD.

6.76 For this reason, we propose to carry out a survey each year asking connection customers who have obtained a connection from WPD whether they were aware that they could have asked a

third party to provide the connection. This survey will be supplemented with feedback from the engagement with major customers on how awareness can be improved.

☑ RIIO-ED1 measure – Annual survey of customers awareness of alternative providers

6.77 The results of the annual survey will be published in the WPD stakeholder report and the information will be used for future competition test submissions.

Secondary deliverable – Extension of contestable work to HV

6.78 Existing developments to extend contestable work to HV has allowed third party jointers to carry out the physical connection work on site under the operational control and instruction of WPD authorised staff.

6.79 This will be extended to allow third parties to carry out their own switching, testing and commissioning. Should third parties require it, work on overhead lines will also be considered.

6.80 All these extensions will require careful consideration of the operational safety rules, the interactions with WPD authorised staff and WPD control, consideration of network security for customers and appropriate testing of new installations before energisation.

☑ RIIO-ED1 measure – Extension of contestable HV work

6.81 During RIIO-ED1 WPD proposes to work with third party service providers to extend the scope of HV work that can be carried out by third parties and incorporate these into Common Connections Charging Statements.

Secondary deliverable –Extension of contestable work to reinforcement

6.82 In the majority of cases, new connections can be made without the need to reinforce the existing network. The evolution of contestable work has therefore concentrated on the larger aspects of connections provision, starting with the assets on the new development and progressing onto the points of connection with the existing network.

6.83 Network reinforcement is required where there is limited capacity on the existing network to accommodate the load of new connections. It may result in upstream assets being increased in size or additional circuits being provided.

6.84 Part of assessing a connection application includes network analysis to determine whether reinforcement is necessary. We anticipate that WPD will continue to assess this need, but that the work may be delivered by a third party.

6.85 Third parties do not currently carry out reinforcement work. In limited situations they may lay cables, but do not make any interconnections.

6.86 During RIIO-ED1 the scope of contestable work will be extended to allow third parties to carry out network reinforcement. This will require changes to technical processes, interaction between WPD and third parties and financial transactions. For example processes will be required to provide funds (from DUoS) to the third party to pay for the part of the reinforcement not funded by the customer.

☑ RIIO-ED1 measure – Extension of contestable work to reinforcement

6.87 During RIIO-ED1 WPD proposes to allow third parties to carry out reinforcement work and the scope of this work will be incorporated into Common Connections Charging Statements.

7 Outputs - customer satisfaction

7.1 The provision of excellent customer service for WPD's 7.8 million customers is a core business objective.

7.2 WPD will deliver the following customer satisfaction outputs and secondary deliverables during RIIO-ED1:

Customer service

- Continue to be the number one performing DNO group across all elements of the Broad Measure of Customer Satisfaction.
- Maintain certification to the Customer Service Excellence standard.

Telephone response

- Respond to telephone calls quickly; answering them within 2 seconds.
- Ensure abandoned calls are less than 1%.
- Always provide customers with the option to talk to a WPD call taker.

Communication with customers

- Provide a restoration time for every outage.
- Call back all customers who have been in contact about a fault.
- Contact customers within two days of receiving a non-fault enquiry.
- Provide on demand messaging via text and social media for customers who want be kept informed by means other than the telephone.
- Develop 'self-service' options for customers to find information online.

Stakeholder engagement

- Continue to host a Customer Panel where the CEO will meet with WPD's expert stakeholders four times a year.
- Continue to host an annual round of at least 6 stakeholder workshops.
- Continue to produce a stakeholder report every year providing an update of actions taken as a result of stakeholder engagement.

Complaints

- Resolve at least 70% of complaints within one day.
- Continue to have a target of zero complaints where the Ombudsman has to get involved.

Guaranteed Standards of Performance (GSOPs) awareness

- Continue to send the 'Power for Life' publication to all 7.8 million customers which will include promotion of the GSOPs.

Regulatory framework

7.3 Ofgem wants to ensure that DNOs are focussed on providing a good service to customers.

7.4 Ofgem will assess customer service by using the Broad Measure of Customer Satisfaction (BMCS) that was introduced in DPCR5, but some of the elements and weightings will be revised.

7.5 The BMCS is an incentive mechanism that provides rewards or penalties in three areas of customer service: customer satisfaction, complaints and stakeholder engagement.

7.6 Customer satisfaction is assessed through a survey and deals separately with three types of interaction:

- customers requesting a connection (minor connections only);
- customers experiencing a supply interruption;
- customers making a general enquiry.

7.7 The complaints part of the BMCS results in penalties where DNOs do not meet specified target performance. The measure is subdivided into four components with greater weighting applied to repeat complaints and complaints that take longer than 31 days to resolve.

7.8 The final part of the BMCS considers stakeholder engagement with rewards available for DNOs that engage well and use the information obtained to improve the service provided to customers. This incentive has been strengthened to encourage DNOs to focus more on issues relating to vulnerable customers.

7.9 The range of outputs and secondary deliverables being proposed by WPD address all these areas and describe a number of different approaches we will use to continue to provide excellent customer service.

Customer service

7.10 WPD consistently achieves excellent levels of customer service that are reflected across all elements of the Broad Measure of Customer Satisfaction. Our reputation for customer service has generated a lot of interest from other customer service organisations with many visiting us to learn how they can improve.

7.11 During RIIO-ED1, we will continue to refine and improve the processes and practices for customer service to maintain industry leading performance. We will use feedback from our stakeholders and learning from best practice in other organisations to make improvements to what we do and how we do it.

☑ RIIO-ED1 Measure – Broad Measure of Customer Satisfaction

7.12 The regulatory Broad Measure of Customer Satisfaction covers the majority of customer service considerations and, during RIIO-ED1, our target will be to remain a top performer within the Broad Measure.

Customer Service Excellence standard

7.13 The Customer Service Excellence standard is a Government scheme which recognises organisations that provide effective and excellent customer service. WPD has been accredited to the standard since 1992 (when it was known as the Charter Mark).

7.14 Every year, Customer Service Excellence assessors review customer service against five criteria:

- customer insight;
- culture of the organisation;
- information and access;
- delivery;
- timeliness and quality of service.

7.15 WPD proudly achieves 'Compliance Plus' ratings against the standard in a number of areas. A copy of the 2013 assessment can be found at the following link: http://www.westernpower.co.uk/docs/About-us/Stakeholder-information/Our-future-business-plan/Supporting-Outputs-information/2013-Customer-service-excellence-report.aspx

7.16 Since the Customer Service Excellence standard provides an independent view of WPD's customer service, we will continue to be assessed against it.

☑ RIIO-ED1 measure – Assessment against Customer Service Excellence standard

7.17 WPD will continue to target to exceed the compliance requirements of the Customer Service Excellence assessment criteria, demonstrated by achieving 'Compliance Plus' ratings.

Telephone response

7.18 Allowing customers to speak to someone is an essential part of good customer service and we are proud of the telephone response that we already provide.

7.19 We will continue to operate highly efficient Contact Centres using the latest technology to provide automated messaging for power loss in addition to well trained staff to talk to customers who wish to speak to us in person.

7.20 Where circumstances lead to exceptionally high call volumes, we expand the number of call takers by using trained staff across our business to maintain service levels and provide customers with information.

7.21 We also provide facilities for contact centre and other trained staff to take calls at home, should bad weather prevent them from travelling to work.

Answering calls quickly

7.22 Whilst there are no incentives in this area, we recognise that customers can be frustrated when their calls are not answered quickly.

☑ RIIO-ED1 measure – Answering calls quickly

7.23 During RIIO-ED1, we will target to answer calls within two seconds.

Low rates of abandoned calls

7.24 Abandoned calls arise when customers decide to hang up before they speak to a call taker. This is normally as a result of being kept on hold for a long time. WPD's approach of answering call quickly results in very few abandoned calls.

☑ RIIO-ED1 measure – Keep abandoned calls at a low level

7.25 During RIIO-ED1, we will target to have less than 1% of our inbound calls being abandoned.

Speaking to a call taker

7.26 Whilst messaging is adequate for some customers, many prefer to speak to a call taker to find out further information or get reassurance about when supplies will be restored.

☑ RIIO-ED1 measure – Provide an option to talk to a call taker

7.27 We will ensure that telephony systems will continue to provide customers with the option to talk to a call taker.

Communicating with customers

7.28 Customers want to be kept informed and updated when they have an enquiry, require a service or are off supply. These are simple requirements and we will continue to build on the service initiatives we have introduced in DPCR5.

7.29 We will develop new channels of communication beyond the traditional telephone and written methods. Advances in technology mean that customers want to be able to communicate online, via e-mail, text, smart phone or social networks.

7.30 Part of our stakeholder engagement has been used to explore which communication methods should be considered. Stakeholders suggested that many organisations, including local authorities, are using alternative technology and that multi-media communications should be available.

7.31 Stakeholders also stressed that changes should be implemented quickly and at no extra cost to customers. We have already started the development of systems and processes and we will continue to develop these and other new technologies during RIIO-ED1.

Provide a restoration time for every outage

7.32 When supplies are interrupted, customers welcome good information about when they will be back on supply.

7.33 Currently information on estimated time of restoration is provided for the majority of the outages but for a number the restoration times are still uncertain.

☑ RIIO-ED1 measure – Provide a restoration time for every outage

7.34 During RIIO-ED1, we will obtain regular progress updates from field staff to provide a restoration time for every outage.

Call back customers who have been in contact about a fault

7.35 When customers contact WPD because they are off supply the main thing they want to know is when the power will be restored. In some situations it is difficult to accurately predict the duration of an outage initially and as the fault progresses it may become necessary to revise the estimated time of restoration.

7.36 For some time WPD has been calling customers back and has carried this out for 40% of customers who call about faults.

7.37 During RIIO-ED1 all customers contacting WPD about a fault will be offered a call back to provide progress updates or check that supplies are restored. During the call backs, the opportunity will be taken to gain feedback on the service provided to obtain useful information for further service improvements.

☑ RIIO-ED1 measure – Call backs

7.38 All customers who have been in contact about a fault will be offered a call back.

Contact customers within two days for non-fault enquiries

7.39 Feedback from connection customers has led to the development of an internal standard for contacting customers for non-fault enquiries. When customers make an application for a new connection or make any other general enquiry, their details are logged on WPD systems by central administrative staff. This creates a prompt for local teams to contact the customers.

7.40 This approach means that customers asking for action from us will be contacted by a local team member who will be directly involved with addressing the customer's requirements. The internal standard requires that contact is made within two days of receiving the request.

☑ RIIO-ED1 measure – Contact customers within two days for non-fault enquiries

7.41 During RIIO-ED1, all customers with non-fault enquiries will be contacted within two days.

Provide on-demand messaging

7.42 Some customers want to be kept informed about what is happening on the network through communication methods other than the telephone. Advances in communication technology have changed the way some people access information. Texting and the use of social media are used widely and some customers want the option to receive on-demand services.

7.43 We will develop systems to provide messaging via text and social media to send information to customers who have asked to be kept informed.

☑ RIIO-ED1 measure – Provide on demand messaging

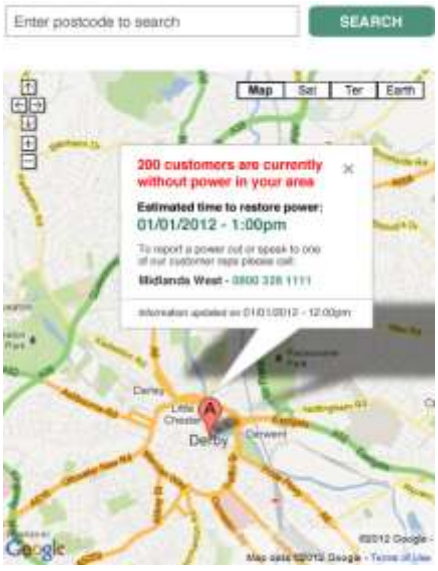
7.44 During RIIO-ED1, we will develop systems to provide on-demand messaging via text and social media, evolving the systems as communication media change. When developed and tested, the on-demand options will be publicised on the WPD website.

Develop 'self-service' online information

7.45 In addition to providing on demand services we will also enhance the 'self-service' capability of the WPD website to allow customers searching for network outage information to find it quickly and in an easy to use format.

7.46 Some customers and public service organisations would like the facility to access information on faults affecting them via laptop, tablets or smart phone technology.

7.47 Ahead of RIIO-ED1 we will introduce a revised map-based online information system that enables customers to get real time up to date incident information. It will provide information specific to postcodes and includes contact information should customers then wish to speak to us.



☑ RIIO-ED1 measures – Develop 'self-service' online outage information

7.48 We will develop 'self-service' options for customers to find outage information online, providing a quick link to the service from the homepage of the WPD website.

Engaging with stakeholders

7.49 Regular stakeholder engagement is used to improve day-to-day operations and inform business priorities. WPD has over 4,500 active stakeholder contacts, categorised into customer segments, allowing targeted engagement of specific issues. Engagement occurs throughout the business and there are specific events dedicated to stakeholder engagement.

7.50 Every quarter, WPD's CEO meets with an expert Customer Panel to shape our thinking and future priorities. This group is made up of 20 permanent members with at least one member for each customer segment to ensure views are balanced and representative of all stakeholders.

7.51 In addition, there are at least six stakeholder workshops held every year where key themes and investment priorities are tested and discussed with a wider audience. These are facilitated by WPD staff, alongsideprofessional event organisers who encourage contribution and objectively record responses.

7.52 Periodically market research is used, accessing a large number of stakeholders, to carry out in-depth surveys that provide views on investment priorities.

7.53 An annual awareness campaign is used to make customers aware of WPD. This includes the distribution of the 'Power for Life' publication to every household and television adverts shown at different times on a variety of stations. This provides information for customers and invites them to contact WPD to ask further questions.

7.54 Together these events provide very useful feedback and will continue during RIIO-ED1.

☑ RIIO-ED1 measure – Customer Panel

7.55 We will continue to host a Customer Panel where the CEO will meet with WPD's expert stakeholders four times a year.

☑ RIIO-ED1 measure – Stakeholder workshops

7.56 We will continue to host an annual round of at least 6 stakeholder workshops across the area.

☑ RIIO-ED1 measure – Stakeholder report

7.57 We will continue to produce a stakeholder report every year providing an update of actions taken as a result of stakeholder engagement and an update of progress towards delivering RIIO-ED1 output measures.

Resolution of complaints

7.58 WPD endeavours to get things right first time but sometimes things can go wrong. When complaints are received they are treated with urgency and with an aim to resolve them to the customer's satisfaction quickly. Local team managers are responsible for dealing with complaints visiting customers where necessary to understand what can be done to put things right.

7.59 Performance is measured within the BMCS in four categories:

- complaints resolved in day 1;
- complaints remaining unresolved after 31 days;
- repeat complaints;
- Ombudsman referrals.

7.60 WPD will target to have leading performance in each element in the overall measure, avoiding penalties from Ofgem.

☑ RIIO-ED1 measure – Resolving complaints within one day

7.61 WPD will aim to resolve at least 70% of complaints within one day although the overall performance will be determined by the regulatory BMCS measure.

7.62 Consistent reporting has been available for 2011/12 and 2012/13 and WPD's average performance over the two-year period is shown in the table below.

Percentage of complaints resolved in day one (two year average)					
	West Midlands	East Midlands	South Wales	South West	WPD Total
Percentage of complaints resolved in day 1	64%	62%	54%	53%	59%

☑ RIIO-ED1 measure – Ombudsman investigations

7.63 If they are dissatisfied with a DNO's response customers have the option to raise their complaint with the industry Ombudsman. WPD will ensure that every complaint is adequately dealt with by WPD staff and have a target of having zero complaints needing to be investigated by the Ombudsman.

7.64 We have achieved zero Ombudsman complaints in WPD South Wales since 2003 and in WPD South West since 2005. We had zero Ombudsman complaints in both WPD East Midlands and WPD West Midlands in 2012/13.

Increasing awareness of Guaranteed Standards of Performance

7.65 GSOPs provide a means for individual customers to receive compensation payments when performance fails to meet the standards. They cover the provision of connections, supply interruptions and response to problems such as voltage complaints. WPD performs well across all categories and the number of failures is very low.

7.66 Ofgem are concerned that some customers may not be sufficiently informed about guaranteed standards and are therefore potentially missing out on some payments, particularly where standards require customers to claim following failures.

7.67 Where WPD is aware of a failure, a payment will be made without the need for a customer to claim.

7.68 Every year, we will publicise the Guaranteed Standards of Performance (GSOPs) in WPD's 'Power for Life' publication that is posted to all WPD customers. GSOPs will be a permanent article in the publication so that customers are continually reminded of the standards that apply to our service.

☑ RIIO-ED1 measures – Annual communication to all customers

7.69 We will continue to send the 'Power for Life' publication to all 7.8 million customers to raise awareness of WPD, which will include information about GSOPs and links to more detailed information.

8 Outputs - social obligations

8.1 WPD's vulnerable customer strategy is designed to deliver the following social obligations outputs and secondary deliverables during RIIO-ED1:

Improving understanding of vulnerability

- Work with expert partners to improve understanding of the needs of vulnerable customers.
- Train staff to recognise the signs of vulnerability.

Improve the data held on the Priority Services Register

- Proactively contact vulnerable customers at least once every two years to check the details on the priority service register.
- Improve the quality of Priority Services Register data by working with other agencies and sharing information.
- Co-ordinate meetings with suppliers to agree criteria for vulnerability.

Improve the services provided for vulnerable customers

- Raise awareness of the Priority Service Register.
- Make 10,000 crisis packs available.
- Contact all medically dependent customers every three hours during power cuts.
- Continue to provide practical support via the RVS and British Red Cross.
- Seek feedback from vulnerable customers to improve service.
- Develop mechanisms for sharing information with local resilience forums.

Address fuel poverty by supporting customers to access key information

- Build a database of regional agencies we can refer customers to for assistance.
- Work with partners to develop links to/from WPD's website.
- Develop joint information, awareness campaigns and co-ordinate assistance with partners.
- Provide bespoke training to WPD front line staff.
- Use data analysis to help identify localities with high concentration of vulnerable households.
- Develop local outreach services.

WPD's vulnerable customer strategy (VCS)

8.2 Since 2005, WPD's partnership approach to vulnerable customers has been recognised as best practice by Ofgem's Customer Service Reward and the Government's Customer Service Excellence accreditation.

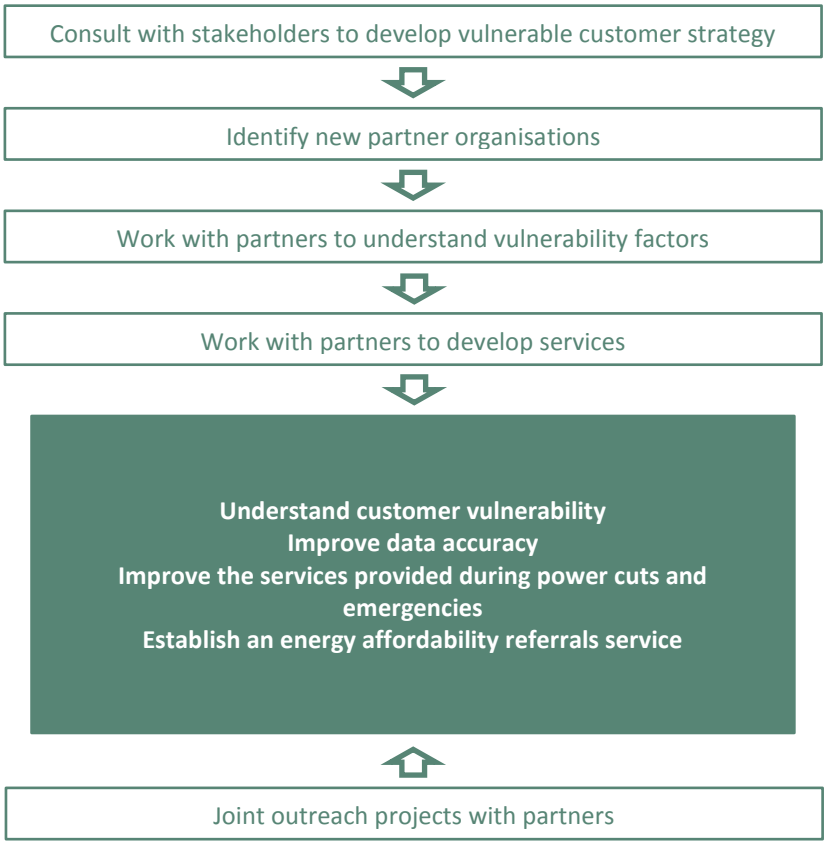
8.3 During this time, WPD's approach to service provision has been focused on customers on the Priority Services Register (PSR) who are registered as being dependent on electricity due to age, disability or chronic illness.

8.4 Going forward, WPD will focus on social obligations in relation to a broader group of customers who are defined as vulnerable for a range of reasons including energy affordability. In order to respond to the needs of these customers, WPD has consulted stakeholders on new approaches to vulnerability.

8.5 Our VCS will achieve the following objectives;

- understand the nature of vulnerability and customer need;
- improve the accuracy of our records with respect to vulnerable customers;
- improve the services provided to vulnerable customers during power cuts and emergencies;
- refer customers to partners that can assist with energy affordability matters.

8.6 The diagram below shows the main elements of the WPD VCS.



Stakeholder engagement

8.7 Stakeholders have played an important role in the development of the WPD VCS.

8.8 We attended Ofgem's workshops on customer vulnerability to hear initial stakeholder views.

8.9 We asked the Centre for Sustainable Energy (CSE) to develop a brief on the issues around a DNO's response to vulnerability and energy affordability and also conduct workshops with WPD. This formed the basis of our consultation.

8.10 We consulted with our Customer Panel on the appropriate response of WPD to social obligations, and worked with one particular member from the British Red Cross to develop a proposed delivery strategy.

8.11 We presented our draft social obligations proposals on vulnerability at the National Energy Action Conference in Cardiff on 31 January 2013. Specific interest groups were invited to participate in social obligations workshops held in Bristol and Birmingham, where we consulted on our proposed social obligations outputs. These workshops also provided an opportunity to identify future community partners.

8.12 We included social obligations within our Business Plan workshops attended by a wide range of stakeholders (see Stakeholder sections for further details).

8.13 We held a further session with our Customer Panel to consult on our proposed social obligations outputs and costs within the draft Business Plan.

Stakeholder views

8.14 Our stakeholders agreed that WPD should have a role in supporting vulnerable customers and told us that we should:

- develop new ways to maintain up-to-date PSR records;
- focus on enhancing our existing core services in conjunction with partner organisations (such as the British Red Cross, RVS and Local Resilience Forums) and embed them further into routine business operations;
- engage with customers, where the opportunity arises, to provide access to information and advice about energy affordability issues;
- avoid duplicating assistance available from other organisations by building referral networks with community organisations.

8.15 We have used this stakeholder feedback to develop our Vulnerable Customer Strategy and specific actions proposed for RIIO-ED1.

Building on existing partnership working

Working in partnership

8.16 WPD already leads the industry in the provision of services to priority needs customers through partnership working. Our partners have a good understanding of the needs of vulnerable customers and by working together we improve how we deal with those customers. During RIIO-ED1 we will enhance the services we provide with our existing partnerships. We will also look to develop links with additional community organisations that can provide assistance for different types of vulnerable customers.

Providing support during power cuts

8.17 During prolonged power cuts we operate partnership initiatives with the British Red Cross, RVS and oxygen providers.

8.18 We also work closely with Local Resilience Forums to co-ordinate services during severe weather and other emergencies.

8.19 These organisations and others such as Age UK work with us to help vulnerable customers prepare for power cuts and we will continue to work with these partners to provide assistance relating to power cuts.

Using partnerships to improve the accuracy of the Priority Services Register

8.20 WPD holds a Priority Services Register (PSR) that records details about vulnerable customers so that additional support can be provided when any of these customers contact WPD or when their supply is interrupted. Approximately 715,000 customers are on the PSR across our four licenced areas which equates to almost 10% of our customer base. Over 165,000 customers are registered for medical dependency on power or for special communication needs.

8.21 It is important that the register is accurate so that resources are deployed effectively. Partnership organisations can hold information that helps us to keep the register up-to-date. For example we have worked with oxygen providers to share data about medically dependent customers. Where data protection requirements can be met, we will work with suppliers and community partners to find solutions to enable sharing and improving data.

Working with partners to develop services

8.22 We work with partners to develop and provide services for vulnerable customers. Some of the existing approaches include:

- 'Louder Than Words' services accredited by Action on Hearing (formerly RNID);
- 'Language Line' service to provide translation for customers;
- advice leaflets written by Mencap in easy read format;
- partnership with the disability theatre group High Jinx to understand the communication needs of disabled or other vulnerable customers.

8.23 We will continue to work with a range of third parties to provide accessible services and make use of new technology.

Working with partners to tackle fuel poverty

8.24 Although as a DNO we have no direct obligations to deal with fuel poverty, we do have a social responsibility to play a role in addressing fuel poverty and cold homes.

8.25 We have begun to act through partnerships with Warmfront/Home Energy Efficiency Scheme and National Energy Action to facilitate initiatives to tackle fuel poverty in relation to priority needs customers.

8.26 Going forward, we will develop a network of partners to help establish an energy affordability referrals service.

Improving our understanding of vulnerability

8.27 WPD will adopt the British Standard on Inclusive Service Provision (BS 18477:2010) to provide a framework for developing our understanding of vulnerable customers. This standard states: "*Consumer vulnerability is relative and dynamic, and a consumer's needs and abilities can change with time or circumstance*".

8.28 We will build a network of partners who can provide a better understanding of vulnerability factors to help us to determine the needs of these customers and work with us on new initiatives.

8.29 It is important that staff are trained to recognise vulnerable customers so that they can provide the appropriate services.

8.30 We will work with partners to develop bespoke communication and listening skills training for front line Contact Centre staff to enable them to identify key warning signs of vulnerability. This will include recognising signs of disability, illness, age and fuel poverty.

☑ RIIO-ED1 measure – Partnerships

8.31 The scope of our understanding of vulnerability will be demonstrated by the range of partners we have engaged with and initiatives we are undertaking with them.

☑ RIIO-ED1 measure – Staff training

8.32 During RIIO-ED1 we will develop training material and describe the scope of the training in regulatory submissions for stakeholder engagement for vulnerable customers.

Improving the data held on the Priority Services Register

8.33 Customers are added to the PSR mainly via notification from electricity suppliers. Over time, circumstances may change: sick people may recover following surgery, elderly people may move to residential homes or people may simply relocate. Customers often forget to notify their supplier of changes that affect the PSR and as a result records can become out of date.

Contacting PSR customers

8.34 At present WPD uses several approaches to validate data on the PSR. When customers with a medical dependency or special communication need join the PSR, we write to them to provide power cut advice and a direct dial number. This provides an opportunity to check that the details received from suppliers are correct. In addition when power cuts affect customers on the PSR the accuracy of existing records can be verified. We have also run a programme of writing to customers to confirm their details. This needs to be handled sensitively as receiving such a letter can be upsetting for customers who may have lost that relative.

8.35 To ensure that PSR records are regularly checked, WPD will set up a dedicated team of staff trained to contact customers and validate the details held about them. By working through the list progressively, the accuracy of the data will be improved. The process will be repeated every two years. We will pilot this in advance of RIIO-ED1 to ensure that we develop the best approach to carrying this out efficiently.

☑ RIIO-ED1 measure – Contacting PSR customers every two years

8.36 The number of PSR records that are validated each year will be published in the annual stakeholder report. This will be shown relative to the total number of records to illustrate that the two year cycle of contact is being achieved.

Working with other agencies to identify vulnerable customers

8.37 Other public service centred organisations such as utilities, local authorities, housing associations and the health service all collect data about vulnerable customers. In many instances data protection regulations prohibit the sharing of data without consent. Where data protection allows, WPD will work with these organisations to identify additional customers that should be on the PSR.

8.38 We will also make use of independent data models that identify types of customers. For example the Centre for Sustainable Energy has undertaken a project 'Who's on the Wires' which identifies likely areas of fuel poverty. This will allow us to direct information and resources to the right areas.

☑ RIIO-ED1 measure – Using data from other agencies

8.39 We will describe the activities that we have carried out with other agencies to identify additional vulnerable customers in submissions to Ofgem for the stakeholder engagement part of the BMCS.

☑ RIIO-ED1 measure – Working with suppliers to agree criteria for vulnerability

8.40 We will work with suppliers to agree the criteria for identifying and describing vulnerable customers so that the services the industry provides are more co-ordinated. Progress will be reported in submissions to Ofgem for the stakeholder engagement part of the BMCS.

Providing additional services for vulnerable customers

8.41 Electricity is an essential part of modern life and customers have become increasingly reliant on an uninterrupted supply. It is vital that vulnerable customers are prepared for a power cut and know how to cope. Customers, especially those dependent on electricity, are advised to have alternative arrangements such as battery powered back-up and to know how to contact WPD for information.

Publicising the PSR

8.42 We will continue to work with a range of partners including Age UK/Age Cymru, the British Red Cross and local authorities to distribute our information leaflets andpublicise the PSR and WPD's emergency telephone Contact Centre numbers.

☑ RIIO-ED1 measure – publicising the PSR

8.43 We will describe the activities that we have carried out to publicise the PSR in submissions to Ofgem for the stakeholder engagement part of the BMCS.

Assisting vulnerable customers to be prepared for a power cut

8.44 All new PSR customers who rely on power for medical equipment or who have special communication needs will receive an advice letter, a leaflet about power cuts and a direct dial telephone number.

8.45 We will also provide power cut advice online.

8.46 In addition to providing advice on how customers can be prepared for power interruptions, we will offer more direct assistance by distributing 10,000 crisis packs (including items such as an analogue phone, torch, gloves, gel hand-warmer, blanket and information leaflets) via our own staff and our partners. We will work with members of the Customer Panel to review the contents of the packs so that we can provide useful items that vulnerable customers will use.

☑ RIIO-ED1 measure – Distribute 10,000 crisis packs

8.47 We will aim to distribute 10,000 crisis packs to those most in need of them. The number distributed each year will be shown in the annual stakeholder report.

Providing additional services for vulnerable customers during power cuts

8.48 The PSR identifies which customers may need assistance during a power cut. Those who are dependent on power for medical equipment are prioritised as being more at risk during a loss of supply. Medically dependant customers and those with communication needs are provided with direct dial telephone numbers to contact WPD.

8.49 We will continue to telephone medically dependent and blind customers prior to a planned outage, in addition to the normal notification by letter. If necessary we will visit the customer to explain what will happen and identify additional requirements. If the customer cannot manage without their supply then we will consider providing a generator.

8.50 The PSR data will be used to contact medically dependent customers within the first three hours of a prolonged power cut to provide updates on power restoration times and identify if additional support or further contact is required.

8.51 We will make greater use of our crisis packs developed with the British Red Cross, by providing stocks to local teams for distribution to vulnerable customers during outages lasting longer than six hours.

8.52 All vulnerable customers are eligible for assistance from the RVS or the British Red Cross, whether they are on the PSR or not. Contact Centre staff can arrange for the partner organisations to attend and provide hot food, drinks, advice and support. The RVS will respond to requests for individual customers whilst we make proactive use of the British Red Cross for prolonged outages affecting a local community. We will continue to develop the services we provide with our existing partnerships with the RVS and Red Cross and look to develop further services with other organisations.

8.53 Where customers are reliant upon oxygen supplies WPD will continue to liaise with oxygen providers so that they can ensure customers have sufficient breathing apparatus and provide any advice or support needed.

☑ RIIO-ED1 measure – Contact PSR customers within three hours of a prolonged power cut

8.54 We will develop our incident management system so that it has the capability to record when a vulnerable customer receives a call from us about a power cut. This information will be used to demonstrate how we are performing against this measure.

☑ RIIO-ED1 measure – Services provided for PSR customers

8.55 We will describe the range of services that we provide in annual submissions to Ofgem for the stakeholder engagement part of the BMCS. This will illustrate the range of services we provide and which partner organisations assist in delivering them.

Providing assistance during emergencies

8.56 Emergencies such as damage caused by severe weather can leave vulnerable customers without power for prolonged periods of time.

8.57 When emergencies occur we will provide support to vulnerable customers. This includes providing hot drinks and distributing our crisis packs. We have a range of vehicles suitable for operating in severe weather conditions, such as 4x4s, that can be used to reach vulnerable customers to provide this support. In addition, flying conditions permitting, we will also make use of the WPD helicopter fleet to provide supplies to vulnerable customers who are cut off from other means of access.

8.58 We will also use arrangements with our existing partners including the British Red Cross, VRS to provide assistance such as hot meals, blankets and torches. We will work within the Local Resilience Forums to develop new links with local community organisations to extend the coverage of external partnerships that can provide assistance during emergencies.

8.59 Our staff play a major role during emergencies. We will look at ways to prepare them for the physical challenges of dealing with severe weather. For example as part of WPD's flood defence measures, we have already trained staff who might play a part in a flooding incident in water rescue. This training was provided by the Mid and West Wales Fire and Rescue Service based in Carmarthenshire and is the same as that received by Lifeboat and Environment Agency staff.

8.60 During an emergency it is important that the media, local authorities and other emergency resilience partners are kept informed about the number of customers off supply and the progress in restoring supplies. To enhance our existing communication processes we will develop facilities on our website to provide online updates.

8.61 In particularly severe weather conditions WPD is part of the Gold Command arrangements working with other emergency services. We will continue to be actively involved in Strategic Gold Command (prior to event) and Active Gold Command (during the event). This will involve regularly communicating with Government, emergency services, the Environment Agency and other Category 1 and 2 responders during events.

8.62 Senior staff from the Control Centre will provide updates on the number of customers affected, advise on risks to the electricity network and gather information that can assist operational teams across the business. This is very much a two-way process, where mutual support is regularly provided e.g. we offer the use of our specialist vehicles to support the emergency services and fire services to assist in dealing with flooded substations.

☑ RIIO-ED1 measure – Emergency resilience plans

8.63 An overview of our plans for emergencies will be provided in the annual regulatory submissions on stakeholder engagement for vulnerable customers.

Addressing fuel poverty and cold homes

8.64 Some customers on low incomes cannot afford to use electricity to effectively heat their properties. There is growing concern that customers will suffer as economic growth remains low and austerity measures affect fuel poor customers further. WPD does not have a direct obligation to provide energy efficiency advice but we are already working with other agencies (such as the charity National Energy Action) to provide information on the causes of and solutions for fuel poverty.

8.65 We will work with existing and new partners to develop a referral framework of regional agencies such as local authorities, Citizens Advice, voluntary agencies and energy charities that can be contacted for assistance on fuel poverty issues.

8.66 Links will be established on the WPD website to direct customers to partner organisation websites. We will also look for opportunities to develop other joint information such as customer mailings.

8.67 Front line staff will receive training, developed with our partners, to allow them to identify the key warning signs of fuel poverty and refer customers to appropriate organisations that can help.

☑ RIIO-ED1 measure – Fuel poverty initiatives

8.68 The initiatives developed for tackling fuel poverty will be described in the annual regulatory submissions on stakeholder engagement for vulnerable customers.

Outreach work

8.69 We recently trialled a project in Derbyshire in conjunction with National Energy Action, which targeted vulnerable customers and assisted them in a number of energy related areas to improve their quality of life. These customers were given advice on energy efficiency, fuel poverty and power cuts.

8.70 We will seek opportunities to participate in other outreach projects across our region where there is a focus on energy or vulnerable customers.

8.71 More use will be made of social indicator data to identify where customers are likely to be vulnerable or fuel poor so that we can target outreach initiatives.

☑ RIIO-ED1 measure – Identification of fuel poor customers

8.72 The analysis we have used to identify fuel poor customers for targeted outreach work will be described in annual regulatory submissions on stakeholder engagement for vulnerable customers.

☑ RIIO-ED1 measure – Outreach projects

8.73 The outreach projects that we participate in will be described in annual regulatory submissions on stakeholder engagement for vulnerable customers.

Research, reporting and monitoring

8.74 WPD will undertake annual research to measure customer satisfaction levels of PSR customers and seek feedback on service improvements.

8.75 We will report on our activities in our annual Stakeholder Report, our annual customer mailing and through Ofgem's BMCS Stakeholder Engagement Incentive submission.

8.76 Many of the social obligations outputs and deliverables are qualitative rather than quantitative and so we have commissioned the Centre for Sustainable Energy to develop a method for performance measurement based on a balanced scorecard.

☑ RIIO-ED1 measure – Social obligations balanced scorecard

8.77 The Social Obligations Balanced Scorecard is designed to enable us to benchmark:

- the services we provide;
- the customer contacts we make and the customer relationships we have;
- the information we have about our customers;
- the relationships we have or establish with other agencies;
- our broader ambitions to be a socially responsible.

8.78 The results that we obtain will be summarised in the annual stakeholder report.

Social obligations balanced scorecard

Strategic understanding and commitment

Aspect of performance	Weighting *	Weak	Fair	Good	Excellent
1. **Strategic understanding and commitment** to role DNO can play in tackling relevant social issues	High	Recognition of social role confined to generalised statements and limited integration into strategy or business planning	References to social role within strategy but tendency to treat as 'add on' aspects of business strategy and practices rather than integral aspect of service development and delivery	Fully integrated understanding of social role with clear plans for developing systems and customer-facing services to reflect role with targets for improved performance and increased impact	Delivering on social role a key business driver underpinning design, planning and delivery of all services with core objective to 'make the most of what DNO does' to tackle relevant social issues
Source of evidence	Ofgem assessment of company regulatory reporting PLUS company submission to DR process		**Questions for DNO submission template**	a. How is your company responding to the opportunities to develop its role in tackling relevant social issues? b. Where do you feel your company is falling short and could improve its performance? c. What plans do you have to improve performance?	

Use of data and customer insight

Aspect of performance	Weighting*	Weak	Fair	Good	Excellent
2. **Use of data and customer insight**, to underpin design, planning and delivery of services for **vulnerable households**	High	Limited use of data or customer insight, largely based on existing PSR and associated PSR 'recruitment' systems	Ad hoc use of data, mainly provided by others, to enhance insight but no strategic approach to customer insight to enable targeted work to address vulnerability and support social role	Strategic approach to acquisition, management and use of data relating to customer vulnerability, with clear evidence of how its use is influencing and improving service development and delivery	As 'good' plus using data to assess future risk of vulnerability and sharing analysis (and definitions) with other relevant parties to develop shared picture of challenge and underpin own and joint initiatives
Source of evidence	Company submission to DR process		**Questions for DNO submission template**	a. How does your company collect, analyse and use data regarding households connected to your network? b. What do you see as the key barriers to progress on building a picture of the risk of household vulnerability across your network? c. What steps is your company taking to address these barriers?	

Priority service register

Aspect of performance	Weighting*	Weak	Fair	Good	Excellent
3. Approach taken to management and use of **Priority Service Register** and associated services	High	Broad-brush approach to recruitment of people onto PSR with limited understanding of vulnerabilities across network area and needs for support in event of power failure or planned outage.	Well- managed PSR list with evidence of strategic approach to who's on it and careful differentiation between needs of different customers which is well-reflected in services and support offered to customer when needed	PSR approach informed by good data analysis and embedded as a key driver of tailored customer service provision, with effective data-sharing with referral network partners and energy suppliers	As 'good' plus PSR used to drive range of proactive tailored interventions to increase resilience and capacity of PSR customers to manage power outage, based on detailed understanding of customer vulnerabilities and needs
Source of evidence	Subset of questions on customer survey PLUS DR process submission		**Questions for DNO submission template**	a. How do you decide who should be on your PSR and what support they need? b. How is your PSR informing your customer service practices and systems? c. What are you planning to improve about this aspect of your company's work – and why?	

Affordable warmth initiatives

Aspect of performance	Weighting*	Weak	Fair	Good	Excellent
4. **Affordable warmth initiatives,** including off-gas activities, integration with others' schemes	High	Activity limited to ad hoc and largely opportunistic range of initiatives, led by others, with little attempt to establish a strategic approach or understand nature and scale of affordable warmth challenge in network area	Signs of a strategic approach to involvement in affordable warmth initiatives, based on basic analysis of nature and scale of problem in area and development of partnerships, with DNO role focused principally on making referrals	Evidence of well-developed strategy with clear objectives based on thorough analysis of need, effective partnerships at local and area-wide levels and well-defined role in targeted interventions.	As 'good' with extensive training of customer-facing staff to identify and support fuel poor customers, constructive participation in development of interventions with relevant partners, and strategic engagement in local and regional fora working on community resilience to cold weather.
Source of evidence	Company submissions to DR process		**Questions for DNO submission template**	a. What impact have the affordable warmth initiatives in which you've been involved had, and what contribution do you make to their success? b. What did you learn this year from your activity to support action in your network areas on affordable warmth? c. How has this learning changed your approach in future?	

Referral networks

Aspect of performance	Weighting*	Weak	Fair	Good	Excellent
5. Development of, and participation in **referral networks for services for vulnerable households** and quality of associated systems and processes	Medium	Some examples of linking up with other services for vulnerable household and partnerships to improve cross-referrals, but generally ad hoc and localised	Willing participant in referral networks across area when invited, though missing more localised services and limited integration into customer management systems	Active participation in range of referral networks to ensure coverage across area with clear data management protocols established and mechanisms for tracking customers and responding to referral partner requests for input.	As 'good' but leading partner in referral networks across area, using range of DNO services and capabilities to support networks.
Source of evidence	Company submission to DR process		**Questions for DNO submission template**	a. What steps has your company taken to ensure that vulnerable customers with whom you have contact are referred on to other relevant agencies to secure other forms of support they need? b. What role do you play in referral networks across you areas? c. What improvements do you think could still be made?	

Integration into business processes

Aspect of performance	Weighting*	Weak	Fair	Good	Excellent
6. Level of integration of social role into **customer-facing services** and associated processes	Medium	Customer-facing services show little attention to capturing customer information to identify vulnerabilities beyond basic PSR recruitment	Customer-facing services routinely capturing information on customer needs and vulnerabilities to support tailoring of PSR services and to trigger referrals for further support to limited range of services delivered by others	Customer service staff trained in identifying and responding to customer vulnerabilities with a range of services and referral mechanisms, selected to meet wide range of customer needs and circumstances. Services routinely monitored and evaluated to test extent to which they are meeting customer needs.	As 'good' with social role a key aspect of customer services and front-line staff training and service design with all front-line staff trained to identify and record customer vulnerability with access to a wide range of responses developed and available to support customer. A degree of flexibility available to staff to 'do right thing' for any customer to meet evident need (with feedback to improve services).
Source of evidence	Specific questions on customer survey plus company submission to DR process		**Questions for DNO submission template**	a. What are you doing to make sure your front-line staff are making the most of their contacts with customer to identify and address their vulnerabilities? b. What challenges is your company facing in achieving these goals? c. How is your company addressing these challenges and what will change if you succeed?	

Costs of providing additional services for vulnerable customers

8.79 The costs of providing additional services for vulnerable customers are relative small when compared to the overall expenditure. The various costs are collated into the table below.

Activity	Annual Cost	Output/Benefit delivered
A dedicated team to carry out a 2-year rolling programme data cleanse and maintenance of PSR records, by contacting PSR customers, and liaising with suppliers and partners.	£0.2m	Improve the Data Held on the Priority Services Register
Information and Support to PSR/vulnerable customers during power cuts. Includes contracts with RVS and British Red Cross, liaison with other community based/emergency organisations, awareness training/information to network services staff - and the development and maintenance of web-based information.	£0.1m	Improve the Services Provided for Vulnerable Customers
Referral Service for vulnerable customers - liaison with partners to build and maintain a database of contact organisations (vulnerability, energy efficiency and fuel poverty) and provision of bespoke training to Contact Centre staff.	£0.1m	Address Fuel Poverty by Supporting Customers to Access Key Information
Production and distribution of resources including 10,000 crisis packs and power cut advice leaflets for use internally and by external partners.	£0.01m	Improve the Services Provided for Vulnerable Customers
Support for specific outreach projects/events and joint information campaigns with identified partners to provide power cut advice, promote PSR services and signpost energy efficiency/fuel poverty advice to vulnerable/fuel poor customers. Customer research.	£0.5m	Address Fuel Poverty by Supporting Customers to Access Key Information/Improve the services provided for vulnerable customers/improve PSR data
Total costs per annum for 4 DNO areas	**£1.0m**	

9 Appendix A1 – Health and criticality risk matrix outputs

9.1 The following matrices show the net result of WPD's asset replacement and asset refurbishment interventions. They are derived from the difference between the matrices for the end of RIIO-ED1 position with intervention and the end of RIIO-ED1 position without intervention.

9.2 The net positions are provided for all the following asset categories:

- LV UGB and LV pillars (not at substations)
- LV switchgear at substations
- LV OHL support
- HV switchgear ground mounted at Primary substations
- HV switchgear ground mounted at Distribution substations
- HV transformers ground mounted
- HV OHL support – poles
- EHV switchgear ground mounted
- EHV transformer
- EHV UG cable (gas)
- EHV UG cable (oil)
- EHV OHL support –towers
- EHV OHL support –poles
- EHV OHL fittings and conductor on tower lines
- 132kV circuit breakers
- 132kV transformer
- 132kV UG cable (gas)
- 132kV UG cable (oil)
- 132kV OHL support –towers
- 132kV OHL fittings and conductor on tower lines

LV UGB and LV Pillars (outdoors not at substations)

West Midlands

		Heath Index (Probability of failure)				
		HI1	HI2	HI3	HI4	HI5
Criticality	C1	0	0	0	0	0
	C2	2,448	0	0	-239	-2,209
	C3	0	0	0	0	0
	C4	0	0	0	0	0

East Midlands

		Heath Index (Probability of failure)				
		HI1	HI2	HI3	HI4	HI5
Criticality	C1	0	0	0	0	0
	C2	1,456	0	0	0	-1,456
	C3	48	0	0	0	48
	C4	0	0	0	0	0

South Wales

		Heath Index (Probability of failure)				
		HI1	HI2	HI3	HI4	HI5
Criticality	C1	0	0	0	0	0
	C2	250	0	0	0	-250
	C3	6	0	0	0	-6
	C4	0	0	0	0	0

South West

		Heath Index (Probability of failure)				
		HI1	HI2	HI3	HI4	HI5
Criticality	C1	1	0	0	0	-1
	C2	703	0	0	0	-703
	C3	24	0	0	0	-24
	C4	0	0	0	0	0

LV switchgear (at substations)

West Midlands

		Heath Index (Probability of failure)				
		HI1	HI2	HI3	HI4	HI5
Criticality	C1	0	0	0	0	0
	C2	1,500	-222	-23	-136	-1,119
	C3	272	-9	-1	-17	-245
	C4	0	0	0	0	0

East Midlands

		Heath Index (Probability of failure)				
		HI1	HI2	HI3	HI4	HI5
Criticality	C1	0	0	0	0	0
	C2	1,190	-207	-96	-619	-268
	C3	161	-17	-21	-74	-49
	C4	0	0	0	0	0

South Wales

		Heath Index (Probability of failure)				
		HI1	HI2	HI3	HI4	HI5
Criticality	C1	0	0	0	0	0
	C2	736	-52	-94	-47	-543
	C3	12	-2	-3	-1	-6
	C4	0	0	0	0	0

South West

		Heath Index (Probability of failure)				
		HI1	HI2	HI3	HI4	HI5
Criticality	C1	7	0	0	0	-7
	C2	954	-56	-82	-122	-694
	C3	32	0	-2	-6	-24
	C4	0	0	0	0	0

LV OHL support

West Midlands

		Heath Index (Probability of failure)				
		HI1	HI2	HI3	HI4	HI5
Criticality	C1	0	0	0	0	0
	C2	34,736	0	-4,343	-6,079	-24,314
	C3	0	0	0	0	0
	C4	0	0	0	0	0

East Midlands

		Heath Index (Probability of failure)				
		HI1	HI2	HI3	HI4	HI5
Criticality	C1	0	0	0	0	0
	C2	22,524	0	-1,126	-3,379	-18,019
	C3	0	0	0	0	0
	C4	0	0	0	0	0

South Wales

		Heath Index (Probability of failure)				
		HI1	HI2	HI3	HI4	HI5
Criticality	C1	0	0	0	0	0
	C2	17,457	0	0	-8,170	-9,287
	C3	0	0	0	0	0
	C4	0	0	0	0	0

South West

		Heath Index (Probability of failure)				
		HI1	HI2	HI3	HI4	HI5
Criticality	C1	0	0	0	0	0
	C2	28,834	0	-4,614	-6,343	-17,877
	C3	0	0	0	0	0
	C4	0	0	0	0	0

HV switchgear ground mounted at Primary substations

West Midlands

		Heath Index (Probability of failure)				
		HI1	HI2	HI3	HI4	HI5
Criticality	C1	140	-11	-14	0	-115
	C2	457	-22	-66	-102	-267
	C3	98	-13	-13	-55	-17
	C4	35	0	0	-25	-10

East Midlands

		Heath Index (Probability of failure)				
		HI1	HI2	HI3	HI4	HI5
Criticality	C1	91	-18	0	0	-73
	C2	397	-85	0	0	-312
	C3	181	-25	0	-11	-145
	C4	4	0	0	-2	-2

South Wales

		Heath Index (Probability of failure)				
		HI1	HI2	HI3	HI4	HI5
Criticality	C1	31	0	0	-1	-30
	C2	117	0	-2	-14	-101
	C3	5	0	0	-1	-4
	C4	24	0	0	-1	-23

South West

		Heath Index (Probability of failure)				
		HI1	HI2	HI3	HI4	HI5
Criticality	C1	127	0	-28	-5	-94
	C2	386	0	-73	-19	-294
	C3	127	0	-9	-19	-99
	C4	5	0	0	-4	-1

HV switchgear ground mounted at Distribution substations

West Midlands

		Heath Index (Probability of failure)				
		HI1	HI2	HI3	HI4	HI5
Criticality	C1	865	-70	-134	-195	-551
	C2	1035	-68	-105	-262	-702
	C3	587	-36	-45	-229	-335
	C4	139	-2	-12	-31	-107

East Midlands

		Heath Index (Probability of failure)				
		HI1	HI2	HI3	HI4	HI5
Criticality	C1	795	-330	0	-119	-481
	C2	1,288	-146	0	-411	-951
	C3	860	-18	0	-616	-372
	C4	18	-18	0	-3	0

South Wales

		Heath Index (Probability of failure)				
		HI1	HI2	HI3	HI4	HI5
Criticality	C1	0	0	0	0	0
	C2	788	-112	-25	-47	-668
	C3	190	-11	-1	-2	-192
	C4	0	0	0	0	0

South West

		Heath Index (Probability of failure)				
		HI1	HI2	HI3	HI4	HI5
Criticality	C1	19	-18	-1	0	-3
	C2	1,806	-107	-185	-43	-1,819
	C3	404	0	-17	-6	-458
	C4	20	0	0	0	-24

HV transformers ground mounted

West Midlands

		Heath Index (Probability of failure)				
		HI1	HI2	HI3	HI4	HI5
Criticality	C1	400	0	0	-91	-309
	C2	1,155	0	-1	-377	-777
	C3	425	0	-1	-178	-246
	C4	31	0	0	-13	-18

East Midlands

		Heath Index (Probability of failure)				
		HI1	HI2	HI3	HI4	HI5
Criticality	C1	286	0	0	-20	-266
	C2	895	0	0	-213	-682
	C3	461	0	0	-123	-338
	C4	33	0	0	-7	-26

South Wales

		Heath Index (Probability of failure)				
		HI1	HI2	HI3	HI4	HI5
Criticality	C1	207	0	0	-15	-192
	C2	594	0	0	-224	-370
	C3	69	0	0	-31	-38
	C4	0	0	0	0	0

South West

		Heath Index (Probability of failure)				
		HI1	HI2	HI3	HI4	HI5
Criticality	C1	275	0	-1	0	-274
	C2	1,057	0	-2	-172	-883
	C3	195	0	0	-74	-121
	C4	2	0	0	0	-2

HV OHL support – poles

West Midlands

		Heath Index (Probability of failure)				
		HI1	HI2	HI3	HI4	HI5
Criticality	C1	0	0	0	0	0
	C2	34,545	0	-1,727	-5,182	-27,636
	C3	4,081	0	-204	-612	-3,265
	C4	95	0	-5	-14	-76

East Midlands

		Heath Index (Probability of failure)				
		HI1	HI2	HI3	HI4	HI5
Criticality	C1	0	0	0	0	0
	C2	24,132	0	-1,207	-3,620	-19,305
	C3	3,394	0	-170	-509	-2,715
	C4	47	0	-2	-7	-38

South Wales

		Heath Index (Probability of failure)				
		HI1	HI2	HI3	HI4	HI5
Criticality	C1	0	0	0	0	0
	C2	25,798	0	0	-9,850	-15,948
	C3	1,886	0	0	-712	-1,154
	C4	26	0	0	-10	-16

South West

		Heath Index (Probability of failure)				
		HI1	HI2	HI3	HI4	HI5
Criticality	C1	0	0	0	0	0
	C2	31,473	0	-5,037	-6,922	-19,514
	C3	341	0	-54	-76	-211
	C4	0	0	0	0	0

EHV switchgear ground mounted

West Midlands

		Heath Index (Probability of failure)				
		HI1	HI2	HI3	HI4	HI5
Criticality	C1	44	0	0	0	-44
	C2	48	0	0	0	-48
	C3	10	0	0	0	-10
	C4	0	0	0	0	0

East Midlands

		Heath Index (Probability of failure)				
		HI1	HI2	HI3	HI4	HI5
Criticality	C1	81	0	0	0	-81
	C2	125	0	0	-20	-105
	C3	37	0	0	-4	-33
	C4	40	0	0	-11	-29

South Wales

		Heath Index (Probability of failure)				
		HI1	HI2	HI3	HI4	HI5
Criticality	C1	22	0	0	0	-22
	C2	77	0	0	-8	-69
	C3	23	0	0	-2	-21
	C4	10	0	0	-3	-7

South West

		Heath Index (Probability of failure)				
		HI1	HI2	HI3	HI4	HI5
Criticality	C1	30	-2	-2	-1	-25
	C2	85	-1	0	-3	-81
	C3	41	0	0	-6	-35
	C4	14	0	0	-4	-10

EHV transformer

West Midlands

		Heath Index (Probability of failure)				
		HI1	HI2	HI3	HI4	HI5
Criticality	C1	22	0	0	0	-22
	C2	15	0	0	0	-15
	C3	12	0	0	-2	-10
	C4	6	0	0	0	-6

East Midlands

		Heath Index (Probability of failure)				
		HI1	HI2	HI3	HI4	HI5
Criticality	C1	28	0	0	0	-28
	C2	38	0	0	0	-38
	C3	28	0	0	-4	-24
	C4	2	0	0	0	-2

South Wales

		Heath Index (Probability of failure)				
		HI1	HI2	HI3	HI4	HI5
Criticality	C1	9	0	0	0	-9
	C2	28	0	0	0	-28
	C3	13	0	0	0	-13
	C4	0	0	0	0	0

South West

		Heath Index (Probability of failure)				
		HI1	HI2	HI3	HI4	HI5
Criticality	C1	34	0	0	0	-34
	C2	38	0	0	0	-38
	C3	19	0	0	0	-19
	C4	3	0	0	0	-3

EHV UG cable (gas)

West Midlands

		Heath Index (Probability of failure)				
		HI1	HI2	HI3	HI4	HI5
Criticality	C1	0	0	0	0	0
	C2	0	0	0	0	0
	C3	0	0	0	0	0
	C4	0	0	0	0	0

East Midlands

		Heath Index (Probability of failure)				
		HI1	HI2	HI3	HI4	HI5
Criticality	C1	n/a	n/a	n/a	n/a	n/a
	C2	n/a	n/a	n/a	n/a	n/a
	C3	n/a	n/a	n/a	n/a	n/a
	C4	n/a	n/a	n/a	n/a	n/a

South Wales

		Heath Index (Probability of failure)				
		HI1	HI2	HI3	HI4	HI5
Criticality	C1	0	0	0	0	0
	C2	0	0	0	0	-4.3
	C3	0	0	0	0	0
	C4	0	0	0	0	0

South West

		Heath Index (Probability of failure)				
		HI1	HI2	HI3	HI4	HI5
Criticality	C1	0	0	0	0	0
	C2	0	0	0	0	-34
	C3	0	0	0	0	0
	C4	0	0	0	0	0

EHV UG cable (oil)

West Midlands

		Heath Index (Probability of failure)				
		HI1	HI2	HI3	HI4	HI5
Criticality	C1	0	0	0	0	0
	C2	0	0	0	0	-0.6
	C3	0	0	0	0	0
	C4	0	0	0	0	0

East Midlands

		Heath Index (Probability of failure)				
		HI1	HI2	HI3	HI4	HI5
Criticality	C1	0	0	0	0	0
	C2	0	0	0	0	0
	C3	0	0	0	0	0
	C4	0	0	0	0	0

South Wales

		Heath Index (Probability of failure)				
		HI1	HI2	HI3	HI4	HI5
Criticality	C1	0	0	0	0	0
	C2	0	0	0	0	0
	C3	0	0	0	0	0
	C4	0	0	0	0	0

South West

		Heath Index (Probability of failure)				
		HI1	HI2	HI3	HI4	HI5
Criticality	C1	0	0	0	0	0
	C2	0	0	0	0	-14.4
	C3	0	0	0	0	0
	C4	0	0	0	0	0

EHV OHL support –towers

West Midlands

		Heath Index (Probability of failure)				
		HI1	HI2	HI3	HI4	HI5
Criticality	C1	0	4	0	-2	-2
	C2	0	14	0	-8	-6
	C3	0	30	0	-30	0
	C4	0	0	0	0	0

East Midlands

		Heath Index (Probability of failure)				
		HI1	HI2	HI3	HI4	HI5
Criticality	C1	4	4	0	-4	-4
	C2	10	20	0	-20	-10
	C3	5	24	0	-24	-5
	C4	0	0	0	0	0

South Wales

		Heath Index (Probability of failure)				
		HI1	HI2	HI3	HI4	HI5
Criticality	C1	0	14	0	-14	0
	C2	0	2	0	-2	0
	C3	0	0	0	0	0
	C4	0	0	0	0	0

South West

		Heath Index (Probability of failure)				
		HI1	HI2	HI3	HI4	HI5
Criticality	C1	4	7	0	-7	-4
	C2	4	10	0	-10	-4
	C3	1	3	0	-3	-1
	C4	0	0	0	0	0

EHV OHL support –poles

West Midlands

		Heath Index (Probability of failure)				
		HI1	HI2	HI3	HI4	HI5
Criticality	C1	458	0	-86	-115	-257
	C2	3,764	0	-694	-951	-2,119
	C3	280	0	-50	-72	-158
	C4	180	0	-35	-44	-101

East Midlands

		Heath Index (Probability of failure)				
		HI1	HI2	HI3	HI4	HI5
Criticality	C1	631	0	-116	-116	-399
	C2	3,69	0	-696	-697	-2,376
	C3	415	0	-78	-77	-260
	C4	3	0	0	-2	-1

South Wales

		Heath Index (Probability of failure)				
		HI1	HI2	HI3	HI4	HI5
Criticality	C1	451	0	0	-159	-292
	C2	3,191	0	0	-1,123	-2,068
	C3	48	0	0	-17	-31
	C4	0	0	0	0	0

South West

		Heath Index (Probability of failure)				
		HI1	HI2	HI3	HI4	HI5
Criticality	C1	739	0	-104	-147	-488
	C2	3,440	0	-482	-687	-2,271
	C3	293	0	-41	-59	-193
	C4	0	0	0	0	0

EHV OHL fittings

West Midlands

		Heath Index (Probability of failure)				
		HI1	HI2	HI3	HI4	HI5
Criticality	C1	205	0	0	0	-205
	C2	521	0	0	0	-521
	C3	221	0	0	0	-221
	C4	0	0	0	0	0

East Midlands

		Heath Index (Probability of failure)				
		HI1	HI2	HI3	HI4	HI5
Criticality	C1	77	0	0	0	-77
	C2	807	0	0	0	-807
	C3	0	0	0	0	0
	C4	0	0	0	0	0

South Wales

		Heath Index (Probability of failure)				
		HI1	HI2	HI3	HI4	HI5
Criticality	C1	55	0	0	0	-55
	C2	117	0	0	-97	-20
	C3	57	0	0	-22	-35
	C4	0	0	0	0	0

South West

		Heath Index (Probability of failure)				
		HI1	HI2	HI3	HI4	HI5
Criticality	C1	137	0	0	0	-137
	C2	172	0	0	0	-172
	C3	54	0	0	0	-54
	C4	56	0	0	0	-56

EHV OHL conductor on tower lines

West Midlands

		Heath Index (Probability of failure)				
		HI1	HI2	HI3	HI4	HI5
Criticality	C1	0	0	0	0	0
	C2	19	0	0	0	-19
	C3	0	0	0	0	0
	C4	0	0	0	0	0

East Midlands

		Heath Index (Probability of failure)				
		HI1	HI2	HI3	HI4	HI5
Criticality	C1	23	0	0	0	-23
	C2	0	0	0	0	0
	C3	0	0	0	0	0
	C4	0	0	0	0	0

South Wales

		Heath Index (Probability of failure)				
		HI1	HI2	HI3	HI4	HI5
Criticality	C1	0	0	0	0	0
	C2	0	0	0	0	0
	C3	0	0	0	0	0
	C4	0	0	0	0	0

South West

		Heath Index (Probability of failure)				
		HI1	HI2	HI3	HI4	HI5
Criticality	C1	0	0	0	0	0
	C2	0	0	0	0	0
	C3	0	0	0	0	0
	C4	0	0	0	0	0

132kV circuit breakers

West Midlands

		Heath Index (Probability of failure)				
		HI1	HI2	HI3	HI4	HI5
Criticality	C1	32	0	0	0	-32
	C2	17	0	0	0	-17
	C3	9	0	0	0	-9
	C4	1	0	0	0	-1

East Midlands

		Heath Index (Probability of failure)				
		HI1	HI2	HI3	HI4	HI5
Criticality	C1	11	0	0	0	-11
	C2	16	0	0	0	-16
	C3	17	0	0	0	-17
	C4	3	0	0	0	-3

South Wales

		Heath Index (Probability of failure)				
		HI1	HI2	HI3	HI4	HI5
Criticality	C1	1	0	0	0	-1
	C2	3	0	0	0	-3
	C3	2	0	0	0	-2
	C4	0	0	0	0	0

South West

		Heath Index (Probability of failure)				
		HI1	HI2	HI3	HI4	HI5
Criticality	C1	7	0	0	-1	-6
	C2	6	0	0	-1	-5
	C3	9	0	0	0	-9
	C4	0	0	0	0	0

132kV transformer

West Midlands

		Heath Index (Probability of failure)				
		HI1	HI2	HI3	HI4	HI5
Criticality	C1	3	0	0	0	-3
	C2	18	0	0	-5	-13
	C3	11	0	0	-1	-10
	C4	6	0	0	0	-6

East Midlands

		Heath Index (Probability of failure)				
		HI1	HI2	HI3	HI4	HI5
Criticality	C1	7	0	0	0	-7
	C2	23	0	0	-11	-12
	C3	5	0	0	-1	-4
	C4	0	0	0	0	0

South Wales

		Heath Index (Probability of failure)				
		HI1	HI2	HI3	HI4	HI5
Criticality	C1	4	0	0	0	-4
	C2	8	0	0	0	-8
	C3	3	0	0	0	-3
	C4	3	0	0	0	-3

South West

		Heath Index (Probability of failure)				
		HI1	HI2	HI3	HI4	HI5
Criticality	C1	1	0	0	0	-1
	C2	6	0	0	-3	-3
	C3	3	0	0	-1	-2
	C4	2	0	0	-1	-1

132kV UG cable (gas)

West Midlands

		Heath Index (Probability of failure)				
		HI1	HI2	HI3	HI4	HI5
Criticality	C1	0	0	0	0	0
	C2	0	0	-2.4	0	-6.3
	C3	0	0	0	0	0
	C4	0	0	0	0	0

East Midlands

		Heath Index (Probability of failure)				
		HI1	HI2	HI3	HI4	HI5
Criticality	C1	n/a	n/a	n/a	n/a	n/a
	C2	n/a	n/a	n/a	n/a	n/a
	C3	n/a	n/a	n/a	n/a	n/a
	C4	n/a	n/a	n/a	n/a	n/a

South Wales

		Heath Index (Probability of failure)				
		HI1	HI2	HI3	HI4	HI5
Criticality	C1	n/a	n/a	n/a	n/a	n/a
	C2	n/a	n/a	n/a	n/a	n/a
	C3	n/a	n/a	n/a	n/a	n/a
	C4	n/a	n/a	n/a	n/a	n/a

South West

		Heath Index (Probability of failure)				
		HI1	HI2	HI3	HI4	HI5
Criticality	C1	n/a	n/a	n/a	n/a	n/a
	C2	n/a	n/a	n/a	n/a	n/a
	C3	n/a	n/a	n/a	n/a	n/a
	C4	n/a	n/a	n/a	n/a	n/a

132kV UG cable (oil)

West Midlands

		Heath Index (Probability of failure)				
		HI1	HI2	HI3	HI4	HI5
Criticality	C1	0	0	0	0	0
	C2	0	0	0	0	-23.4
	C3	0	0	0	0	0
	C4	0	0	0	0	0

East Midlands

		Heath Index (Probability of failure)				
		HI1	HI2	HI3	HI4	HI5
Criticality	C1	0	0	0	0	0
	C2	0	0	0	0	0
	C3	0	0	0	0	0
	C4	0	0	0	0	0

South Wales

		Heath Index (Probability of failure)				
		HI1	HI2	HI3	HI4	HI5
Criticality	C1	0	0	0	0	0
	C2	0	0	0	0	0
	C3	0	0	0	0	0
	C4	0	0	0	0	0

South West

		Heath Index (Probability of failure)				
		HI1	HI2	HI3	HI4	HI5
Criticality	C1	0	0	0	0	0
	C2	0	0	0	0	0
	C3	0.4	0	0	0	-0.4
	C4	0	0	0	0	0

132kV OHL support –towers

West Midlands

		Heath Index (Probability of failure)				
		HI1	HI2	HI3	HI4	HI5
Criticality	C1	0	28	0	-28	0
	C2	0	40	0	-40	0
	C3	0	28	0	-28	0
	C4	0	16	0	-16	0

East Midlands

		Heath Index (Probability of failure)				
		HI1	HI2	HI3	HI4	HI5
Criticality	C1	6	48	0	-48	-6
	C2	2	62	0	-62	-2
	C3	7	66	0	-66	-7
	C4	0	8	0	-8	0

South Wales

		Heath Index (Probability of failure)				
		HI1	HI2	HI3	HI4	HI5
Criticality	C1	5	10	0	-10	-5
	C2	23	55	0	-55	-23
	C3	5	31	0	-31	-5
	C4	0	0	0	0	0

South West

		Heath Index (Probability of failure)				
		HI1	HI2	HI3	HI4	HI5
Criticality	C1	3	43	0	-43	-3
	C2	12	69	0	-69	-12
	C3	2	12	0	-12	-2
	C4	0	0	0	0	0

132kV OHL fittings

West Midlands

		Heath Index (Probability of failure)				
		HI1	HI2	HI3	HI4	HI5
Criticality	C1	866	0	0	0	-866
	C2	538	0	0	0	-538
	C3	245	0	0	0	-245
	C4	87	0	0	0	-87

East Midlands

		Heath Index (Probability of failure)				
		HI1	HI2	HI3	HI4	HI5
Criticality	C1	1,093	0	0	0	-1,093
	C2	713	0	0	0	-713
	C3	767	0	0	0	-767
	C4	88	0	0	0	-88

South Wales

		Heath Index (Probability of failure)				
		HI1	HI2	HI3	HI4	HI5
Criticality	C1	135	0	0	0	-135
	C2	333	0	0	0	-333
	C3	223	0	0	0	-223
	C4	0	0	0	0	0

South West

		Heath Index (Probability of failure)				
		HI1	HI2	HI3	HI4	HI5
Criticality	C1	459	0	0	0	-459
	C2	264	0	0	0	-264
	C3	175	0	0	0	-175
	C4	26	0	0	0	-26

132kV OHL conductor on tower lines

West Midlands

		Heath Index (Probability of failure)				
		HI1	HI2	HI3	HI4	HI5
Criticality	C1	112.3	0	0	0	-112.3
	C2	62.5	0	0	0	-62.5
	C3	26.5	0	0	0	-26.5
	C4	14.1	0	0	0	-14.1

East Midlands

		Heath Index (Probability of failure)				
		HI1	HI2	HI3	HI4	HI5
Criticality	C1	111.1	0	0	-16.9	-94.2
	C2	114.7	0	0	-20	-94.7
	C3	19.2	0	0	-0.7	-18.5
	C4	23	0	0	-23	0

South Wales

		Heath Index (Probability of failure)				
		HI1	HI2	HI3	HI4	HI5
Criticality	C1	22.6	0	0	-8.7	-13.9
	C2	35.3	0	0	-8.8	-26.5
	C3	42.8	0	0	-1.7	-41.1
	C4	0	0	0	0	0

South West

		Heath Index (Probability of failure)				
		HI1	HI2	HI3	HI4	HI5
Criticality	C1	66.9	0	0	0	-66.9
	C2	28	0	0	0	-28
	C3	3.7	0	0	-3	-0.7
	C4	0	0	0	0	0

10 Appendix A2 – Mapping of outputs to areas of expenditure

Expenditure	Outputs					
	Safety	Reliability	Environment	Connections	Customer Satisfaction	Social Obligations
LOAD RELATED						
Connections			✓	✓	✓	
General reinforcement		✓	✓	✓		
Fault level	✓	✓				
Transmission exit points		✓				
Diversions		✓				
NON-LOAD RELATED						
Asset replacement		✓				
Quality of supply		✓			✓	
Worst served customers		✓			✓	
Operational IT&T	✓	✓			✓	
Flood defences		✓				
Black Start		✓				
Substation and network security	✓	✓				
Security of critical national infrastructure		✓				
ESQCR overhead line height and proximity	✓					
Visual amenity			✓			
Oil pollution mitigation			✓			
SF_6 losses			✓			
Technical losses			✓			
Noise reduction			✓			
NETWORK OPERATING COSTS						
Inspection and maintenance	✓	✓				
Tree cutting to maintain clearance from lines	✓	✓				
Tree clearance for resilience		✓				
Trouble call (faults)		✓			✓	
Responding to 1 in 20 year storms		✓			✓	
Smart meter related cut-out call outs			✓			
Substation electricity		✓				
Remote generation		✓				
Dismantlement		✓				
CLOSELY ASSOCIATED INDIRECTS	✓	✓	✓	✓	✓	
BUSINESS SUPPORT COSTS	✓	✓	✓	✓	✓	✓

2015-2023

RIIO-ED1 **BUSINESS PLAN**

SA-05 Supplementary Annex - Expenditure

June 2013 (updated April 2014)

WESTERN POWER DISTRIBUTION

Serving the Midlands, South West and Wales

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1 Introduction

1.1 This document is a supplementary annex to the Western Power Distribution (WPD) Business Plan for the eight year period from 1st April 2015 to 31st March 2023.

1.2 It sets out the expenditure plans for all the different cost categories.

1.3 It covers expenditure for the four WPD distribution licences of West Midlands, East Midlands, South Wales and South West.

1.4 The eight year period aligns with the next regulatory price control review period, known as RIIO-ED1; the first for electricity distribution to be determined using Ofgem's Revenue = Incentives, Innovation and Outputs framework. The Business Plan, supplementary annexes, detailed cost tables and financial models form the submission under RIIO-ED1 to the regulator Ofgem (Office for Gas and Electricity Markets), who will use the information to determine allowed revenues.

Structure of this document

1.5 We appreciate that the readers of the WPD Business Plan suite of documents will range from regulatory experts and well informed stakeholders through to new customers who may have had little previous knowledge of WPD.

1.6 This document is aimed at readers who require a more detailed understanding. A less detailed description can be found in the main Business Plan Overview document.

1.7 This document is subdivided into the following sections:

Chapter	Title	Content
3-8	**Load related investment**	The expenditure requirements for reinforcing the network and for dealing with diversions.
9-26	**Non-load related investment**	Network investment for replacing and refurbishing assets, improving safety, reducing environmental impact and making improvements to network performance.
27-32	**Network operating costs**	Expenditure on inspection and maintenance, responding to and repairing faults, tree clearance and other network operating costs.
33-43	**Closely associated indirects**	The costs of managing projects, control centres, contact centres, stores and other activities related to delivery of work programmes.
44-47	**Business support costs**	The costs of corporate activities such as human resources and finance.
48-52	**Vehicles, IT, property and small tools**	Expenditure on non-operational items incorporating related areas of expenditure in closely associated indirect costs and business support costs.
53	**Non price control costs**	Expenditure on network related work that is not funded through DUoS. This includes fully funded diversions and service alterations.
54	**Non activity based costs**	Expenditure on items that are in many cases beyond the control of WPD such as transmissions exit charges, business rates and Ofgem licence fees.
55-58	**Special considerations**	A description of other factors that affect the expenditure forecasts such as real price effects and efficiency assumptions.
Appendices		Three appendices covering the Transform model used for forecasting load related reinforcement requirements, a description of cost benefit analysis that supports the business plan and summary cost tables that include pensions.

Costs included in this document

1.8 The expenditure included in this document

- excludes real price effects;
- includes efficiency savings;
- excludes pension costs;
- is in 2012/13 prices.

1.9 For clarity summary tables have been produced using rounding, which in some summary tables leads to minor differences between totals and the sum of the components.

1.10 When comparing the data to the Business Plan Data Template spreadsheets, the gross costs in the spreadsheets will be higher as they include pension costs. Appendix A3 contains summary tables of core costs that include pensions which can be compared to the Business Plan Data Tables.

Costs benefit analysis undertaken

Criteria used for deciding where to include a CBA

1.11 Cost Benefit Analysis (CBA) provides a method for comparing the costs and the benefits of investment proposals.

1.12 Since costs and benefits may occur over time the comparison of each is made as if they are effectively happening 'today' by giving them a Net Present Value (NPV). The NPV is calculated by using a discount rate, in our case the WACC, to reduce the value of future cash flows. By doing so we can effectively treat all cash flows as if they had occurred today.

1.13 Where the NPV is positive the investment is worthwhile in financial terms. Where the NPV is negative there may be other non-financial benefits which are considered before rejecting the investment proposal.

1.14 CBA analyses have been prepared for areas of expenditure that meet the following criteria:

- a material level of expenditure;
- a strategic decision (e.g. decision between leasing or purchasing vehicles);
- where expenditure is optional (i.e. it is possible to not invest but with consequential loss of other benefits e.g. quality of supply improvement);
- where mandated by Ofgem in their CBA guidance.

1.15 In addition Ofgem guidance has also highlighted two other criteria where CBA is required:

- where an approach is adopted that is significantly higher cost than a previous strategy; or
- where a DNO is likely to appear higher cost than others because an alternative approach has been adopted

(we have no areas that fall into either of these categories).

1.16 The CBAs that we have undertaken are a mixture of analysis at asset category/class of expenditure and specific project level.

1.17 All CBAs have been compiled in accordance with the Ofgem guidance

Scope/categories of CBAs

1.18 The above criteria has resulted in CBAs being produced for the following category areas;

- diversions;
- reinforcement;
- asset replacement and refurbishment;
- operational IT and telecoms;
- BT 21 CN;
- quality of supply;
- protection against flooding;
- environment;
- Black Start;
- inspection and maintenance;
- tree cutting;
- smart metering;
- vehicles and transport;
- non-operational IT and telecoms;
- property management.

1.19 The reinforcement category includes CBAs assessing smart solutions in addition to the use of the Transform model to produce forecasts for our best view case, the reference case and the other DECC scenarios.

1.20 Based on benchmarking information and our performance levels, we are satisfied that our business model is efficient. We have therefore used CBA to optimise our asset replacement intervention policies and to confirm that material expenditure decisions have positive NPVs when assessed using the Ofgem methodology.

Uncertainty and sensitivity analysis

1.21 Where costs are uncertain or potential changes in costs may change the outcome of the CBA, sensitivity analysis is undertaken.

1.22 The sensitivity analysis factors in a range of potential variation in costs relevant to the subject area.

Access to CBAs

1.23 To access the detail of each CBA hyperlinks have been established to specific folders contained on the WPD website.

1.24 For ease of use, and to reduce the number of folders reviewers are required to access, we have grouped a number of related CBAs into each folder.

1.25 A description of the CBAs and how these can be accessed for review is contained in Appendix A2 to this document.

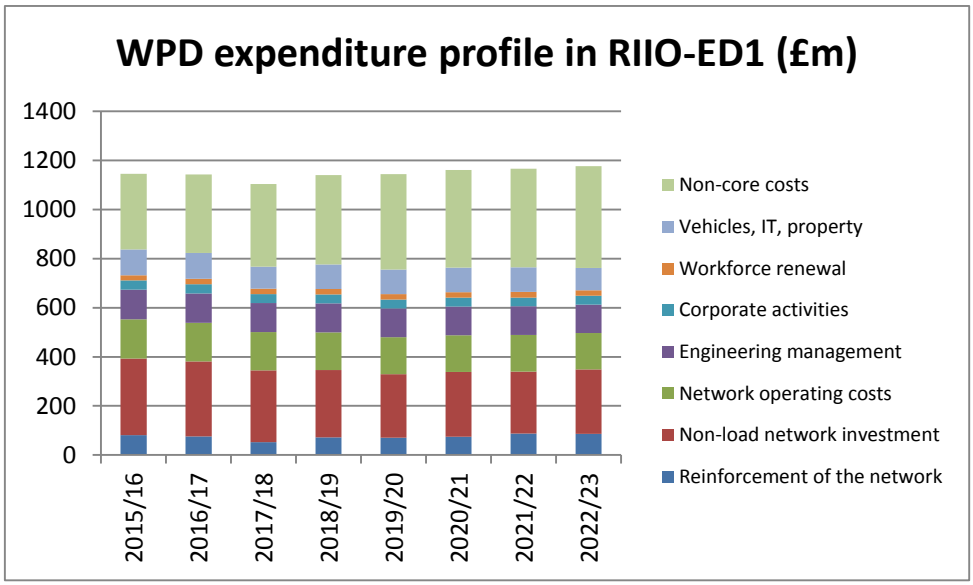
2 High level summary of expenditure

2.1 The following table provides a high level summary of the expenditure that will be funded through DUoS over the RIIO-ED1 period.

Expenditure within the Price Control (£m)					
	West Midlands	**East Midlands**	**South Wales**	**South West**	**WPD Total**
Reinforcement of the network	198.0	267.2	48.6	84.7	**598.5**
Non-load network investment	664.2	587.3	396.9	575.1	**2,223.5**
Network operating costs	355.0	370.9	194.1	304.9	**1,224.9**
Engineering management	288.6	290.8	147.9	214.5	**941.8**
Corporate activities	87.0	83.2	47.3	75.8	**293.3**
Workforce renewal	47.7	47.7	35.6	46.9	**177.9**
Vehicles, IT, property & tools	237.2	233.1	120.3	201.9	**792.5**
Non-core costs and pass through items	801.0	872.0	530.3	728.2	**2,931.4**
Total	**2,678.7**	**2,752.2**	**1,521.0**	**2,232.0**	**9,183.8**

Note that the expenditure represents WPD's best view which includes expenditure for worst served customers and undergrounding in AONBs and National Parks. These two costs categories are not included in the opening 'base' Price Control Financial Model (PCFM) because they are costs that are logged up and funded retrospectively. There is therefore a small difference between WPD's best case and the PCFM base case.

2.2 The following chart illustrates how the expenditure for WPD is profiled over the RIIO-ED1 period.



WPD total core expenditure forecast

WPD Total - Core costs funded through DUoS											
Costs excluding RPEs & pensions, including efficiency (£m at 2012/13 prices)	**Average per year in DPCR5**	**Average per year in RIIO-ED1**	**Spend profile in RIIO ED1**								**Total RIIO-ED1**
			2015/16	**2016/17**	**2017/18**	**2018/19**	**2019/20**	**2020/21**	**2021/22**	**2022/23**	
Customer Related Reinforcement	-7.5	6.5	6.0	5.9	6.2	6.6	6.7	6.7	6.8	7.1	52.0
General Network Reinforcement	53.4	43.4	69.9	64.6	36.6	46.8	36.9	31.8	35.4	25.5	347.5
Reinforcement for Low Carbon Technologies	0.0	24.9	4.7	4.7	9.3	18.3	27.3	36.2	45.0	53.6	199.0
TOTAL - Reinforcement of the Network	**45.9**	**74.8**	**80.6**	**75.2**	**52.1**	**71.7**	**70.9**	**74.7**	**87.2**	**86.2**	**598.5**
Asset Replacement	192.4	202.6	203.6	204.4	202.5	203.4	202.7	202.2	201.8	200.2	1620.8
Diversions	25.6	39.2	53.6	52.0	37.2	37.5	28.5	32.9	33.4	38.4	313.5
Quality of Supply (reducing power cuts)	12.6	3.7	5.1	5.1	5.0	4.9	4.9	4.9	0.0	0.0	29.9
Improving service for remote ("worst served") customers	0.3	0.4	0.0	1.6	1.6	0.0	0.0	0.0	0.0	0.0	3.2
Real Time Control Systems and Telecommunications	14.1	12.0	18.9	11.5	24.0	12.5	6.3	8.6	3.6	10.6	96.0
Protecting equipment from flooding risk	4.2	1.9	5.0	4.0	2.3	0.4	0.7	1.3	0.5	0.7	14.9
Enhancing site security, ESQCR and other legal requirements	18.4	11.7	15.7	14.9	14.7	9.9	9.8	9.7	9.6	9.4	93.7
Reducing oil and gas leaks from equipment	4.8	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	13.6
Undergrounding in National Parks and AONBs	1.1	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	8.0
Other Network Investment	9.9	3.7	8.3	9.4	3.0	3.4	2.4	1.4	1.4	0.6	29.9
TOTAL - Non-Load Network Investment	**283.4**	**277.9**	**312.9**	**305.6**	**293.0**	**274.7**	**258.0**	**263.7**	**253.0**	**262.6**	**2223.5**
Inspection, maintenance and routine tree cutting	75.0	48.4	49.7	49.3	48.8	48.3	47.9	48.1	47.6	47.2	386.9
Tree clearance to improve network resilience to severe weather	4.2	7.6	7.8	7.7	7.7	7.7	7.4	7.4	7.4	7.4	60.5
Responding to and repairing faults	92.0	88.9	93.5	92.2	90.7	89.3	87.9	86.8	85.9	85.0	711.3
Other network operating costs	7.9	8.3	8.5	8.5	8.4	8.3	8.2	8.2	8.1	8.0	66.2
TOTAL - Network Operating Costs	**179.1**	**153.1**	**159.5**	**157.7**	**155.6**	**153.6**	**151.4**	**150.5**	**149.0**	**147.6**	**1224.9**
Engineering management	**132.5**	**117.7**	**119.9**	**119.5**	**118.0**	**117.4**	**116.9**	**117.1**	**116.6**	**116.4**	**941.8**
Corporate activities	**67.1**	**36.7**	**38.0**	**37.8**	**37.1**	**36.7**	**36.4**	**36.1**	**35.8**	**35.4**	**293.3**
Workforce renewal	**20.3**	**22.2**	**21.5**	**22.0**	**22.4**	**22.4**	**22.4**	**22.4**	**22.4**	**22.4**	**177.9**
Vehicles, IT, Property & Engineering Equipment	**115.9**	**99.1**	**105.2**	**105.6**	**89.7**	**100.0**	**100.0**	**100.1**	**100.7**	**91.2**	**792.5**
TOTAL CORE COSTS	**844.2**	**781.5**	**837.6**	**823.4**	**767.9**	**776.5**	**756.0**	**764.6**	**764.7**	**761.8**	**6252.4**

West Midlands - core expenditure forecast

West Midlands - Core costs funded through DUoS											
Costs excluding RPEs & pensions, including efficiency (£m at 2012/13 prices)	**Average per year in DPCR5**	**Average per year in RIIO-ED1**	**Spend profile in RIIO ED1**								**Total RIIO-ED1**
			2015/16	**2016/17**	**2017/18**	**2018/19**	**2019/20**	**2020/21**	**2021/22**	**2022/23**	
Customer Related Reinforcement	-2.7	2.3	2.10	2.10	2.20	2.30	2.30	2.30	2.40	2.40	18.1
General Network Reinforcement	26.2	15.6	18.40	19.00	16.40	17.60	16.90	11.50	12.10	12.90	124.8
Reinforcement for Low Carbon Technologies	0.0	6.9	1.30	1.30	2.57	5.07	7.55	10.01	12.46	14.87	55.1
TOTAL - Reinforcement of the Network	**23.5**	**24.8**	**21.80**	**22.4**	**21.2**	**25.0**	**26.8**	**23.8**	**27.0**	**30.2**	**198.0**
Asset Replacement	62.7	62.0	62.7	63.3	62.2	62.4	62.0	61.6	61.4	60.7	496.3
Diversions	9.4	10.8	9.6	8.8	8.5	9.2	9.5	13.9	13.3	13.3	86.1
Quality of Supply (reducing power cuts)	3.7	1.9	2.6	2.6	2.6	2.5	2.5	2.5	0.0	0.0	15.3
Improving service for remote ("worst served") customers	0.0	0.1	0.0	0.5	0.5	0.0	0.0	0.0	0.0	0.0	1.0
Real Time Control Systems and Telecommunications	5.0	3.1	5.7	3.9	6.8	1.2	1.6	1.9	0.8	2.5	24.4
Protecting equipment from flooding risk	0.6	0.2	0.0	0.1	0.2	0.1	0.2	0.4	0.1	0.1	1.2
Enhancing site security, ESQCR and other legal requirements	5.0	3.0	3.2	3.1	3.1	3.0	3.0	3.0	2.9	2.9	24.2
Reducing oil and gas leaks from equipment	1.3	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	4.0
Undergrounding in National Parks and AONBs	0.4	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	2.4
Other Network Investment	1.1	1.2	3.2	3.4	0.7	0.8	0.5	0.3	0.3	0.1	9.3
TOTAL - Non-Load Network Investment	**89.2**	**83.03**	**87.80**	**86.50**	**85.40**	**80.00**	**80.10**	**84.40**	**79.60**	**80.40**	**664.2**
Inspection, maintenance and routine tree cutting	25.9	13.7	14.1	14.0	13.8	13.7	13.6	13.7	13.5	13.4	109.8
Tree clearance to improve network resilience to severe weather	1.3	2.0	2.0	2.0	2.0	2.0	1.9	1.9	1.9	1.9	15.6
Responding to and repairing faults	28.6	26.3	27.7	27.3	26.8	26.4	25.9	25.6	25.3	25.0	210.0
Other network operating costs	**2.4**	2.5	2.5	2.5	2.5	2.5	2.4	2.4	2.4	2.4	19.6
TOTAL - Network Operating Costs	**58.2**	**44.4**	**46.30**	**45.80**	**45.10**	**44.60**	**43.80**	**43.60**	**43.10**	**42.70**	**355.0**
Engineering management	**44.0**	**36.1**	**36.80**	**36.7**	**36.2**	**35.9**	**35.9**	**35.8**	**35.7**	**35.6**	**288.6**
Corporate activities	**27.2**	**10.9**	**11.30**	**11.2**	**11.0**	**10.9**	**10.8**	**10.7**	**10.6**	**10.5**	**87.0**
Workforce renewal	**4.6**	**6.0**	**5.80**	**5.9**	**6.0**	**6.0**	**6.0**	**6.0**	**6.0**	**6.0**	**47.7**
Vehicles, IT, Property & Engineering Equipment	**36.5**	**29.7**	**31.90**	**31.1**	**25.0**	**28.0**	**31.0**	**32.3**	**31.0**	**26.9**	**237.2**
TOTAL CORE COSTS	**283.20**	**234.72**	**241.70**	**239.60**	**229.87**	**230.37**	**234.35**	**236.61**	**232.96**	**232.27**	**1877.7**

East Midlands - core expenditure forecast

East Midlands - Core costs funded through DUoS											
Costs excluding RPEs & pensions, including efficiency (£m at 2012/13 prices)	**Average per year in DPCR5**	**Average per year in RIIO-ED1**	**Spend profile in RIIO ED1**								**Total RIIO-ED1**
			2015/16	**2016/17**	**2017/18**	**2018/19**	**2019/20**	**2020/21**	**2021/22**	**2022/23**	
Customer Related Reinforcement	-3.2	2.1	1.90	1.9	2.0	2.2	2.1	2.3	2.2	2.2	16.8
General Network Reinforcement	19.8	20.3	46.00	39.4	12.9	14.6	8.5	11.7	19.6	10.0	162.7
Reinforcement for Low Carbon Technologies	0.0	11.0	2.06	2.1	4.1	8.1	12.0	15.9	19.8	23.6	87.7
TOTAL - Reinforcement of the Network	**16.6**	**33.4**	**49.96**	**43.4**	**19.0**	**24.9**	**22.6**	**29.9**	**41.6**	**35.8**	**267.2**
Asset Replacement	53.9	52.2	52.60	52.4	52.1	52.0	51.8	52.4	52.3	52.1	417.7
Diversions	9.0	10.5	13.30	12.9	12.6	12.4	8.3	8.2	8.3	8.3	84.3
Quality of Supply (reducing power cuts)	3.7	1.1	1.50	1.5	1.4	1.4	1.4	1.4	0.0	0.0	8.6
Improving service for remote ("worst served") customers	0.0	0.0	0.00	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.2
Real Time Control Systems and Telecommunications	5.7	3.2	5.90	4.0	6.9	1.3	1.9	2.0	0.8	2.6	25.4
Protecting equipment from flooding risk	1.5	0.6	1.30	1.7	0.9	0.1	0.2	0.4	0.2	0.2	5.0
Enhancing site security, ESQCR and other legal requirements	3.9	3.2	3.30	3.3	3.2	3.2	3.1	3.1	3.1	3.0	25.3
Reducing oil and gas leaks from equipment	1.7	0.6	0.60	0.6	0.6	0.6	0.6	0.6	0.6	0.6	4.8
Undergrounding in National Parks and AONBs	0.4	0.1	0.10	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.8
Other Network Investment	7.7	1.9	4.80	5.3	1.3	1.4	1.0	0.6	0.6	0.2	15.2
TOTAL - Non-Load Network Investment	**87.5**	**73.4**	**83.40**	**81.9**	**79.2**	**72.5**	**68.4**	**68.8**	**66.0**	**67.1**	**587.3**
Inspection, maintenance and routine tree cutting	21.2	11.4	11.70	11.60	11.50	11.40	11.30	11.40	11.30	11.20	91.40
Tree clearance to improve network resilience to severe weather	0.7	1.8	1.80	1.8	1.8	1.8	1.7	1.7	1.7	1.7	14.0
Responding to and repairing faults	30.4	30.3	31.70	31.3	30.8	30.4	30.0	29.6	29.3	29.0	242.1
Other network operating costs	**2.7**	2.9	3.00	3.0	3.0	2.9	2.9	2.9	2.9	2.8	23.4
TOTAL - Network Operating Costs	**55.0**	**46.4**	**48.20**	**47.7**	**47.1**	**46.5**	**45.9**	**45.6**	**45.2**	**44.7**	**370.9**
Engineering management	**44.1**	**36.4**	**37.40**	**37.1**	**36.5**	**36.2**	**36.1**	**35.9**	**35.9**	**35.7**	**290.8**
Corporate activities	**23.4**	**10.4**	**10.90**	**10.80**	**10.5**	**10.4**	**10.3**	**10.2**	**10.1**	**10.0**	**83.2**
Workforce renewal	**4.9**	**6.0**	**5.80**	**5.9**	**6.0**	**6.0**	**6.0**	**6.0**	**6.0**	**6.0**	**47.7**
Vehicles, IT, Property & Engineering Equipment	**36.4**	**29.1**	**29.80**	**29.3**	**26.0**	**28.6**	**30.1**	**30.1**	**31.8**	**27.4**	**233.1**
TOTAL CORE COSTS	**267.9**	**235.0**	**265.5**	**256.1**	**224.3**	**225.1**	**219.4**	**226.5**	**236.6**	**226.7**	**1880.2**

South Wales - core expenditure forecast

South Wales - Core costs funded through DUoS											
Costs excluding RPEs & pensions, including efficiency (£m at 2012/13 prices)	**Average per year in DPCR5**	**Average per year in RIIO-ED1**	**Spend profile in RIIO ED1**								**Total RIIO-ED1**
			2015/16	**2016/17**	**2017/18**	**2018/19**	**2019/20**	**2020/21**	**2021/22**	**2022/23**	
Customer Related Reinforcement	-0.5	1.1	1.0	0.9	1.1	1.0	1.2	1.1	1.1	1.3	8.7
General Network Reinforcement	3.6	3.6	2.3	2.3	2.8	7.4	5.8	5.1	1.7	1.2	28.6
Reinforcement for Low Carbon Technologies	0.0	1.4	0.3	0.3	0.5	1.0	1.5	2.1	2.6	3.0	11.3
TOTAL - Reinforcement of the Network	**3.1**	**6.1**	**3.6**	**3.5**	**4.4**	**9.4**	**8.5**	**8.3**	**5.4**	**5.5**	**48.6**
Asset Replacement	30.9	35.0	34.1	34.9	34.6	35.9	35.5	34.9	35.2	34.9	280.0
Diversions	3.0	8.3	17.4	17.2	8.8	8.7	3.5	3.5	3.6	3.7	66.4
Quality of Supply (reducing power cuts)	2.4	0.4	0.5	0.5	0.5	0.5	0.5	0.5	0.0	0.0	3.0
Improving service for remote ("worst served") customers	0.2	0.1	0.0	0.5	0.5	0.0	0.0	0.0	0.0	0.0	1.0
Real Time Control Systems and Telecommunications	1.2	2.9	3.6	2.0	5.5	5.0	1.2	2.1	0.9	2.6	22.9
Protecting equipment from flooding risk	1.3	1.0	3.6	2.1	1.1	0.1	0.2	0.1	0.1	0.3	7.6
Enhancing site security, ESQCR and other legal requirements	3.3	1.3	1.4	1.3	1.3	1.3	1.3	1.2	1.2	1.2	10.2
Reducing oil and gas leaks from equipment	0.4	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	2.4
Undergrounding in National Parks and AONBs	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	1.6
Other Network Investment	0.9	0.2	0.1	0.2	0.3	0.4	0.3	0.2	0.2	0.1	1.8
TOTAL - Non-Load Network Investment	**43.7**	**49.6**	**61.2**	**59.2**	**53.1**	**52.4**	**43.0**	**43.0**	**41.7**	**43.3**	**396.9**
Inspection, maintenance and routine tree cutting	12.6	9.9	10.2	10.1	10.0	9.9	9.8	9.8	9.7	9.6	79.1
Tree clearance to improve network resilience to severe weather	1.0	1.6	1.7	1.6	1.6	1.6	1.6	1.6	1.6	1.6	12.9
Responding to and repairing faults	11.6	11.6	12.3	12.1	11.9	11.7	11.5	11.3	11.2	11.1	93.1
Other network operating costs	**1.1**	1.1	1.2	1.2	1.1	1.1	1.1	1.1	1.1	1.1	9.0
TOTAL - Network Operating Costs	**26.3**	**24.3**	**25.4**	**25.0**	**24.6**	**24.3**	**24.0**	**23.8**	**23.6**	**23.4**	**194.1**
Engineering management	**18.8**	**18.5**	**18.8**	**18.9**	**18.4**	**18.6**	**18.3**	**18.4**	**18.3**	**18.2**	**147.9**
Corporate activities	**6.4**	**5.9**	**6.1**	**6.1**	**6.0**	**5.9**	**5.90**	**5.8**	**5.8**	**5.7**	**47.3**
Workforce renewal	**4.4**	**4.5**	**4.2**	**4.4**	**4.5**	**4.5**	**4.5**	**4.5**	**4.5**	**4.5**	**35.6**
Vehicles, IT, Property & Engineering Equipment	**17.0**	**15.0**	**15.5**	**16.6**	**14.60**	**17.0**	**14.9**	**14.3**	**13.9**	**13.5**	**120.3**
TOTAL CORE COSTS	**119.7**	**123.8**	**134.8**	**133.7**	**125.6**	**132.1**	**119.1**	**118.1**	**113.2**	**114.1**	**990.7**

South West - core expenditure forecast

South West - Core costs funded through DUoS											
Costs excluding RPEs & pensions, including efficiency (£m at 2012/13 prices)	**Average per year in DPCR5**	**Average per year in RIIO-ED1**	**Spend profile in RIIO ED1**								**Total RIIO-ED1**
			2015/16	**2016/17**	**2017/18**	**2018/19**	**2019/20**	**2020/21**	**2021/22**	**2022/23**	
Customer Related Reinforcement	-1.1	1.1	1.0	1.0	0.9	1.1	1.1	1.0	1.1	1.2	8.4
General Network Reinforcement	3.8	3.9	3.2	3.9	4.5	7.2	5.7	3.5	2.0	1.4	31.4
Reinforcement for Low Carbon Technologies	0.0	5.6	1.1	1.1	2.1	4.1	6.2	8.2	10.1	12.1	44.9
TOTAL - Reinforcement of the Network	**2.7**	**10.6**	**5.3**	**6.0**	**7.5**	**12.4**	**13.0**	**12.7**	**13.2**	**14.7**	**84.7**
Asset Replacement	44.9	53.4	54.2	53.8	53.6	53.1	53.4	53.3	52.9	52.5	426.8
Diversions	4.2	9.6	13.3	13.1	7.3	7.2	7.2	7.3	8.2	13.1	76.7
Quality of Supply (reducing power cuts)	2.8	0.4	0.5	0.5	0.5	0.5	0.5	0.5	0.0	0.0	3.0
Improving service for remote ("worst served") customers	0.1	0.1	0.0	0.5	0.5	0.0	0.0	0.0	0.0	0.0	1.0
Real Time Control Systems and Telecommunications	2.2	2.9	3.7	1.6	4.8	5.0	1.6	2.6	1.1	2.9	23.3
Protecting equipment from flooding risk	0.8	0.1	0.1	0.1	0.1	0.1	0.1	0.4	0.1	0.1	1.1
Enhancing site security, ESQCR and other legal requirements	6.2	4.3	7.8	7.2	7.1	2.4	2.4	2.4	2.4	2.3	34.0
Reducing oil and gas leaks from equipment	1.4	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	2.4
Undergrounding in National Parks and AONBs	0.2	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	3.2
Other Network Investment	0.2	0.5	0.2	0.5	0.7	0.8	0.6	0.3	0.3	0.2	3.6
TOTAL - Non-Load Network Investment	**63.0**	**71.9**	**80.5**	**78.0**	**75.3**	**69.8**	**66.5**	**67.5**	**65.7**	**71.8**	**575.1**
Inspection, maintenance and routine tree cutting	15.3	13.3	13.7	13.6	13.5	13.3	13.2	13.2	13.1	13.0	106.6
Tree clearance to improve network resilience to severe weather	1.2	2.3	2.3	2.3	2.3	2.3	2.2	2.2	2.2	2.2	18.0
Responding to and repairing faults	21.4	20.8	21.8	21.5	21.2	20.8	20.5	20.3	20.1	19.9	166.1
Other network operating costs	**1.7**	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.7	1.7	14.2
TOTAL - Network Operating Costs	**39.6**	**38.1**	**39.6**	**39.2**	**38.8**	**38.2**	**37.7**	**37.5**	**37.1**	**36.8**	**304.9**
Engineering management	**25.6**	**26.8**	**26.9**	**26.8**	**26.9**	**26.7**	**26.6**	**27.0**	**26.7**	**26.9**	**214.5**
Corporate activities	**10.1**	**9.5**	**9.7**	**9.7**	**9.6**	**9.5**	**9.4**	**9.4**	**9.3**	**9.2**	**75.8**
Workforce renewal	**6.4**	**5.9**	**5.7**	**5.8**	**5.9**	**5.9**	**5.9**	**5.9**	**5.9**	**5.9**	**46.9**
Vehicles, IT, Property & Engineering Equipment	**26.0**	**25.2**	**28.0**	**28.6**	**24.1**	**26.4**	**24.0**	**23.4**	**24.0**	**23.4**	**201.9**
TOTAL CORE COSTS	**173.4**	**188.0**	**195.7**	**194.1**	**188.1**	**188.9**	**183.1**	**183.4**	**181.9**	**188.7**	**1503.8**

Load related investment

3 Background to our 'Best View' forecast

3.1 The UK is committed to reducing its carbon dioxide emissions by at least 80% by 2050, relative to 1990 levels. This commitment will be met through the decarbonisation of heating and transport, improvements in energy efficiency and producing electricity from renewable sources. The Government has set out its approach to energy and climate change in its document "The Carbon Plan: Delivering our Low Carbon Future", published in December 2011. This sets out potential pathways (scenarios) to put the UK on track to halve greenhouse gas emissions, on 1990 levels, by the mid-2020s and a path towards an 80% reduction by 2050. The impact of this on our networks is significant.

3.2 Historically, the main driver of load related investment has been the general economic conditions, as there was a correlation between GDP growth and load growth. In more recent times, this correlation has become weak. The main remaining effect of general economic condition is the effect on the number of new connections to the networks.

3.3 More significant drivers of future load related investment will be:

- the impact of customers installing electric heating (mainly heat pumps), photovoltaic (PV) small scale embedded generation (SSEG) and purchasing electric cars or 'plug in' hybrid cars that will need access to a charging facility;
- continuing growth in larger scale generation (generally solar, wind, waste incineration and the potential for Combined Heat and Power (CHP)).

General economic conditions

3.4 The current economic conditions create uncertainty in relation to future investment. The impact of this uncertainty affects underlying growth in electricity usage, and particularly affects the number of new connections we can expect. It is also likely to impact on the willingness of customers to invest in low carbon technologies as lower economic activity is likely to delay capital investments by customers and also to delay any significant increase in the differential between energy from low carbon sources and carbon derived energy. The current UK fiscal position also makes the introduction of any significant new subsidies to encourage low carbon technologies unlikely in the early part of the RIIO-ED1 forecast.

3.5 In our RIIO-ED1 planning we have reviewed forecast data available from the Ernst & Young ITEM Club (EYIC), The National Institute for Economic and Social Research (NIESR) and also from HM Treasury. From this range of economic indicators we have derived our own set of forecast indicators that we have used within the Business Plan.

3.6 The key economic indicators used to derive our plans are as follows:

Key economic indicators					
		2013	2014	2015	2016 – 2023
GDP growth		0.0%	1.7%	2.5%	2.5%
CPI		1.6%	2.0%	2.0%	2.0%
RPI		2.6%	2.5%	2.5%	2.8%

New connections

3.7 A key driver of electricity demand growth is new connection activity for housing and commercial developments. Data collated by Oxford Economics shows that there will be progressive growth in the volume of connections.

3.8 The new connections activity is within a competitive environment where customers can choose a connections service. WPD has always offered a new connections service, but there are now other providers of this service. Overall we expect that by 2023 we will have lost further new connections activity in the South West and South Wales and we will have regained some market share in the West Midlands and East Midlands.

Impact of low carbon technologies (LCTs)

3.9 Our best view scenario for the impact of LCTs, such as heat pumps, electric vehicles and domestic level PV, on our business is based on the results of work we have undertaken with the Centre for Sustainable Energy (CSE) in Bristol.

3.10 Our best view scenario represents a significant change in the usage of the network by LCTs and our plan incorporates the requirement to allocate resources to deliver as this change occurs.

3.11 The network impact of all scenarios is heavily influenced by the location that low carbon technologies and generation connect to the network. In particular the degree of clustering of heat pumps, electric vehicle charging and small scale embedded generators (SSEG) on the LV network has a significant impact on the investment needed. To date, the only technology that has been installed in significant numbers is SSEGs (almost entirely domestic photovoltaic). The work we have undertaken with the CSE gives a highly detailed view (at individual house level) of where there is likely to be a take up of these different technologies. We have analysed their respective distribution to give a view of clustering for each technology.

3.12 The output from the CSE work has also been used to assess the number of HV/LV substations that are likely to experience loading problems during the RIIO-ED1 period.

3.13 The Department for Energy and Climate Change (DECC) has, via the Smart Grid Forum (SGF) 'workstream 1' created scenarios for heat pumps, electric vehicles and PV that are consistent with the Government's Carbon Plan. A further group of the SGF, 'work stream 3', has produced both national and regional models (the Transform model) to show the impact of these energy scenarios on the GB distribution network.

3.14 The output from these models has been used to understand the range of potential outcomes which has helped to shape the required uncertainty mechanism during RIIO-ED1.

Demand side management and energy efficiency

3.15 Information within the Carbon Plan indicates electrical energy efficiency improvements in buildings of between 7% and 13% by 2020 due to improvement in the electrical efficiency of lighting and appliances. Some further reductions in electricity usage in homes are likely from 2020 following the completion of the smart meter rollout. This will provide better information to homeowners allowing them to better control their own usage of electricity in line with the introduction of more 'Time Of Use' tariffs by suppliers.

3.16 Demand side management (DSM) will be delivered by a combination of the introduction of Time of Use tariffs by suppliers and additional initiatives that will require more direct control of certain types of equipment in customers' premises.

3.17 Our expectation is that uptake of DSM by domestic customers and small and medium enterprises will be slow.

3.18 It is more likely that active DSM on the distribution network will be delivered by larger industrial businesses and generators who are already offering Short Term Operating Reserve (STOR) (needed to help balance demand and generation minute by minute) to National Grid. The Supplementary Annex (SA-03) Innovation highlights the work being undertaken in our FALCON low carbon networks fund project to facilitate DSR at this level.

Distributed generation (DG)

3.19 We continue to see a significant number of enquiries for large scale (5 to 10MW) PV particularly in Devon/Cornwall. Discussions with the main developers indicate a high likelihood of installations totalling 0.5 to 2GW in Devon and Cornwall provided that the current levels of Renewable Obligations Certificate (ROC) subsidies continue. These enquiries are starting to move further north into our South Wales and Midlands areas.

3.20 Plans for new onshore wind farms are expected to continue where significant wind resources are available – this in mainly in mid/south Wales and Lincolnshire.

3.21 Increasingly, urban local authorities are requiring CHP to be an integral part of any significant redevelopment. For example, Birmingham City Council's draft core strategy to 2026 requires large residential developments of more than 50 properties and non-residential developments over 1,000 sq. m. to include CHP or connection to an existing CHP facility. This results in issues associated with the 'fault level' capability of our network and is a key driver for our Low Carbon Network Fund project 'FlexDGrid', which we are undertaking to develop ways to manage such fault level issues. This is described in more detail in the Supplementary Annex (SA-03) Innovation.

3.22 National Grid is currently contracting for significant quantities of STOR each year from generators. We are seeing a significant number of applications for connection of generators in the 10MW to 30MW range to fulfil these contracts. We expect that these will form the majority of fossil fuel generation connected to our networks.

European Network Codes

3.23 The European Union's third legislative package for the internal energy market calls for the European network of transmission system operators for electricity to undertake drafting of network codes. These codes cover the requirements for generators, demand connections, operational security and operational planning and scheduling. As the objective of these codes is focused on cross border trading, the majority of provisions do not directly impact UK DNOs; however there are some provisions which will affect how we deal with the connection of generators, some protection arrangements and a significant increase in the data that will need to be produced and shared with National Grid as the Transmission System Operator. These requirements are likely to increase the resources needed in both network design and control activities.

Description of the CSE work 'On our wires'

Purpose of the work

3.24 The purpose of the work was to develop a better picture of the people and organisations connected to the Western Power Distribution (WPD) network to help forecasting demand (and associated business planning) particularly in terms of the likelihood of the uptake of low carbon technologies.

3.25 The work used statistical modelling and Graphical Information System (GIS) analysis techniques combining a range of existing high resolution, geo-spatially disaggregated socio-economic and property-related data-sets together with WPD network location data.

3.26 Modelling work has been undertaken by CSE using their Housing Assessment Model which is a sophisticated model of the housing stock at individual property level. This uses data about housing type, tenure and socio-demographic group to model which households are more likely to take up technologies and what the capacity would be. The technologies included are PV, ground source heat pumps, air source heat pumps, and direct electric heating.

Modelled new heat related demand

3.27 The heat demand for a property is calculated in the CSE Housing Assessment Model using data on:

- the size of the property in terms of number of bedrooms;
- built form (e.g. detached house, flat);
- wall type (solid or cavity - derived from the property age).

3.28 It also uses data from the English House Condition Survey and calculations based on the Building Research Establishment's Standard Assessment Procedure (or SAP, a way of measuring the energy cost of heating a dwelling). It calculates a heat transfer coefficient for each property and this is used with an internal target temperature of 21°C, an external sub-zero temperature of -5°C and the total net gains in the dwelling (taking into account solar and internal gains for that time of year) to calculate a peak heat demand for these circumstances.

3.29 To receive a heat pump in the modelling, properties had to be capable of improvement to a SAP D (SAP ratings go from A, which is the most efficient level met by only a handful of properties, to G being the most inefficient). Where properties would meet this level with improvement measures (wall and loft insulation), the peak demand figure used is the demand after the improvements.

3.30 A significant level of detail has been included in the analysis to show what the impact will be at distribution substation level.

3.31 More details of this work can be seen in the Centre for Sustainable Energy report. This may be found http://www.westernpower.co.uk/docs/About-us/Stakeholder-information/Our-future-business-plan/Supporting-Expenditure-information/CSE-On-Our-Wires-Methodology-Report.aspx

4 Provision of connections

Introduction

4.1 Customers who require a new or increased (augmented) electricity supply need to obtain a new or larger connection to the network. This may require new assets that will be exclusively used by the customer (sole use assets) and may also require the capacity of the existing network to be increased (reinforcement).

4.2 When a customer requests a connection, WPD carries out the network design, calculates the associated costs and provides a connection quotation. Once the customer accepts the quotation, the work is organised and dates are agreed with the customer. All aspects of the process are subject to Ofgem Guaranteed Standards of Performance and WPD strives to achieve zero failures against these guarantees.

Connection categories

4.3 There are three main types of connections:

- demand;
- distributed generation (DG);
- unmetered.

4.4 Demand connections are provided for customers who consume electricity.

4.5 Distributed generation connections are provided where the predominant use of the connection is the export of electricity or where an existing connection has to be augmented to enable the export of electricity. This category does not include new demand connections that also have an element of generation export, e.g. a new property fitted with a PV installation is a demand connection not a DG connection.

4.6 Unmetered connections are provided to local authorities and developers for low power consumption equipment such as street lights and traffic lights.

Competition in connections

4.7 Historically, DNOs were the only organisations that could provide a connection but the opening up of the connections market to third party providers has led to increased competition in the provision of connections.

4.8 Over the last ten years there has been growth in the number of third party providers carrying out connections work, with customers now being able to choose from:

- Independent Connection Providers (ICPs) who construct the network and pass on ownership of that network to DNOs or IDNOs via Connection and Adoption Agreements;
- Independent Distribution Network Operators (IDNOs) who retain ownership and operation of the networks;
- DNOs.

4.9 Third party providers have the freedom to elect whether or not to accept connections work, but under the Electricity Act 1989, DNOs are obliged to provide a connection if asked to do so. This has resulted in competition for larger developments but negligible competitive activity for smaller schemes or one-off small value connections.

4.10 Third parties can only carry out work that is deemed to be contestable (open to competition).

4.11 Initially contestable work was limited to the construction of new assets within the boundaries of new developments, but the scope of work that is contestable has grown progressively, with third party providers now being able to make the final live connections to the existing WPD overhead and underground network at LV. WPD will endeavour to continue to extend the scope of the contestable work, co-operating with third parties and developing processes. This will include allowing third parties to carry out reinforcement of the network which to date has predominantly been an activity carried out by DNOs.

4.12 More detail of the expansion of the scope of contestable work and the movement in market share between WPD and third parties is detailed below.

Expenditure overview

4.13 The following provides a summary of the costs for each type of connection:

Connections expenditure (by connection type) - Total RIIO-ED1 (£m)					
	West Midlands	**East Midlands**	**South Wales**	**South West**	**WPD total**
Demand connections	140.0	135.2	72.7	136.2	484.2
DG connections	38.8	29.6	33.6	45.5	147.4
Unmetered connections	13.3	6.8	2.8	5.9	28.8
Total connections expenditure	**192.1**	**171.6**	**109.1**	**187.5**	**660.4**

4.14 The cost for each category can be subdivided into sole use costs and costs for network reinforcement.

4.15 Sole use costs are treated as being outside the price control since they are fully funded by the customer requesting the connection.

4.16 Reinforcement costs are considered as part as the price control because a proportion of the costs are funded through DUoS. The part of reinforcement funded by connection customers is determined by comparing the capacity required specifically for the customer against the overall capacity provided by the reinforcement. This proportion is called the Cost Apportionment Factor (CAF) and the methods for calculating it are defined within Connections Charging Statements published by each DNO. The remainder of the costs for reinforcement are funded through DUoS.

4.17 This treatment of costs create three main cost categories:

- sole use costs;
- customer funded reinforcement;
- DUoS funded reinforcement.

4.18 The following tables show how the costs for demand connections and DG connections are split across these cost categories:

Demand connections expenditure - Total RIIO-ED1 (£m)					
	West Midlands	**East Midlands**	**South Wales**	**South West**	**WPD total**
Sole use	114.7	110.3	61.5	124.5	411.0
Customer funded reinforcement	9.4	10.2	5.1	5.9	30.7
DUoS funded reinforcement	15.9	14.7	6.1	5.8	42.5
Total demand connections expenditure	**140.0**	**135.2**	**72.7**	**136.2**	**484.2**

DG connections expenditure - Total RIIO-ED1 (£m)					
	West Midlands	**East Midlands**	**South Wales**	**South West**	**WPD total**
Sole use	35.7	25.5	29.0	40.9	131.1
Customer funded reinforcement	1.0	1.9	2.1	1.9	6.8
DUoS funded reinforcement	2.2	2.2	2.5	2.6	9.5
Total DG connections expenditure	**38.8**	**29.6**	**33.6**	**45.5**	**147.4**

4.19 The following table summarises the DUoS funded expenditure and illustrates that this equates to approximately 8% of total connection costs across WPD.

DUoS expenditure - Total RIIO-ED1 (£m)					
	West Midlands	**East Midlands**	**South Wales**	**South West**	**WPD total**
Total DUoS funded expenditure	18.1	16.9	8.6	8.4	52.0
%age of total connections expenditure	9.4%	9.9%	7.9%	4.5%	7.9%

Future forecasts

4.20 The forecast of future expenditure has been carried out by assessing requirements within different market segments. For each market segment we have considered:

- the volumes of connections;
- the growth in work that is contestable;
- the proportion of projects delivered by third party providers;
- the proportion of projects that require reinforcement;
- the impact of third party providers carrying out reinforcement work;
- the impact of LCTs on connection costs.

Market segments used in the forecast

4.21 Connections have been categorised into segments that are dependent on the voltage of the connection, the highest voltage being worked on, the size of the development and whether it is for demand, generation or an unmetered supply. The segments used are based upon regulatory reporting segments, which are more disaggregated than the market segments used for the regulatory Competition Test.

4.22 The segments used for demand connections align with regulatory reporting categories and are:

- LVSSA – Single domestic connections with no mains work at low voltage (LV);
- LVSSB – 2 to 4 domestic connections or one-off commercial connections at LV;
- LVAL - All other LV (with only LV work);
- LVHV - LV end connections involving high voltage (HV) work;
- HVHV - HV end connections involving only HV work;
- LVEHV - LV end connections involving extra high voltage (EHV) work;
- HVEHV - HV end connections involving EHV work;
- EHV - EHV end connections involving only EHV work;
- HV132 - HV or EHV connections involving 132kV work;
- 132 - 132kV end connections involving only 132kV work.

4.23 The total project costs for each demand segments are shown below, illustrating that the majority of expenditure is on LVSSA, LVAL, LVHV and HVHV connections.

Demand connections expenditure in RIIO-ED1 (£m)					
	West Midlands	**East Midlands**	**South Wales**	**South West**	**WPD Total**
LVSSA	16.1	16.3	12.7	23.5	68.6
LVSSB	4.5	5.2	1.6	2.0	13.3
LVAL	28.4	31.1	11.9	19.0	90.4
LVHV	42.3	47.6	28.5	57.5	175.9
HVHV	37.8	26.7	9.7	26.0	100.2
LVEHV	-	-	-	-	-
HVEHV	5.4	5.4	5.4	5.4	21.7
EHV	1.9	1.9	1.9	1.9	7.5
HV132	2.5	-	-	-	2.5
132kV	1.0	1.0	1.0	1.0	4.1
TOTAL	**140.0**	**135.2**	**72.7**	**136.2**	**484.2**

4.24 The segments used for DG connections are based on regulatory reporting requirements, but the category for HV work has been subdivided further to assess LV DG connections with HV work separately to HV DG connections with HV work. The full list of categories used for DG connections is:

- DGLV – DG connections involving LV work only;
- DGLVHV – DG connections at LV requiring work at HV;
- DGHV – DG connections at HV requiring HV work only;
- DGEHV – DG connections requiring EHV work;
- DG132 – DG connections requiring 132kV work.

4.25 The total project costs for each DG segment are shown below, illustrating that the majority of expenditure is on HV and EHV connections.

DG connections expenditure in RIIO-ED1 (£m)					
	West Midlands	**East Midlands**	**South Wales**	**South West**	**WPD Total**
DG LV	1.7	1.2	0.8	0.5	4.2
DG LVHV	2.2	2.1	0.3	5.3	9.9
DG HV	21.6	12.3	16.6	19.3	69.9
DG EHV	12.3	11.7	11.7	13.7	49.4
DG 132	1.1	2.2	4.1	6.7	14.0
TOTAL	**38.8**	**29.6**	**33.6**	**45.5**	**147.4**

4.26 The segments used for unmetered connections are

- UMLA – ummetered local authority;
- PFI – unmetered connections for private finance initiatives;
- OUMC – other unmetered connections.

4.27 The total project costs for each unmetered segments are shown below, illustrating that the majority of expenditure is on unmetered local authority connections.

Unmetered connections expenditure in RIIO-ED1 (£m)					
	West Midlands	**East Midlands**	**South Wales**	**South West**	**WPD Total**
UMLA	10.0	4.4	2.3	3.2	20.0
PFI	-	-	-	-	-
OUMC	3.3	2.4	0.5	2.6	8.8
TOTAL	**13.3**	**6.8**	**2.8**	**5.9**	**28.8**

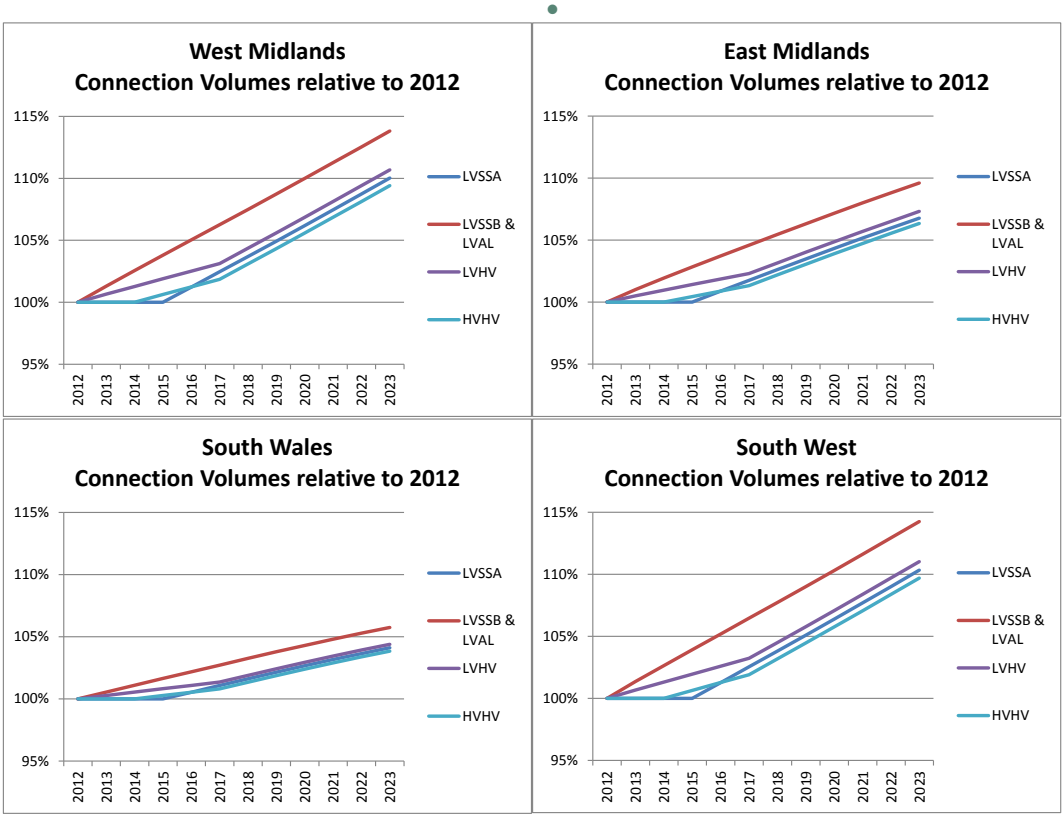
Future connections activity

Demand connections

4.28 The volume of connections varies each year and is dependent upon various factors including economic strength, attitude of developers and government incentives. Data collected by Oxford Economics on housing stock projections by local authorities has been used to determine the annual percentage change in housing stock. This change has then been applied in varying degrees to different segments.

4.29 The following charts show the market volumes relative to 2012 for segments involving LV and HV work. These growths are based upon the following assumptions:

- The most buoyant market is for small to medium sized housing developments which do not required any HV work. The housing stock projections have been applied in full to the LVAL and LVSSB segments;
- One-off plot volumes (LVSSA) will remain constant until 2015 at which point small developers will feel more confident about market conditions and volumes will grow in line with housing stock projections;
- Large domestic developments where work is required at HV (LVHV) will grow, but at half the rate of housing stock projections until 2017, with growth after this point being in line with projections;
- Commercial and industrial connections at HV requiring HV work (HVHV) will be constant until 2014, then grow at half the rate of housing stock projections until 2017, after which the full rate applies.



4.30 Connection volume growth across the four licence areas will differ, with growth being highest in the West Midlands and the South West (approximately 15% increase in LVAL volumes in 2023 compared to 2012) and lowest in South Wales at 6%.

4.31 Demand connection volumes will be very low on EHV and 132kV networks and the following assumptions have been used for the entire RIIO-ED1 period:

- LVEHV - no volumes are forecast in this segment.
- HVEHV - four projects in each licence area; two requiring reinforcement.
- EHV – two projects every six years; one without reinforcement and one with reinforcement.
- HV132 - a project every six years without reinforcement in West Midlands only.
- 132 - one project in each licence area across the period that will not require reinforcement.

4.32 The table below shows the total forecast volume of demand connection projects across RIIO-ED1:

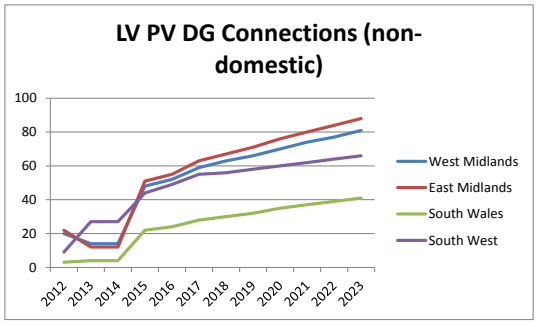
Forecast number of demand connections projects in RIIO-ED1					
	West Midlands	**East Midlands**	**South Wales**	**South West**	**Total**
LVSSA	19,434	18,662	13,394	30,191	81,681
LVSSB	2,522	2,566	849	1,339	7,276
LVAL	4,507	4,773	2,074	4,010	15,364
LVHV	1,858	1,573	1,931	3,357	8,719
HVHV	648	613	188	421	1,870
LVEHV	-	-	-	-	-
HVEHV	4	4	4	4	16
EHV	3	3	3	3	12
HV132	1	-	-	-	1
132kV	1	1	1	1	4
TOTAL	**28,978**	**28,195**	**18,444**	**39,326**	**114,943**

Distributed generation connections

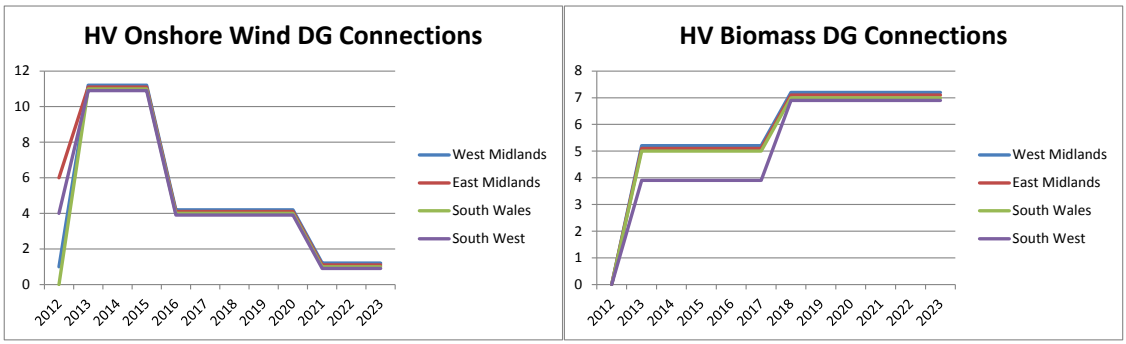
4.33 DECC scenario projections show a high take up of domestic PV installations. These will be installed on a 'fit and report' basis and it is assumed that none will require a new DG connection.

4.34 The collective effect of connecting them could give rise to the need for network reinforcement or installation of voltage regulation equipment and the costs for this are captured within general network reinforcement expenditure.

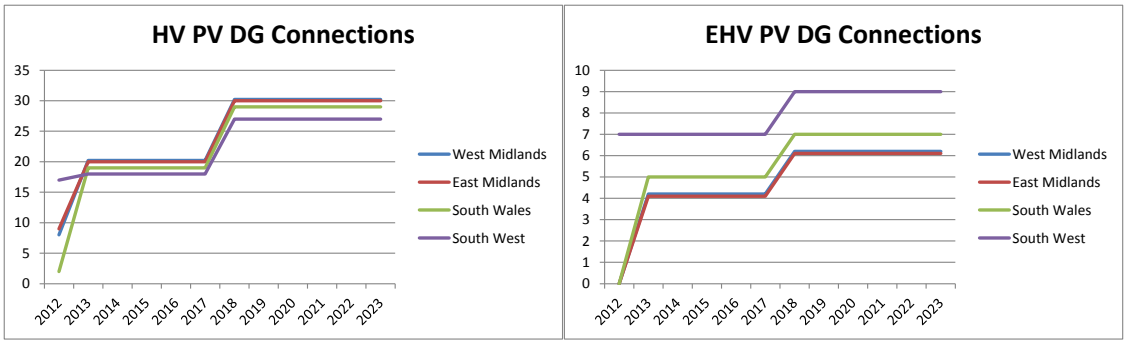
4.35 LV DG connection volumes are derived from forecasts of non-domestic PV installations assuming that 10% require a new or augmented connection.



4.36 HV DG connection volumes are derived from forecasts for onshore wind, biomass and large scale PV generation. The opportunities for onshore wind are becoming limited and we predict that volumes will fall. We expect that there will be a steady stream of connection projects for biomass fuelled generators. The following charts illustrate the forecast volume of HV DG connection projects for onshore wind and biomass generation.



4.37 Across the South West and increasingly across the rest of the areas, developers are installing large scale PV arrays on fields. Support mechanisms are making these installations very profitable for farmers who would otherwise use the land for alternative purposes. Many of the PV arrays require a connection to the HV network, whilst some of the largest installations are connected directly onto the 33kV network (particularly in South West and South Wales).



4.38 There are a very small volume of DG connection projects at 132kV. The highest forecast is for 6 connections to be made to the South West network across the RIIO-ED1 period.

4.39 The table below shows the forecast volume of DG connection projects in RIIO-ED1:

Forecast number of DG connections projects in RIIO-ED1					
	West Midlands	**East Midlands**	**South Wales**	**South West**	**WPD Total**
DG LV	346	410	240	103	1,099
DG LVHV	196	175	26	369	766
DG HV	295	295	287	271	1,148
DG EHV	44	52	52	68	216
DG 132	1	2	4	6	13
TOTAL	**882**	**934**	**609**	**817**	**3,242**

Expansion of scope of contestable work

4.40 Work that can be carried out by a third party is described as being contestable.

4.41 The forecasts assume that at LV the majority of work on overhead lines and cables is contestable. The only exception is work in existing substations such as the provision of an additional feeder way. Substation work is infrequent and therefore it has been assumed that LV work is 100% contestable.

4.42 Processes have been developed to allow trials to extend contestable work on HV networks. The current trials allow jointing and associated operational activity by suitable accredited third parties with interaction with WPD's operational control and operational technicians. It is anticipated that these works will become contestable before 2014. It has been assumed that the scope of contestable work will grow to include overhead line connections and construction work within existing substations by 2018.

4.43 The operation of the EHV and 132kV networks is subject to more complex arrangements and access to the network depends on outage availability. It has been assumed that third parties will be able to build new assets 'off line' but final connections to the network will be carried out by WPD.

Market share lost to third parties

4.44 Third parties are most active in the LVAL, LVHV and HVHV segments providing connections for medium to large domestic estates and commercial/industrial developments. Many third party providers are based in the Midlands area and consequently this is where there is the most competitive activity. It is anticipated that third parties will expand into the Newport and Cardiff areas in South Wales and Bristol, Bath and Somerset in South West.

4.45 It has been assumed that third party providers will continue to increase or retain their market share in the segments where they are active. The exceptions to this are for LVHV and HVHV demand projects in the West Midlands and East Midlands where it is forecast that WPD will recover market share as a consequence of more competitive, lower connection costs arising from efficiencies introduced following WPD's takeover.

4.46 Market share changes for demand connection projects carried out by third party providers at 2012 and projected to 2023 are shown below. For all other market segments we have assumed no change to market share.

Proportion of demand connection projects carried out by third parties (RIIO-ED1)				
Segment	**West Midlands**	**East Midlands**	**South Wales**	**South West**
LVAL	Increase from 11% to 13%	Increase from 13% to 15%	Increase from 1% to 2%	Increase from 1.5% to 6%
LVHV	Held at 15%	Reduction from 25% to 20%	Increase from 1% to 10%	Increase from 1% to 12%
HVHV	Reduction from 55% to 40%	Reduction from 47% to 40%	Increase From 5% to 18%	Held at 30%

4.47 Third parties providers have been very active in the DG connections market for connections involving HV or EHV work and our forecasts suggest that their market share will continue to increase. The proportions carried out by third parties at 2012 and projected to 2023 are shown below:

Proportion of DG connection market share carried out by third parties (RIIO-ED1)				
Segment	**West Midlands**	**East Midlands**	**South Wales**	**South West**
DGLV	No change Remains at 0%	No change Remains at 0%	No change Remains at 0%	No change Remains at 0%
DGLVHV	Increase from 0% to 5%	Increase from 2% to 7%	Increase from 0% to 5%	Increase from 0% to 5%
DGHV	Increase from 20% to 30%	Increase from 25% to 30%	Increase from 21% to 30%	Increase from 18% to 30%
DGEHV	Increase from 20% to 75%	Increase from 42% to 75%	Increase from 33% to 75%	Increase from 46% to 75%
DG132	Assumed flat at 25%	Assumed flat at 25%	Assumed flat at 25%	Assumed flat at 25%

4.48 The impact of these changes means that third parties providers will carry out more sole use work. The RIIO-ED1 expenditure forecasts exclude those costs that are expected to migrate to third party providers because they will become direct transactions between customers and third party providers.

4.49 The value of expenditure that is assumed to migrate to third party providers in the future is summarised in the table below. This is equivalent to 4.4% of the demand and DG connection sole use expenditure that will remain within WPD.

Sole use costs that will migrate to third party providers Total RIIO-ED1 (£m)					
	West Midlands	**East Midlands**	**South Wales**	**South West**	**WPD Total**
Demand connections	3.9	2.2	1.7	8.3	16.1
DG connections	4.2	0.8	1.2	1.5	7.7
Total sole use costs migrating to third parties	8.1	3.0	2.9	9.8	23.8

Connections requiring reinforcement

4.50 The majority of connection projects can be carried out as pure network extension work where all the new assets are specifically for the new connections (sole use). In some instances the existing network requires to be reinforced to provide the necessary upstream capacity.

4.51 The anticipated growth in demand based LCTs for vehicle charging and heat pumps will lead to less spare capacity on the LV network as more of these LCTs are connected, leading to a greater proportion of connections requiring reinforcement to enable connection. For demand connections this will mainly impact the LVAL and LVHV connection segments, with limited change in other segments. The table below illustrates the change for WPD provided demand connections.

Percentage of demand connection projects delivered by WPD requiring reinforcement (RIIO-ED1)				
Segment	**West Midlands**	**East Midlands**	**South Wales**	**South West**
LVAL	Increase from 7.0% to 9.5%	Increase from 7% to 9.5%	Increase from 1.9% to 4.4%	Increase from 4.3% to 6.8%
LVHV	Increase from 37% to 42%	Increase from 43% to 48%	Increase from 44% to 49%	Increase from 28% to 33%

Reinforcement work becomes contestable

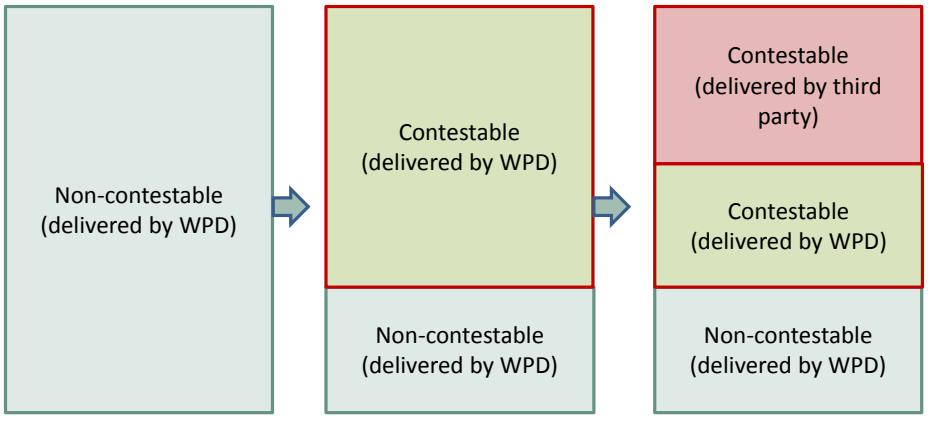
4.52 Network reinforcement accounts for approximately 14% of all connections expenditure.

Connection reinforcement expenditure - Total RIIO-ED1 (£m)					
	West Midlands	**East Midlands**	**South Wales**	**South West**	**WPD total**
Customer funded reinforcement	10.4	12.0	7.2	7.9	37.5
DUoS funded reinforcement	18.1	16.9	8.6	8.4	52.0
Total connections reinforcement expenditure	28.5	29.0	15.8	16.2	89.5
%age of total connections expenditure	14.8%	16.9%	14.5%	8.7%	13.6%

4.53 Whilst third parties have been permitted to carry out sole use work to extend the network for new connections, DNOs have generally carried out network reinforcement activity. This situation will change as elements of reinforcement work become contestable and third parties start to carry out reinforcement work.

4.54 The following diagram illustrates this evolution where:

- currently all reinforcement work is non-contestable;
- at some point in the future (which we have assumed ranges from 2014 to 2016 for different market segments) a proportion of the work will become defined as contestable but WPD will still carry out this work whilst third party providers go through an authorisation process;
- at 'future 2' third parties will progressively start to deliver some of the contestable reinforcement, once they have received approval to carry out the work and financial mechanisms have been developed. We have assumed that this occurs the following year after reinforcement is declared as being contestable.

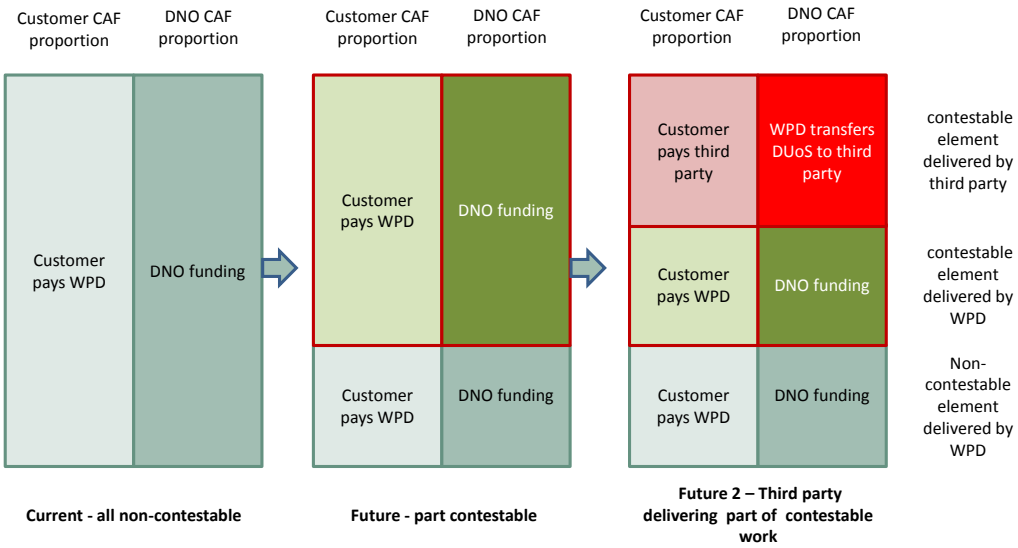


4.55 Where customers only utilise part of the capacity provided by reinforcement, they fund a proportion of the costs determined by the Cost Apportionment Factors (CAF) defined within Connection Charging Statements. For example if a customer uses half the capacity they will contribute 50% to the cost of the reinforcement. The remainder of the reinforcement will be funded by WPD from DUoS allowances. The move to allowing third parties to carry out reinforcement work will lead to changes in how the reinforcement is funded.

4.56 Currently reinforcement of the network is carried out by WPD and the customer pays WPD for their CAF proportion of the costs. Once this changes so that part of reinforcement work is defined as contestable (but remains delivered by WPD), the customer will still pay WPD for their CAF proportion of the costs but there will be two classifications of cost (contestable and non-contestable).

4.57 When third parties start to carry out some of the contestable reinforcement (at future 2), the payments will become more complex as illustrated in the following bullet points and diagram.

- the customer will pay WPD their CAF proportion of any non-contestable work;
- WPD will fund the remainder of non-contestable work;
- the customer will pay WPD their CAF proportion of contestable work delivered by WPD;
- WPD will fund the remainder of contestable work delivered by WPD;
- the customer will pay the third party their CAF proportion of contestable work delivered by the third party;
- WPD will pay the third party (transferring DUoS) for the remainder of the costs of contestable work delivered by the third party.



4.58 The detailed calculations used for the connection forecasts assume a proportion of costs become contestable and that third parties deliver some of the reinforcement work. Relative to the current situation where all costs are non-contestable, this means that the contributions from customers for reinforcement will reduce (because some of the payments will go directly to the third parties who are executing the works), but the DUoS requirement will be the same (albeit that some of it will be transferred to the third party).

4.59 The expenditure forecasts in the Business Plan include these costs, as it is uncertain when the industry will reach agreement on how to implement the changes to allow third parties to carry out reinforcement.

4.60 The potential impact, should the change arise has been forecast and is shown in the table below:

Potential impact of third parties carrying out reinforcement for connections in RIIO-ED1 (£m)					
	West Midlands	**East Midlands**	**South Wales**	**South West**	**WPD Total**
Customers make payments to third parties instead of DNOs	0.7	0.4	0.2	0.1	1.5
Transfer of DUoS from WPD to third parties	1.5	0.7	0.6	0.1	2.9
Total potential impact	**2.2**	**1.1**	**0.8**	**0.3**	**4.4**
%age of total reinforcement costs	8%	4%	5%	2%	5%

Impact of low carbon technology on connection costs

4.61 As customers adopt more LCTs and this becomes an integral part of new connections (e.g. vehicle charging points in new properties) the assets used for new connections will need to be of a larger capacity, with associated higher costs. This will impact all demand segments where the end connection is at LV.

Overlap with forecasts for general reinforcement

4.62 There is no overlap with the forecasts for general reinforcement. The forecast for general reinforcement use the output from a model that assumes that future networks will be built with sufficient capacity to cater for connection of low carbon technology. The model does not include any allowance for increased costs of new connections in its results.

Unmetered connections

4.63 Volumes of unmetered connections in the West Midlands and East Midlands are forecast to remain steady over the RIIO-ED1 period since third party activity is established and not forecast to change.

4.64 Volumes in South Wales are forecast to increase as a result of some local authorities currently using third parties reverting back to WPD, attracted by lower connection prices. It is assumed that volumes will grow by 5% per annum between 2012/13 and 2015/16 and then remain at the higher levels during RIIO-ED1.

4.65 Volumes in the South West are forecast to fall as business is lost to third parties. It is assumed that volumes will reduce by 5% per annum from 2012/13 until the middle of RIIO-ED1.

4.66 The volumes of connections forecast to be delivered by WPD in each market segment are shown in the table below:

Volumes of unmetered connections (RIIO-ED1)					
	West Midlands	**East Midlands**	**South Wales**	**South West**	**WPD Total**
UMLA	11,044	4,864	2,537	3,570	22,015
PFI	-	-	-	-	-
OUMC	3,601	2,641	567	2,871	9,680
TOTAL	**14,645**	**7,505**	**3,104**	**6,441**	**31,695**

5 General reinforcement

5.1 General reinforcement is an area of activity that enables WPD to provide adequate capacity in the network to meet load demands and ensure that the voltage of the network remains within statutory limits.

Objective

5.2 The provision of network capacity is defined in two main documents:

- Electricity Networks Association Engineering Recommendation for Security of Supply P2/6 specifies the expected capability of the network to meet demands under defined outage conditions.
- The Electricity Supply Quality and Continuity Regulations (ESQCR) define voltage limits.

5.3 The fundamental planning principles used by WPD for the development of the network seek to comply with these expectations and meet the future needs of customers. Load forecasting techniques are used to predict future demands and voltage regulation is examined by considering the impact of loads and connected generation.

5.4 Where forecasts suggest that networks will become overloaded, actions will be taken to ensure that the networks remain compliant with P2/6 and meet the voltage limits of the ESQCR.

Changing operating context

5.5 For many years the function of electricity networks has remained unchanged, acting as a one-way conduit to transport electrical energy from central generation to homes and businesses. Load growth has been reasonably predictable; steadily increasing as more electrical goods have been used and easing back during times of recession. The provision of additional capacity has been achieved through installing larger or additional transformers, lines and cables.

5.6 Concerns about global climate change have led to unprecedented levels of interest in energy. To address this issue the Government has agreed to a reduction in greenhouse gas emissions and introduced incentives and obligations to create a lower carbon future. Decarbonisation of travel, heating and energy production is anticipated to have a significant impact on distribution networks, resulting in a recognition that distribution networks will need to change over time to accommodate electric vehicle charging, growth in electricity based heating and an upsurge in distributed generation.

5.7 Scenario modelling suggests that there could be significant load growth and/or voltage regulation issues requiring extensive network reinforcement on a scale that would lead to large increases in costs to customers. The obligation to provide an economic solution for customers means that 'smarter', lower cost alternatives to traditional reinforcement need to be developed and adopted.

5.8 During RIIO-ED1 the changes to energy usage will be progressive and therefore 'smart' solutions will be used in an incremental way, being considered when local circumstances indicate they are appropriate. These smart alternatives may include commercial arrangements for demand side management (DSM) (where customers will be incentivised financially to change their electricity usage), demand side response (DSR) (where customers are incentivised to reduce demand at short notice in response to issues on the network) or technical solutions such as active network management, electrical energy storage or one of the many other smart technical solutions being developed. Details of the activities and plans for these are included in the Supplementary Annex (SA-03) Innovation.

5.9 Specific solutions will continue to be managed in response to the local driver by accommodating it in the most appropriate manner, balancing economic, technical and operational considerations.

Traditional reinforcement

5.10 The capacity of a network is limited by the rating of equipment and the number of circuits available to carry load current. Where load growth leads to capacity being used up the traditional approach to providing more headroom has been to replace those assets with higher rated equivalents or to provide additional circuits or transformers. Whilst these solutions will continue to be used, the use of smart interventions will grow as the techniques and systems for their use are established.

Smarter interventions

5.11 Funding obtained through Ofgem's Low Carbon Network Fund has accelerated innovation on distribution networks. The development of advanced network techniques such as dynamic rating of equipment, automatic network meshing and active voltage control means that there are alternative ways of providing additional capacity headroom. The introduction of commercial arrangements for demand side management provides a mechanism to influence users to change their loads at time of high demands. These are all considered as smart interventions.

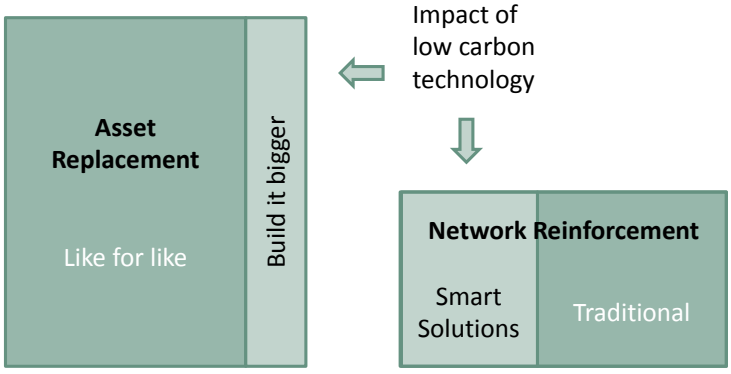
5.12 There will be an increase in demand caused by the volumes of LCT required to meet greenhouse gas reduction targets. Modelling techniques employed by WPD allow predictions to be made about the potential impact but the speed, location and scale of adoption remains uncertain.

5.13 Since there is uncertainty about the volume and location of LCT, it is prudent to develop smarter networks incrementally, progressively improving them as more is learnt about their operation, their benefits and any practical difficulties. WPD will use network monitoring to identify where deployment of smarter solutions is appropriate.

5.14 This approach is supported by stakeholders who believe that the networks should be developed to make better use of the system capacity using smart technology and telecommunication with new solutions being applied incrementally to benefit from this progressive learning.

5.15 Stakeholders also suggest that when replacing assets we should consider future proofing and therefore there will be a proportion of the existing asset replacement programme (particularly where there is confidence about load growth) where 'bigger' assets are installed to take the opportunity to increase capacity whilst this work is being carried out anyway. This will predominantly apply to secondary networks.

5.16 The overall impact of increased loads from LCTs will result in some asset replacement being carried out with larger assets and applying smart solutions to provide capacity headroom without the need for network reinforcement as shown in the diagram:



Legacy network management

5.17 Historic planning approaches in the West Midlands and East Midlands allowed circuits and substations to exceed their firm capacity on more occasions and for longer periods of time. This placed the network at greater risk and meant that the amount of spare capacity to deal with outages was limited as the network was generally more heavily loaded.

5.18 WPD's approach to planning has a lower tolerance of loading that exceeds firm capacity. This is wholly consistent with business objectives to provide a reliable supply of electricity to customers.

5.19 When WPD acquired the licences of West Midlands and East Midlands it inherited a network that had a significant number of substations where demand exceeded firm capacity. These sites are being addressed progressively during DPCR5 and into RIIO-ED1. This means that at the end of DPCR5 there will still be sites that are heavily loaded. This will lead to higher levels of reinforcement in West Midlands and East Midlands (compared to South Wales and South West) whilst the legacy of pre-existing network deficiencies is addressed.

Load forecasts

5.20 WPD uses a range of load forecasting approaches to determine which parts of the network require reinforcement. These include:

- generic assessments considering economic conditions; housing forecasts, energy efficiency predictions and assumptions on the uptake of low carbon technology;
- site specific assessments considering local circumstances;
- the use of the representative network Transform model developed by EA technology for work stream 3 of the Smart Grids Forum.

5.21 These forecasts identify shortfalls in the network capacity and to remain compliant with the objectives above, the shortfalls are subsequently addressed through reinforcement or a smart intervention.

LCT related reinforcement

5.22 The Transform model uses generic load/generation profiles to build up a total system demand. This is able to forecast future system demand growth as a result of a number of factors. These include:

- new build connections;
- the uptake of LCTs (in both new build properties and retrofit to existing properties);
- the clustering of LCTs in a geographic location due to property suitability, socio-economic drivers or availability of natural resources;
- the changes in heating systems, and insulation levels;
- the energy savings associated with efficiency improvements in lighting/domestic appliances;
- the impacts of demand side management.

5.23 Further information about the model can be found in EA Technology's report 'Assessing the Impact of Low Carbon Technologies on Great Britain's Power Distribution Networks', published at http://www.ofgem.gov.uk/Networks/SGF/Publications/Pages/index.aspx.

5.24 The clustering of LCTs has been informed by the CSEs work, which shows that there will be high clustering which will have an impact on the network demand and reinforcement requirements.

5.25 The Transform model has been used to forecast system demand growth for each of WPD's regions for our Business Plan model, and for the four DECC scenarios through the RIIO-ED1 period. The assumptions we have used in the Transform model can be found in appendix A1. The table below shows the resultant WPD Best View scenario forecast for annual percentage growth in peak demand.

Best View Scenario	Annual Load Growth %									
	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
West Midlands	0.13%	0.14%	0.13%	0.13%	0.14%	0.31%	0.47%	0.98%	1.14%	1.28%
East Midlands	0.37%	0.37%	0.34%	0.39%	0.36%	0.57%	0.76%	1.38%	1.58%	1.73%
South Wales	0.04%	0.09%	0.07%	0.05%	0.05%	0.50%	0.75%	1.09%	1.20%	1.20%
South West	0.45%	0.46%	0.46%	0.46%	0.46%	0.77%	1.05%	1.65%	1.94%	2.14%

5.26 All areas show limited growth in the early years, followed by an accelerated growth starting around 2018/19. Energy efficiency initially offsets the growth due to new connections; however the forecast growth due to increasing LCTs becomes more dominant from 2018/19.

Real price effects

5.27 Different types of solutions in the Transform model have different real price effects or 'cost curves' setting how their price changes over time. Ofgem's guidance on the Transform model states that the model should be run with real price effects (RPEs) included, but that the RPEs associated with the conventional solutions cost curve (Type 1 – high aluminium, steel, or copper content) should then be stripped out of the model results. This allows the model to take price movements into account in the cost-benefit assessment of solutions, but present costs on a consistent price base.

Re-profiling of Transform results

5.28 The Transform model uses a small number of generic circuits to represent the thousands of unique circuits in a licence area. Therefore when a particular generic circuit reaches a headroom limit, it purchases the appropriate solution as many times as there are real circuits represented by that generic circuit. This results in unrealistically sporadic investment.

5.29 LCT related reinforcement will require more gradual investment as real circuits reach their headroom. To reflect this in WPD's 'best view' the output of the model has been re-profiled to mirror the forecast ramped uptake of LCTs.

Scaling of Transform results

5.30 It is WPD's view that it is appropriate to scale the resulting expenditure from the Transform model for the following reasons:

- there is significant uncertainty around the future uptake of LCTs, their clustering and hence the impact of LCTs upon distribution networks;
- clustering has a significant impact on the investment needed and whilst our forecasts are based on a detailed analysis of property types and demographic information, other factors such as subsidy or support mechanism designs may result in differing clustering patterns emerging;
- there will be some overlap with asset replacement of HV and LV assets which is difficult to forecast accurately;
- a scaling down of the forecast investment provides a strong incentive on WPD to further innovate and seek the lowest cost solution;
- it is appropriate to share the risk of these uncertainties between WPD and customers.

5.31 As a result, the output from the Transform model for LCT reinforcement in RIIO-ED1 has been scaled down by 30% to determine the expenditure requirement in our Business Plan.

LV and HV non-LCT general reinforcement

5.32 The existing DPCR5 levels of expenditure have been used as the trend for the underlying LV and HV general reinforcement expenditure in RIIO-ED1 and represent the ongoing levels of expenditure driven by local requirements. However, the savings from the use of smart solutions have been recognised within the Business Plan by applying a percentage reduction to these costs. These percentage savings are shown in the table below.

Generic Smart Solution Savings								
	2016	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**
LV	0.0%	0.0%	2.0%	4.0%	5.0%	5.0%	5.0%	5.0%
HV	0.0%	0.0%	4.0%	8.0%	10.0%	10.0%	10.0%	10.0%

5.33 It is our view that a higher level of saving through the application of smart solutions will be gained at HV compared to LV. This is due in part to the aggregation of any LV demand management impacting the upstream HV networks and the development of the HV/LV substation real time rating solution.

5.34 The total expenditure across all four licence areas through the RIIO-ED1 period is approximately £3m per year for LV and approximately £8m per year for HV.

EHV/132kV general reinforcement

5.35 Existing peak electricity demands on our EHV network substations are surveyed each year to establish existing network demands. These are calculated by analysing demand data which is collected on a half hourly basis via our network data & control systems infrastructure. This data provides the 'actual' demand flows but it is then corrected to take account of a number of factors including:

- the impact of larger embedded generation (which offsets 'real' demand);
- abnormal network configurations (where we re-arrange the network for faults or planned outages);
- weather conditions (design standards are based on average weather conditions whereas the peak demand may occur in particularly hot or cold conditions dependent on the make-up of customer load).

5.36 The process above results in a tabulated data set for the normal demand level on each EHV and 132kV substations. Load growth is at each site is forecast by applying the regional demand growth consistent with the results from the Transform model (i.e. including energy efficiency, new connections, LCT uptakes) and is adjusted by known localised developments. These forecasts also form the data for Load Index forecasts.

5.37 The EHV and 132kV substation demand forecast data set is then analysed to identify specific EHV networks where available capacity is forecast to be exceeded. Specific reinforcement schemes are then developed to address these issues.

5.38 These EHV and 132kV schemes are phased through the RIIO- ED1 period to address the forecast system deficiency. This is generally on a 'just in time' basis although due to the significant nature of these schemes the expenditure may take place over a number of years, particularly where new consents for new circuits may be required.

5.39 These schemes have been developed utilising conventional reinforcement approaches. It is recognised that smart solutions will be developed through the RIIO-ED1 period and will become established and available for deployment at the EHV system level. This will lead to lower reinforcement costs towards the end of the period or the deferment of investment. It is not possible at this point in time to identify which individual schemes will benefit from and be appropriate for the deployment of a smart solution. However, this saving has been recognised

within the Business Plan by applying the reductions shown in the table below to EHV scheme costs:

Generic Smart Solution Savings								
	2016	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**
EHV/132kV	0.0%	0.0%	5.0%	7.5%	10.0%	10.0%	10.0%	10.0%

Impact of demand side management (DSM)

5.40 We have used an assumption that there will be low uptake of DSM where the majority of DSM is supplier led. The model does however consider the purchase of DSM agreements as a smart solution option as an alternative to reinforcement and these have contributed to the generic smart solution savings applied to EHV reinforcement.

Scheme development

Scheme categorisation

5.41 Whilst demand growth is generally the main driver of load reinforcement schemes, there are a number of different possible drivers:

- Maximum demand and compliance with N-1 and N-2 outage requirements;
- Voltage levels exceeding statutory limits (high at minimum demand condition and low at maximum demand conditions);
- Step changes in voltage;
- Circuit thermal loadings (where cables and lines limit the demand that can be supplied);
- Fault levels exceeding equipment current carrying capability.

5.42 Where more than one driver applies, schemes are classified by the main driver. This avoids double counting of investment in more than one category.

5.43 Where RIIO-ED1 load reinforcement projects coincide with a condition based replacement projects, the driver has been assigned as being asset replacement.

Scheme design timing

5.44 Load forecasts provide an estimate of when substations will require intervention.

5.45 For the preparation of the RIIO-ED1 business plan this required forecasts for up to 10 years into the future.

5.46 As with any forecast, the actual speed and scale of growth may differ. This means that it is important to focus planning resource effort on those projects where there is greater certainty of need.

5.47 A full scheme design is not undertaken until 'need' for investment approaches the timeframe for construction. This is timed so that construction occurs before the risk increases significantly so that the network remains compliant with statutory and industry obligations.

5.48 The start of detailed design is therefore dependent upon the specific requirements of each site. A simple transformer replacement with no off-site or consent issues could be started 18 months before 'need'. The time-scales are predominantly driven by the lead times for equipment delivery and the availability of outages on the network. A more complex construction of a new 132/33kV site with associated 132kV circuit works requiring external consents/consultation could be started up to four years before the need.

5.49 For projects in the longer-term, outline scopes are produced and annual reforecasting revises time-scales.

5.50 Since growth in demand is dependent upon external factors, there will be some churn of projects in the programme during RIIO-ED1. Some projects will be advanced, some will be delayed and new requirements will be identified. The expenditure forecasts in the plan represent the current best view and since churn includes both advancement and deferment the proposed programme is representative of the need even if the specific projects change.

Scheme design 'optioneering'

5.51 Reinforcement of the network has traditionally involved installing additional assets or larger assets. Whilst these solutions will continue to be used, the extensive innovation programme being carried out by WPD and learning from other DNOs is expected to yield a range of new cheaper smart alternatives. WPD will use the most appropriate and cost effective interventions to provide additional network capacity.

5.52 The initial project design analysis will consider a range of different options, some of which will be dismissed quickly due to the expense involved.

5.53 Typical options that would be considered are:

- permanent load transfers;
- reinforcement by installing additional assets;
- reinforcement by changing assets for higher capacity assets;
- reconfiguration of the network;
- installation of new substations (especially if the load centre has moved and existing network infrastructure is conveniently located);
- the amount of capacity headroom to be created (larger headroom may be considered if there is confidence that other interconnected sites may require reinforcement in the near future);
- use of dynamic line ratings with installation of associated monitoring equipment (where the limiting factor is the circuit);
- potential for demand side management (especially where there are large industrial customers who could manage load demands);
- joint schemes with other distribution network operators (e.g. where demand on one network can be offset by generation on another)
- joint schemes with National Grid (where work on DNO networks can help to reinforce grid supply points);
- multiple cost driver schemes to address other network constraints (such as poor condition assets).

5.54 Investment appraisal is used to determine the most cost efficient option, but this is then considered alongside practical constraints such as obtaining consents for new lines and sites and civil construction requirements.

5.55 When the site approaches need for construction, the selected options undergo a detailed build design that considers the construction requirements on site. Practical issues identified during this phase of design could lead to modifications to the high level option.

Expenditure forecast

5.56 Modelling suggests that the most cost effective means of dealing with future load growth is to have a combination of traditional reinforcement and smart solutions and our proposals for reinforcement expenditure in RIIO-ED1 consider both approaches. The table below shows expenditure by voltage.

General reinforcement expenditure in RIIO-ED1 by voltage (£m)					
	West Midlands	East Midlands	South Wales	South West	WPD Total
LV	49.1	78.3	11.5	36.4	175.4
HV	33.3	42.4	10.7	20.6	107.0
EHV	44.2	60.5	2.4	8.7	115.7
132kV	39.7	48.7	14.7	5.6	108.7
Total	**166.3**	**229.8**	**39.4**	**71.3**	**506.9**

5.57 The table below compares RIIO-ED1 expenditure against DPCR5 expenditure. The difference between the breakdown by voltage and overall expenditure is due to a small proportion of transmission exit charges that will be funded through an ex-ante allowance being included in the overall 8 year total for RIIO-ED1

General reinforcement expenditure (£m)					
	West Midlands	East Midlands	South Wales	South West	WPD Total
DPCR5 Annual Average	23.7	19.3	3.4	3.6	50.1
RIIO-ED1 Annual Average	21.0	28.8	4.9	8.9	63.7
RIIO-ED1 Total (8 years)	**168.2**	**230.6**	**39.4**	**71.3**	**509.5**

5.58 Annual EHV expenditure is shown in the table below. The WPD regions of West Midlands, East Midlands and South West show a reduction in average expenditure levels through the RIIO-ED1 period, while South Wales shows a small increase.

5.59 The requirement to establish a new 132/11kV substation site in the rapidly developing area of Milton Keynes is a significant scheme that dominates East Midlands EHV reinforcement in the first two years of the period.

EHV and 132kV General Reinforcement (£m)											
	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	**RIIO-ED1 Total**	RIIO-ED1 Ave	DPCR5 Ave
West Midlands	12.6	13.1	10.3	12.0	12.6	6.4	7.9	9.0	**83.9**	10.5	20.0
East Midlands	41.0	33.5	3.6	3.3	3.9	7.2	12.4	4.1	**109.2**	13.6	14.7
South Wales	0.8	0.9	1.4	5.9	4.4	3.6	0.0	0.0	**17.1**	2.1	1.9
South West	1.5	1.9	1.1	4.2	3.4	1.5	0.6	0.0	**14.3**	1.8	2.0
Total	**56.0**	**49.4**	**16.4**	**25.5**	**24.3**	**18.7**	**20.9**	**13.1**	**224.5**	**28.1**	**38.6**

Asset requirements

5.60 During RIIO-ED1 the following number of assets will be installed/reinforced as part of reinforcing the network:

	General reinforcement additional/reinforced assets			
	West Midlands	**East Midlands**	**South Wales**	**South West**
LV Cable/Line (km)	467	755	140	437
HV Cable/Line (km)	389	559	150	221
EHV Cable/Line (km)	309	241	31	2
132kV Cable/Line (km)	42	59	13	4
Pole Mounted Dist Tx	1,344	1,311	659	1,654
Ground Mounted Dist Tx	288	469	71	125
EHV Transformers	48	30	2	12
132kV Transformers	28	9	3	3

Network capacity and Load Indices

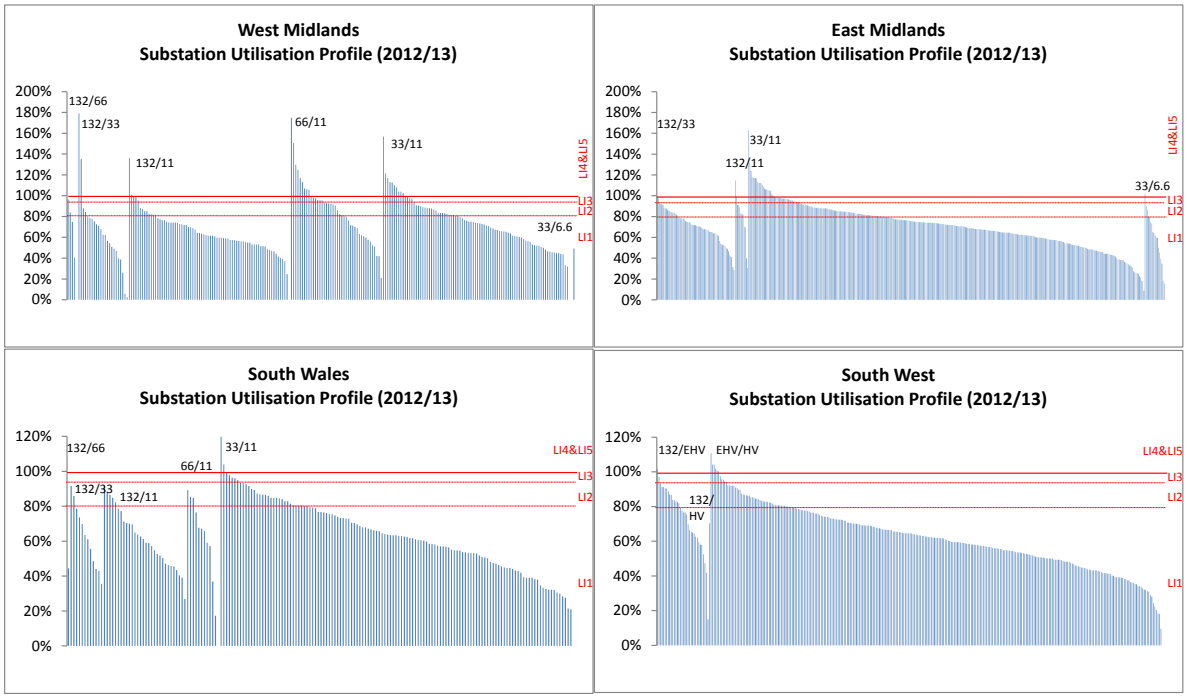
5.61 The capacity of the network is limited by the size (rating) and configuration of existing assets.

5.62 The utilisation of those assets is calculated by comparing the maximum demand to the firm capacity (load rating of the system assets remaining under the outage requirements of P2/6).

5.63 In DPCR5, Ofgem introduced utilisation measures called load indices (LIs) that categorise substations into defined bands of loading. The utilisation at each WPD substation has been used to derive a load index for each site using the common RIIO-ED1 load index bandings proposed by Ofgem (these are shown in the table below).

LI rank	Definition	Loading
LI1	Significant spare capacity	0-80%
LI2	Adequate spare capacity	80%-95%
LI3	Highly utilised	95%-99%
LI4	Fully utilised, mitigation requires consideration	100% for <9 hours per year
LI5	Fully utilised, mitigation required	100% for >9 hours per year

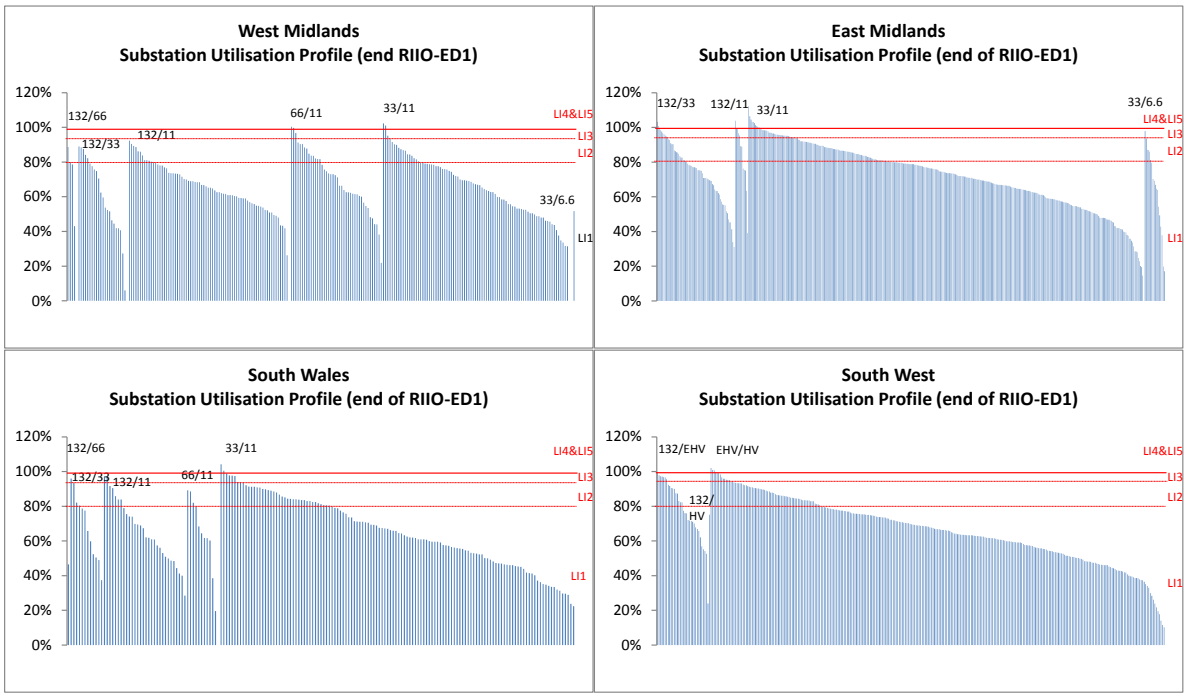
5.64 The following charts show the utilisation in 2012/13 for each substation (each column represents a substation). Note that there are a number of substations with very high utilisation in the West Midlands and East Midlands when compared to South West and South Wales and therefore the charts are presented on different scales.



The charts are based upon the common criteria used in defining LI bands for RIIO-ED1.

5.65 The charts show that in the West Midlands and East Midlands there are higher volumes of substations that exceed 99% of firm capacity (i.e. have peaks above the bold red line). The majority of these LI4 and LI5 substations (that are predominantly 66/11kV or 33/11kV sites) will be addressed during the remainder of DPCR5 and in RIIO-ED1.

5.66 The following charts show the forecast utilisation profiles (all on the same scale) for the end of RIIO-ED1 taking into account the proposed investment.



The charts are based upon the common criteria used in defining LI bands for RIIO-ED1.

5.67 The charts illustrate that the utilisation profiles at the end of ED1 will be broadly similar across all four WPD licence areas.

5.68 They also show that there will remain a small number of substations that will be in the LI4 and LI5 load index categories at the start of RIIO-ED2. These sites represent the future requirement for network reinforcement beyond RIIO-ED1.

5.69 Once the legacy issues have been addressed, future investment requirements should be at lower levels of expenditure because fewer substations will require reinforcement.

Load index movement during RIIO-ED1

5.70 It is WPD's aim to bring the Load Index risk to similar levels across all four licence areas. The same design principles and investment strategies will be employed to meet security standards. The target is to reduce the number of sites classified as LI5 down to zero.

5.71 The following tables summarise volumes of sites in each LI band

- at the start of RIIO-ED1;
- at the end of the period without investment (the change is driven by load growth); and,
- at the end of period with investment (showing the impact of the proposed work programme).

West Midlands – Load Index positions			
Load Index ranking	**Start of RIIO-ED1**	**End of RIIO-ED1 without intervention**	**End of RIIO-ED1 with intervention**
LI1	166	153	180
LI2	42	43	42
LI3	7	4	2
LI4	7	13	4
LI5	6	15	0

East Midlands – Load Index positions			
Load Index ranking	**Start of RIIO-ED1**	**End of RIIO-ED1 without intervention**	**End of RIIO-ED1 with intervention**
LI1	309	258	281
LI2	108	112	119
LI3	11	31	33
LI4	13	19	14
LI5	8	29	2

South Wales – Load Index positions			
Load Index ranking	**Start of RIIO-ED1**	**End of RIIO-ED1 without intervention**	**End of RIIO-ED1 with intervention**
LI1	150	129	129
LI2	32	45	45
LI3	0	7	7
LI4	1	2	2
LI5	0	0	0

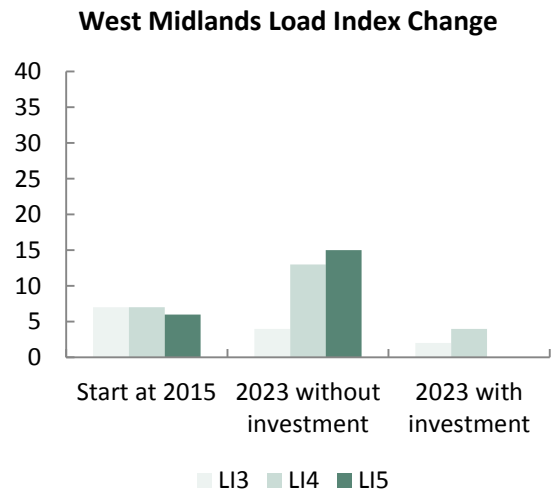
South West – Load Index positions			
Load Index ranking	**Start of RIIO-ED1**	**End of RIIO-ED1 without intervention**	**End of RIIO-ED1 with intervention**
LI1	267	233	243
LI2	54	67	69
LI3	9	12	13
LI4	2	9	7
LI5	0	11	0

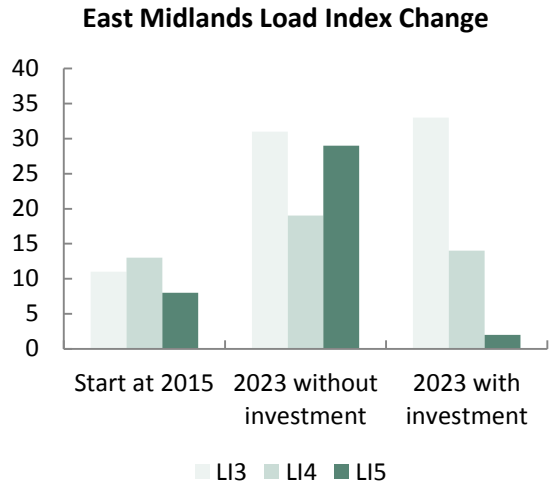
5.72 It can be seen from the tables above, that both East Midlands and West Midlands have a starting point at the beginning of RIIO-ED1 that does not meet WPD's target for no LI5 categorised sites.

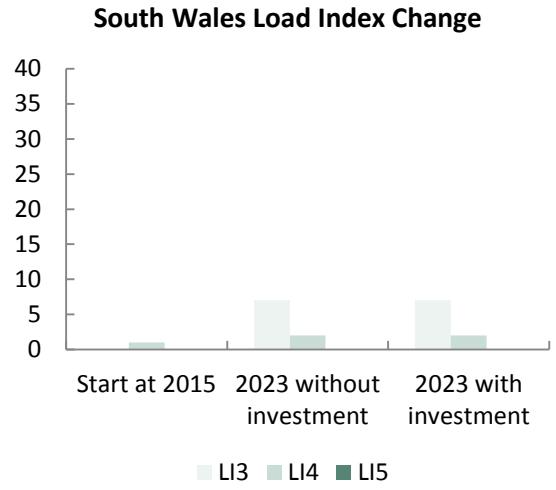
5.73 Data for the end of RIIO-ED1 without investment shows that load growth will lead to an increased number of substations being categorised as LI4 and LI5. The investment programme for RIIO-ED1 will address a number of these LI4 and LI5 sites.

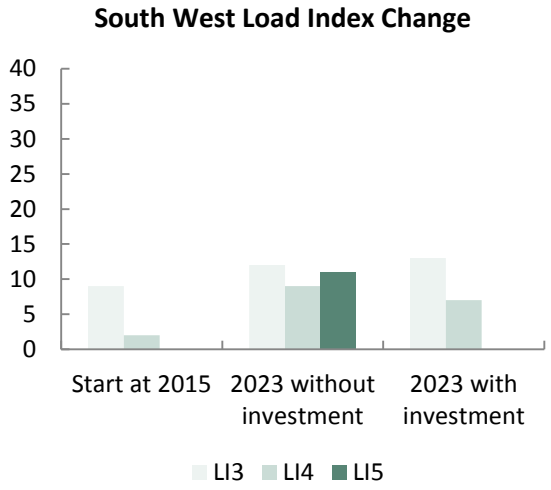
5.74 Overall, this will result in fewer LI4 and LI5 sites in West Midlands and East Midlands at the end of RIIO-ED1 when compared to the start of the period.

5.75 The impact on LI3, LI4 and LI5 categories is also illustrated in the following charts (LI1 and LI2 have not been shown as they would dominate the scale of the charts).









5.76 The largest volume of change between the position without and with investment will be in the East Midlands and whilst the majority of highly loaded sites will be addressed, some will remain. These residual sites will be addressed in RIIO-ED2.

Loading risk

5.77 Load index data can be converted to a risk score by multiplying the number of customers supplied from a substation by a weighting that is dependent upon the load index. Ofgem has proposed the following weighting within Business Plan Data Templates:

Weighting of LIs for conversion to loading risk					
	LI1	LI2	LI3	LI4	LI5
Ofgem weighting	1	1	1	20	100

5.78 Applying these weightings to the LIs and multiplying by the number of customers at each substation gives the following risk positions.

Loading risk – using Ofgem weightings			
Licence Area	**Start of RIIO-ED1**	**End of RIIO-ED1 without intervention**	**End of RIIO-ED1 with intervention**
West Midlands	8,338,896	25,115,535	3,452,548
East Midlands	11,503,853	37,680,797	11,150,822
South Wales	1,589,608	1,676,286	1,676,286
South West	3,061,322	22,514,386	4,302,630

5.79 It should be recognised that the total loading risk score for a licence area is dependent on the total number of customers within that area and by the overall design of the primary networks in terms of multiple transformation levels. For example, South Wales has the lowest number of customers (approximately 1.1m) and East Midlands the highest (approximately 2.6m) which means that the cumulative customer risk score will be correspondingly higher in East Midlands. Also, in networks that utilise both 132/EHV and EHV/11kV transformation levels each customer will tend to be counted twice in this cumulative risk score.

5.80 These loading risk scores can be normalised by using the total number of 'load customers' (the sum of all the customers supplied by primary substations, including double counting where multiple voltage levels are used). This leads to the following results:

Load risk points per load customer	West Midlands	East Midlands	South Wales	South West
Start of RIIO-ED1	2.72	2.29	1.23	1.08
End of RIIO-ED1 with no intervention	8.19	7.50	1.30	7.97
End of RIIO-ED1 with intervention	1.13	2.22	1.30	1.52

5.81 The table shows that the risk per load customer in West Midlands and East Midlands at the start of RIIO-ED1 is around double the value in South Wales and South West. Load growth causes this to increases significantly (in West Midlands, East Midlands and South West) and the proposed investment programmes reduce the risk per load customer. It also shows that the risk per load customer will be allowed to increase slightly in South Wales and South West over the period.

5.82 A load risk point per load customer value of 1.5 equates to around 2.5% of customers being supplied by substations that are LI4 (loaded above 99% of firm capacity), with the rest being LI3 or lower.

5.83 It is proposed that the long term target for load risk points per load customer should be 1.5 or lower. This compliments the target to have no LI5 substations and limits the number of customers who are supplied by LI4 substations to 2.5% of the customer base.

5.84 This means that further reduction of load risk will be required in the East Midlands beyond the end of RIIO-ED1 in order to bring it in line with risk levels in West Midlands, South Wales and South West.

6 Fault level capability

6.1 Certain faults that occur on the network can allow very high current to flow until the network is switched off automatically by circuit breakers. Whilst the network is designed to withstand these levels, the number of generators and large induction motors connected to the network can cause the fault current to exceed the rating of the circuit breakers. This can introduce a risk of catastrophic failure when the switchgear operates.

6.2 WPD has a duty of care to its employees and members of the public to ensure that they are not at risk of injury due to the failure of the company's assets.

6.3 When new high fault level situations are identified, operational limitations are used to reduce the risk. Since these introduce sub-optimal running arrangements, they are only used as interim solutions until the equipment can be changed. The implementation of sub-optimal network running arrangements can affect network performance and constrain the capacity of the network restricting the connection of additional load or generation.

6.4 The main approach to resolving the issue is the replacement of the switchgear for higher rated equipment. In some instances changing transformers for higher impedance models can also provide some fault level headroom.

6.5 An annual fault level survey identifies the locations and situations where the fault level potentially exceeds 95% of the switchgear rating. Solutions are generated to eliminate the risks and restore optimal running arrangements.

6.6 One of the factors that can influence fault level is the connection of distributed generation. The anticipated growth in distributed generation is likely to lead to a number of new fault level issues arising over the RIIO-ED1 period, particularly where generators are located close to primary substations. Traditionally this has been resolved by replacement of equipment with a higher rating, but smarter solutions (being investigated under innovation projects) such as more accurate measurement devices for fault level or using fault current limiters may be lower cost options in some situations.

6.7 Fault level survey results are incorporated into the Long Term Development Statement (LTDS). This provides an indication to potential distributed generation developers where there may be limitations or constraints and therefore financial implications for the connection of distributed generation onto the network. The data in the LTDS is updated annually to reflect changes due to network reinforcement, asset replacement and the connection of DG.

6.8 Fault levels are generally higher in the two WPD Midlands areas due to the number of large power stations connected to National Grid's network. The higher density of load has also lead to the use of 132/11kV substations which tends to create higher fault levels.

6.9 The cost forecast has been derived from specific schemes that will be carried out to address known fault level issues identified in the fault level analysis.

Expenditure forecast

Fault level reinforcement expenditure in RIIO-ED1 by voltage (£m)					
	West Midlands	**East Midlands**	**South Wales**	**South West**	**WPD Total**
HV switchboards	2.8	8.0	0.8	-	11.6
EHV switchboards	1.7	1.3	-	1.2	4.2
132kV switchboards	7.3	10.6	-	3.6	21.5
Total	**11.7**	**19.9**	**0.8**	**4.8**	**37.1**

Fault level reinforcement expenditure (£m)					
	West Midlands	**East Midlands**	**South Wales**	**South West**	**WPD Total**
DPCR5 Annual Average	2.5	0.4	0.2	0.2	3.3
RIIO-ED1 Annual Average	1.5	2.5	0.1	0.6	4.6
RIIO-ED1 Total (8 years)	**11.7**	**19.9**	**0.8**	**4.8**	**37.1**

7 Transmission exit points

7.1 The WPD network is connected to the National Grid at Transmission Connection Points (TCPs). National Grid provides infrastructure at these exit points to allow power to flow from the transmission system to the distribution network. National Grid recovers the cost of providing these connection points through annual charges.

7.2 The National Grid charges include the costs for new assets when additional capacity is requested by WPD and the costs of replacing existing assets determined by National Grid's replacement programme and are charged over a forty year period.

7.3 Where additional capacity is required WPD's preference is to reinforce the distribution network as the costs are usually lower. Inevitably there will still be circumstances where it is necessary to request additional capacity from National Grid. WPD works closely with National Grid at 'Joint Technical Planning Meetings' (JTPM) to determine which approach to reinforcement is the most economical.

7.4 Even though National Grid provides a quotation for any proposed work, the eventual charges are determined by the actual costs of the work. This means that if additional costs are incurred they are passed through to the charges levied on WPD. Hence there is little opportunity to influence the costs once projects are under way.

7.5 Through the JTPMs held with National Grid, WPD have determined the sites and assets that are due to be replaced by National Grid within the RIIO-ED1 period. Depending on the arrangements of the sites, only some of these assets are chargeable through to WPD. Where they are deemed chargeable WPD have used National Grid's charging methodology statement for the indicative charges that will result.

7.6 Based on load growth projections and network developments we have forecast the future capability of the TCPs to remain compliant with the security design standard. This has identified two sites where WPD will require National Grid to reinforce the network in RIIO-ED1. An additional supergrid transformer will be required at Shrewsbury (West Midlands) in 2018 and Staythorpe (East Midlands) in 2021.

7.7 The installation of an additional supergrid transformer is forecast to increase TCP charges by £0.4m per annum from the year of installation. The total new TCP charges during RIIO-ED1 due to WPD requirements are shown below:

Transmission exit point charges due to WPD requirements in RIIO-ED1 (£m)					
	West Midlands	**East Midlands**	**South Wales**	**South West**	**Total**
RIIO-ED1 Total (8 years)	**1.9**	**0.7**	**-**	**-**	**2.6**

7.8 The majority of the increases in Transmission exit points expenditure is as a result of National Grid's replacement programme. The following are therefore treated as pass through costs.

Transmission exit point charges treated as pass through costs (£m)					
	West Midlands	**East Midlands**	**South Wales**	**South West**	**Total**
DPCR5 Annual Average	9.8	7.1	5.1	6.5	28.5
RIIO-ED1 Annual Average	13.5	11.6	8.6	9.0	42.7
RIIO-ED1 Total (8 years)	**107.9**	**92.7**	**68.7**	**71.6**	**340.9**

8 Diversions, conversion of wayleaves to easements and highways work

Background

8.1 WPD operates a vast distribution network via 185,000 substations, 92,000km of overhead lines and 129,000 km of underground cables. Whilst statutory rights allow installation of the distribution network in public land (such as adopted highways), where the network passes over or under private land WPD requires agreements with the property owners.

8.2 Wayleave agreements are used in most cases due to the lower costs involved. A wayleave is a form of licence, granted by a landowner, that gives WPD the right to place and maintain its equipment on private land. It is generally a quick and simple agreement to obtain, usually requiring no legal input, and becomes active the moment it is signed. The majority of wayleaves involve paying the landowner an annual rental for the equipment on their land and compensating the land user for any impact on their activities on the land.

8.3 There are however two main disadvantages:

- a wayleave is a personal contract with the landowner and does not automatically bind their successor in title;
- wayleaves can, in many cases, be terminated.

8.4 Easements are permanent rights of way that remain in place even if the land is sold. Legal rights of way are drawn up by a solicitor and due to their cost tend to be reserved for underground cables, 132kV, 66kV and 33kV overhead lines and other situations where strategically important items of plant must be given an absolute right to exist on private land or where it is cost effective for WPD compared to other solutions.

8.5 The presence or construction of the distribution network can lead to customers or landowners claiming for injurious affection (the cost incurred due to a detrimental effect on the value of land or property).

8.6 Landowners may also trigger requests to remove or divert parts of the existing distribution network to facilitate development of land or where a landowner no longer wants to host WPD equipment on their land.

8.7 The 1989 Electricity Act provides rights for DNOs to acquire land or rights over land either by a compulsory purchase order (CPO) or a necessary wayleave. Both require applications to be made to the Secretary of State and hearings to be conducted. The purchase of land using a CPO is very expensive and takes significant time to complete. The acquisition of a necessary wayleave is more accessible and therefore is used on a more frequent basis. Both approaches can lead to further expense and involve time consuming hearings at the Lands Chamber (an independent specialist judicial body) if terms cannot be agreed for compensation once the necessary wayleave or CPO has been granted.

8.8 The Act allows WPD up to a maximum of 3 months, from the date of a wayleave termination removal notice issued by a landowner or their agent, to make an application to the Secretary of State for a necessary wayleave or CPO. Following this three month period WPD is deemed to be trespassing on the land and has to remove any equipment if such an application has not been made.

8.9 Requests for network diversions, termination of wayleaves or claims for injurious affections can prove costly to WPD. Since the use of statutory powers is expensive and often takes a long time, they are used as a last resort, with WPD using a range of approaches to minimise the potential costs of keeping assets on land or diverting equipment.

Conversion of wayleaves to easements, easements and injurious affections

8.10 Whilst WPD prefers to use lower cost wayleave agreements, in some cases permanent agreements or deeds of easements are required where routes need to be maintained. A lump sum payment (rather than an annual rental) is paid for a permanent or long term agreement to cross the land. Most easements do not involve any injurious affection consideration. The capital cost of the easement is therefore equivalent to a multiple number of the annual wayleave payments had a wayleave agreement been in place. The costs are grouped under the capital expenditure category 'conversion of wayleaves to easements'.

8.11 Where the distribution network (either new or existing) affects the value of property or land, landowners can in some cases claim compensation for this loss. This is particularly true of existing overhead lines or underground cables on wayleave agreements or on easements with compensation clauses. This is governed by compensation law and is known as injurious affection.

8.12 Landowners who believe they have an injurious affection claim will approach WPD to negotiate a compensation settlement. Where a wayleave exists, WPD would seek to acquire a permanent easement in exchange for payment of compensation. WPD's preference is to negotiate with the landowner. But in some cases the negotiation takes place against the background of a formal termination of the wayleave by the landowner.

8.13 If a settlement cannot be reached for a formal termination, the legal process would result in a DECC hearing for a necessary wayleave at considerable cost (which WPD cannot recover even if it wins the case). In some cases, a CPO may be used instead. Following the granting of a necessary wayleave or CPO, where agreement can still not be reached, either party can refer the matter to the Lands Chamber for determination of the compensation sum to be paid but this is usually avoided due to the costs, timescales and risks involved. WPD is only likely to take the formal legal approach in 'ransom' situations or where the proposed settlement would be out of line with established comparable situations and valuation principles.

8.14 Over the last 10 years, a number of compensation agents have established themselves (many in the Midlands area), specialising in injurious affection compensation due to overhead electricity lines affecting property. The landowner or their agent may submit a wayleave termination together with an offer to negotiate a permanent easement to retain the line.

8.15 Each claim is rigorously challenged, but the careful negotiation of many claims over the last 10 years (and the settlement of similar cases by other network operators) has inevitably established principles for calculating the injurious affection, as well as many comparable settlements.

8.16 WPD will normally seek to avoid legal hearings, unless absolutely necessary, as these would increase the costs significantly with the very strong likelihood that the resulting compensation settlement would be in line with the valuation levels already established.

8.17 The typical cost of a necessary wayleave hearing is £15k to £50k (costs will be much higher if a Lands Chamber hearing also results) compared with the average injurious affection settlement for single urban properties of £10k. The resultant timescale and friction with the agent and/or landowner would also have a detrimental effect on WPD's longer term business interests.

8.18 Well established, pragmatic and co-operative relationships with landowners and their representatives is essential to allow WPD to operate, maintain and expand the distribution network in the future. Souring these relationships unnecessarily will only lead to access problems and increased costs in future (e.g. through lack of co-operation to access land). Historically, some other DNOs have gone down a more intransigent route of hearings and delay for what are valid wayleave terminations. This has had little positive effect.

8.19 Where required and appropriate, WPD will legally challenge a claim or termination, should this impact adversely on expenditure.

8.20 It is worth noting that the use of statutory powers is not a panacea for dealing with wayleave terminations and this is generally why hearings are only held for larger and more significant matters. The points to consider are:

- the costs are high per wayleave hearing case and a large resource is also needed to manage the process and prepare evidence;
- each party bears its own costs in relation to a wayleave hearing regardless of outcome;
- to date, all the obligations fall on the network operator to prepare for a hearing (there are no requirements for the landowner to do so);
- assuming a necessary wayleave is granted, further costs (often in the region of £200k) could be incurred if the level of compensation is referred to the Lands Chamber for determination;
- at development sites, planning conditions from the local authority can require the removal of overhead lines. The challenge to this through use of statutory powers cannot be guaranteed and is a complex area of law.

8.21 Where WPD has assets on development sites and these are to be retained (rather than being diverted) there is often an injurious affection compensation liability and unless the demands are outside comparable values there is nothing to be gained from taking the legal route.

8.22 WPD uses a variety of processes, specialists, methods and strategies to control the expenditure associated with injurious affection claims. These include:

- centrally controlled and well established processes for dealing with all injurious affection claims that ensures a consistent approach and appropriate treatment for every case so that compensation costs are in line with comparable settlements (in WPD and other DNOs);
- centralised authorisation of injurious affection settlements and higher value standard easements to ensure control and scrutiny against policy and comparable settlements;
- use of chartered surveyors, acting for WPD, to evaluate and negotiate injurious affection claims for individual properties and for large and complex development sites;
- use of architects or planning consultants to evaluate development plans to ensure optimum layouts have been adopted to minimise compensation due to an overhead line;
- monitoring of local authority development plans and core strategy policies to identify where proposals could affect the distribution network and lead to a cost burden for WPD's customers.

8.23 WPD has worked hard with DECC and other DNOs to review the framework and rules governing the necessary wayleave process to see what changes can be implemented to make it harder for agents or landowners to use the threat of a wayleave hearing as a disproportionate negotiating lever. This resulted in DECC consulting on options at the end of 2012 and with changes to be introduced later in 2013 if approved.

8.24 The main changes propose to introduce a Code of Conduct for both agents and DNOs to follow and to re-address the balance of effort required for wayleave hearings so that the landowner also has certain obligations to meet, with the potential for award of certain costs against the landowner, should they fail to meet their obligations in the process.

8.25 The incentive for landowners to push for unnecessary hearings should be reduced and although other measures are possible to further shift the balance, DECC are highly unlikely to implement statutory powers which adversely affects a landowners rights against network operators. These changes will however assist in removing unnecessary wayleave hearings for ransom type claims (and the costs/resources involved in running these). The changes are unlikely to reduce the expenditure on injurious affection overall, as the duty in law to compensate exists and the majority of claims will be settled against the established values of historic settlements.

8.26 WPD's injurious affection settlements compare favorably to cases we are aware of from other DNOs. Information on individual cases is commercially confidential and can't therefore be set out in this document but the edited examples below demonstrate this well:

- WPD paid 5.5% compensation for a tower at 80m distance, and DNO1 paid 8.2% for one at 75m distance;
- WPD paid 3% for a 132kV overhead line at 57m distance and DNO2 paid 5% for one at 46m distance;
- WPD paid 1.5% for a 132kV overhead line at 125m distance and DNO1 paid 2% for one at the same distance.

Expenditure forecast

8.27 The expenditure forecast and activity volumes for the RIIO-ED1 period for this activity reflect historic costs in DPCR5 and additional costs required to deal with the higher number of claims on development sites that are being progressed following being delayed or mothballed as a result of the economic downturn since 2008.

Development claims

8.28 Development claims are mainly on residential sites but also include commercial sites and mineral extraction/quarry sites. The value of development claims can be significant and the liability for each site typically ranges from £0.5m to £3m (influenced by land values).

8.29 Activity in DPCR5 has been suppressed due to the recession and economic conditions. For this reason, the historic expenditure since 2010 has not included any major development site settlements, but some payments have been made on smaller sites across all of WPD's four licence areas. The value of these payments has been between £100k and £300k in each case.

8.30 We are now seeing increased activity and negotiating again on previously mothballed sites. We expect this to continue as the economic outlook improves.

8.31 During 2012 and 2013 we have had very active discussions on several mothballed sites where the compensation settlement is likely to be significant (£millions in some cases) and which will conclude in the next few years.

8.32 We have also been given outline details of approximately ten new large development sites in WPD's area which are likely to be built in the RIIO-ED1 period, most in the earlier years, and which will require WPD to either pay compensation due to loss of development or divert major 132kV and 33kV overhead lines.

8.33 The following table shows a list of known or potential larger development sites where higher value injurious affection easements are likely to be settled or agreed over approximately the next 5 years. We expect many of these to conclude in the first half of the RIIO-ED1 period and therefore there will be further sites not yet known to us coming forward in the second half of the period.

Development Sites Requiring Higher Value Injurious Affection Easements		
Licence Area	**Site Location**	**Development Type**
West Midlands	Norton Caines (Brownhills Road) Banbury (Wroxton Fields) North Yate, Gloucestershire North West Cheltenham Bevere (Worcester)	Residential Quarry/Mineral Residential Residential & Commercial Residential
East Midlands	Corby (Stanion Way) Kingsbury Quarry (Tamworth) Castle Ashby Boscatt (Boston) Leicester (Faricharm Estate) Milton Keynes (west of town)	Commercial Quarry/Mineral Quarry/Mineral Commercial Residential Residential
South Wales	Llantarnam (Cottage Farm) Church Village Hirwaun	Residential Residential Residential & Commercial
South West	Exeter (Topsham phase 2) Bristol (Emersons Green – part of site) Bristol (Harry Stoke – first phase) East Devon (first phase)	Residential Residential Residential & Commercial Residential

8.34 In our forecasts, we have assumed that these settlements will represent typical levels of activity that will also be seen in the remainder of the RIIO-ED1 period. This means that on average each of WPD's four licence areas will have one to two injurious affection claims on new major development sites per year.

8.35 The complexity of development claim negotiations, as well as unpredictable timescales from developers (influenced by the time taken to obtain planning permissions) affects the timing of capital expenditure. This can significantly affect year on year expenditure. Whilst in reality there will be volatility, the RIIO-ED1 forecast uses a flat profile assuming average costs are incurred each year.

8.36 The expenditure forecast includes the following annual values for large development sites:

- West Midlands: £0.6m/year;
- East Midlands: £1.1m/year;
- South Wales: £0.5m/year;
- South West: £0.8m/year.

General claims/settlements (non-development):

8.37 We have seen the number of 132kV network injurious affection claims start to stabilise in DPCR5. We anticipate that the overall number will start to fall in the next price control period. We expect the volumes to continue to be higher in the Midlands compared to other areas due to size of the network area as well as the developed nature of the land and the presence of many of the specialist compensation agents.

8.38 We expect that the agents specialising in advising landowners on claims for injurious affection, will move their attention on to the next lower voltage level (i.e. 66kV and 33kV). We estimate the numbers will increase by 10%/year initially and then by 20%/year. We expect the volumes of EHV claims will overtake the number of 132kV claims during RIIO-ED1 but the average settlement per claim will be lower due to the lesser impact of EHV overhead lines generally.

8.39 We have also estimated that in a similar manner HV claims will start to increase in the latter part of the RIIO-ED1 period.

8.40 The net effect will mean that the level of expenditure on higher voltage non-development claims will remain broadly in line with historic trends but the activity will shift from 132kV to EHV and HV.

8.41 The approach to be taken in the Midlands will reflect the application of WPD policy to offer long term wayleaves (for lump sum payments) in addition to standard wayleave agreements (with annual rental). These are mainly used on LV and HV lines and cables and enable WPD to secure consent (in low risk situations where an easement is not required or too costly). These have been successful in adding flexibility to negotiations. The increase in volume of transactions due to this policy change does not affect the overall expenditure on LV and HV particularly as the value of each one is quite low.

Conversion of wayleaves to easements, easements and injurious affection expenditure (£m)					
	West Midlands	**East Midlands**	**South Wales**	**South West**	**WPD Total**
DPCR5 Annual Average	3.4	3.5	1.4	1.8	10.1
RIIO-ED1 Annual Average	3.3	3.5	1.9	2.6	11.3
RIIO-ED1 Total (8 years)	**26.4**	**28.2**	**15.4**	**20.4**	**90.4**

Diversions due to wayleave terminations

8.42 Diversions arise when landowners request that assets are moved, often through a wayleave termination or under the threat of one. This may be for reasons such as to facilitate a house extension or for the development of land. They can also arise when large infrastructure upgrades take place such as the electrification of railway lines.

8.43 It is preferred that the person making the request funds the diversion, but it is sometimes necessary for WPD to divert the equipment at its own cost. Wayleaves and easements can also be subject to a "lift and shift" clause, which can provide a mechanism for a landowner to instigate a diversion at the expense of WPD.

8.44 For standard lower value LV and HV diversions, our forecasts for RIIO-ED1 are generally in line with historical values incorporating the slight increasing trend that has been noticeable for a number of years.

8.45 Diversions may also be required where the cost of purchasing an easement or using statutory powers and competition law to retain assets in situ exceeds the cost of moving the equipment.

8.46 We are now seeing increased activity on previously mothballed sites and as the economic outlook improves, we anticipate the number of higher voltage (132kV and EHV) diversions needed on development sites to increase in the RIIO-ED1 period. In some cases the value of injurious affection claims can be high enough for a WPD funded (or part funded) diversion to be the cheaper alternative. The factors affecting this are complex but can be due to the value of land or local authority planning policies, as well as political and public pressure against retaining overhead lines on developments.

8.47 WPD aims to minimise expenditure on diversions due to wayleave terminations by using a variety of different approaches including:

- developing landowner relationships locally through a staff structure that gives Wayleave Officers a geographical area to cover. (Face to face negotiations is normally a very effective way of resolving a termination and can avoid a diversion altogether or lead to an outcome where both sides contribute to the costs.);
- negotiating an agreement to retain the equipment instead of carrying out a more expensive diversion. The option to use statutory powers will also mean negotiations are carried out against this formal alternative;
- central support and co-ordination of complex or higher value cases, ensuring consistent approach to minimise costs;
- making representations to local authorities regarding planning policies which can lead to a requirement for diversion of overhead lines, especially those involving towers (pylons) where a cost burden is placed on WPD and its customers rather than on the developer who benefits financially from the development.

8.48 The following represents a list of known sites where higher cost diversions are likely in the next 5 years (during DPCR5 and first half of the next price control). There will inevitably be future schemes occurring later in the period and this list is taken as representative snapshot of the volume of activity over a typical 5 year period:

Developments sites requiring diversions			
Licence Area	**Site Location**	**Voltage**	**Development Type**
West Midlands	Cheltenham (Midwinter) Bishops Cleeve Redditch (Silcott Farm) Redditch (East Brockhill) Rugeley	66kV 66kV 66kV 66kV 132kV	Residential Residential Residential Residential Bridge Diversion
East Midlands	Newark on Trent Sywell Mansfield Nottingham (Toton) Overstone Leys (Northampton) Brackley (Radstone Fields) Milton Keynes (West)	132kV and 33kV 33kV 66kV 132kV and 33kV 33kV 33kV 33kV	Residential/Commercial Commercial Residential Residential Residential Residential Residential/Commercial
South Wales	South Sebastapool Bridgend (Cefn Cribbwr) Bridgend (Brackla) Hirwaun (Tower Colliery) Merthyr	66kV 66kV 132kV 33kV 33kV	Residential Residential Residential Mine Mine
South West	Emersons Green (Bristol) – part of site Plymouth (Sherford) Truro (Threemilestone) Exeter (Topsham) – phase 1 Taunton (Staplegrove) Bristol (Harry Stoke) – part of site Bridgwater (Bath Road) Taunton (Monkton Heathfield) East Devon Developments	132kV 132kV 132kV 132kV 132kV 132kV 33kV 33kV 132kV	Residential Residential/Commercial Residential Residential Residential Residential Residential Residential Residential/Commercial

Network Rail electrification

8.49 The electrification of railway lines means the replacement of older diesel trains with electric trains. Network Rail has long term proposals for many existing rail lines to be electrified

8.50 WPD has a number of overhead lines and cables that are placed on Network Rail land that will need to be diverted to facilitate the electrification.

8.51 WPD and Network Rail have a Master Wayleave Agreement (MWA) covering rights for WPD overhead lines and cables to be situated on railway property. This agreement dates from 1961 and is in effect a terminable licence (like any other wayleave). There will be similar MWAs in place between Network Rail and the other DNOs.

8.52 Network Rail has informed WPD that it requires that these diversions be at WPD's cost.

8.53 Should a dispute arise as to the nature of diversions required or where the costs fall, the MWA contains arbitration provisions which we expect Network Rail would seek to use as one way of determining the issue of compensation/costs.

8.54 The alternative route in the event of a dispute may be the use by WPD of its statutory powers under the Electricity Act 1989. This would secure WPD's existing rights, although Network Rail may seek compensation for any interference they felt the presence of WPD lines would cause.

8.55 Should this occur and in the absence of an agreement, Network Rail is likely to refer matters to the Lands Chamber for determination. The outcome of arbitration or any referral (for compensation) to the Lands Chamber is at present unknown but WPD must work on the basis that it could be required to meet all the costs or be required to pay an unknown level of compensation. The most likely outcome would be the diversion of WPD equipment to enable electrification of the railway lines.

8.56 Amongst the schemes having received approval from the Department for Transport, the following will impact WPD during the RIIO-ED1 period:

- electrification of the railway line from London Paddington to Swansea (including the Welsh Valley Lines);
- electrification of the Midlands Mainline from Bedford to Sheffield through the East Midlands.

8.57 The current RIIO-ED1 forecast includes costs for diverting WPD assets for these two known schemes and an assumption that work will start on the Birmingham-Plymouth route in the second half of the period.

High Speed 2

8.58 Since High Speed 2 (HS2) is a new line without existing wayleave agreements in place, the costs of diversions will be predominantly fully funded and treated as an excluded service outside of the price control. The Act for HS2 is still in draft but Network Rail have informed us that they expect the relevant provisions covering cost of diversions will be similar to the Crossrail Act 2008.

8.59 A small nominal amount (<£1m) has been included within the diversion forecasts for potential HS2 diversions associated with existing railway routes on Network Rail land.

Diversions due to wayleave termination expenditure

Diversions due to wayleaves terminations (£m)					
	West Midlands	East Midlands	South Wales	South West	WPD Total
DPCR5 Annual Average	5.7	5.5	1.6	2.6	15.4
RIIO-ED1 Annual Average	6.6	6.5	6.4	7.0	25.6
RIIO-ED1 Total (8 years)	53.1	51.6	51.3	56.4	212.4

Network diversions for highways work

8.60 Highways work, such as large scale development of new motorways and road widening may require the diversion of WPD equipment. Whilst the majority of the costs of the diversions are rechargeable to the local authorities or Highways, Regulation 4 of The New Roads and Street Works Act (NRSWA) requires WPD to contribute 18% to the costs. These projects are managed in a co-ordinated manner to minimise the cost impact.

8.61 The forecasts reflect that the majority of the roadworks will continue to be focused in the Midlands with improvements to junctions, road widening and further expansion of managed motorways (variable speed motorways utilising hard shoulders during times of peak traffic). The forecast costs represent the proportion that is not funded by the authorities. Forecasts for RIIO-ED1 are in line with previous levels of expenditure.

Diversions for highways work (£m)					
	West Midlands	East Midlands	South Wales	South West	WPD Total
DPCR5 Annual Average	0.7	0.3	0.0	0.0	1.0
RIIO-ED1 Annual Average	0.9	0.7	0.1	0.1	1.8
RIIO-ED1 Total (8 years)	7.3	5.2	0.5	0.7	13.7

Summary expenditure

Diversions, conversion of wayleaves to easements and highways work expenditure RIIO-ED1 (£m)					
	West Midlands	East Midlands	South Wales	South West	WPD Total
Easements & injurious affection	26.4	28.2	15.4	20.4	90.4
Diversions due to wayleave terminations	53.1	51.6	51.3	56.4	212.4
Diversions for highways work	7.3	5.2	0.5	0.7	13.7
RIIO-ED1 Total Gross	**86.9**	**85.1**	**67.2**	**77.5**	**316.7**
Customer contributions	(0.8)	(0.8)	(0.8)	(0.8)	(3.2)
RIIO-ED1 Total Net	**86.1**	**84.3**	**66.4**	**76.7**	**313.5**

Non-load network investment

9 Risk based asset replacement

Introduction

9.1 The objective of WPD's asset replacement programme is to replace or refurbish assets in a timely manner in order to ensure that the condition based risk is managed to the optimum level for each asset type and the distribution network asset base overall.

9.2 WPD uses both longer term outlooks and shorter term forecasts to derive asset replacement volumes.

9.3 Longer term outlooks (i.e. greater than 10 years) use age based survivor modelling techniques to provide an understanding of long term resource requirements and changing patterns of asset replacement.

9.4 Shorter term forecasts (i.e. 2 to 10 years) use risk based modelling techniques to establish asset replacement volumes that optimise condition based risk.

Distribution network asset management strategy

9.5 WPD's overall Distribution Network Asset Management strategy is outlined in WPD policy document POL:AM1, which states:

> *"It is WPD strategy to install, inspect and maintain its substations, plant, underground cables and overhead lines such that:*
>
> - *An optimum balance is achieved between asset life, cost and reliability;*
> - *The safety of employees, the public and the environment is not unreasonably compromised;*
> - *They comply with statutory and regulatory requirements;*
> - *They are refurbished or replaced when their condition is no longer consistent with an acceptable level of reliability or safety."*

Optimum condition based asset replacement

9.6 As stated in the introduction, the objective of WPD's asset replacement programme is to replace or refurbish assets in a timely manner in order to ensure that the condition based risk is managed to the optimum level for each asset type and the distribution network asset base overall.

9.7 This objective does not presuppose that the prevailing level of condition based risk is correct or cost effective.

9.8 WPD's asset replacement strategy to achieve this objective is to:

- establish condition based "trigger points", based on both probability and consequences of failure, for each asset category, that identify the economic optimum point during an asset's life when the asset should be replaced or refurbished;
- routinely collect and record actual asset condition data; and

- undertake the replacement, or refurbishment, of an asset no earlier than when the actual condition is equal to the relevant optimum condition based trigger point.

9.9 The determination of the optimum condition based trigger point takes into account:

- network performance risk (i.e. impact of Customers Interrupted and Customer Minutes Lost);
- safety risk (e.g. injury to a person coincidental with condition based failure);
- environmental risk (e.g. leakage of oil);
- financial risk (i.e. cost of repair following condition based failure); and
- cost of undertaking asset replacement or refurbishment.

Overview of asset replacement forecasting

9.10 For RIIO-ED1, WPD has used two different techniques, in tandem, to formulate the asset replacement forecast. Longer term forecasts have been produced using age based survivor modelling, which have been refined with shorter term forecasts that use risk based modelling.

9.11 By considering the longer term forecast, WPD aims to ensure that the asset replacement activity levels, in the RIIO-ED1 period, will not lead to a requirement for a step change in overall activity levels in subsequent price control periods. This enables efficient resourcing and stability in expenditure and funding requirements.

9.12 For the shorter term, WPD has used risk based modelling and cost benefit analysis to identify the optimum economic point for asset replacement. This approach compares the cost of asset replacement against the benefits of removing future risk and identifies the point at which the maximum net benefit is delivered. The volume of asset replacement is derived by considering those assets whose health shall reach the optimum economic point for replacement.

9.13 This approach is new for RIIO-ED1.

9.14 WPD has not used risk based modelling to derive asset replacement forecasts for previous price control periods (the DPCR5 forecast considered asset health, but did not incorporate consideration of consequences of failure for individual assets).

9.15 Consequently, the risk based approach used by WPD does not aim to maintain the future network risk at existing levels. Such an approach would presuppose that the existing level of network risk is at the correct level or the most cost effective.

9.16 By adopting a strategy of replacing assets when they reach the optimum economic point for replacement, the overall network risk will naturally migrate to the optimum level.

Longer term forecasting (greater than 10 years)

9.17 Since DPCR3 the industry has used survivor modelling to forecast future asset replacement volumes. Survivor models are age based models that use age as a proxy for condition. The presumption is that as an asset ages, the greater the likelihood that it is in poorer condition and hence the higher the probability that the asset will need to be replaced.

9.18 Survivor models are applied to each asset category and rely upon the following types of information:

- age profile of the asset population;
- mean asset life expectancy;
- an assumed distribution of replacement.

9.19 A distribution of replacement is used because it is unrealistic to assume that all assets are replaced when they reach the mean life expectancy. The statistical distribution determines the probability of replacement for assets in each year of their lives. The models are based on a normal distribution using the mean asset life expectancy and a standard deviation.

9.20 The survivor models produce a forecast of the probable volume of assets that will require replacement in each future year.

9.21 Due to the statistical nature of the model, and the limited data requirements, survivor models are capable of easily producing credible indicative long term forecasts. Forecast volumes, from survivor models, for each year up to 2039/40 have been examined, when considering the long term impact of WPD's RIIO-ED1 asset replacement forecasts.

Shorter term forecasting (2-10 years)

Condition Based Risk Management

9.22 Condition Based Risk Management (CBRM) is an asset management decision support tool that has been developed by EA Technology Limited. It is used to:

- determine both current asset health and current probability of condition based failure;
- forecast deterioration of asset health and the associated change in probability of failure; and
- assess consequences of failure.

9.23 By combining probability of failure and consequence of failure, CBRM can determine both the current and forecast risk of condition based failure.

9.24 CBRM is used by a number, but not all, DNOs in the UK industry. WPD has been working with EA Technology Limited since 2007 on the application of CBRM to WPD asset data.

Condition assessment

9.25 The condition assessment of assets is embedded in WPD's routine inspection and maintenance procedures. For major items of equipment, this is supplemented by additional condition assessment as assets approach the expected average life for the asset type.

9.26 Condition data collected during routine inspection, routine maintenance and non-routine condition assessment, defect repair, etc., is recorded in WPD's asset management system called CROWN.

9.27 This information is used, within the CBRM models, for the evaluation of asset health and condition based risk.

Determining asset health within CBRM models

9.28 CBRM assigns health scores to assets using a continuous scale from 0.5 to 10. These scores are numerical representations of the condition of each asset, with 10 representing assets in poorest condition. The use of a continuous scale facilitates the modelling of degradation of asset health with time.

9.29 An initial health score is derived from an asset's age, locational factors (e.g. whether the asset is located indoors or outdoors, proximity to the coast) and duty factors (e.g. in power transformers, the degree of loading affects the rate of ageing of the winding insulation).

9.30 The initial health score is modified to create the adjusted asset health score by incorporating the condition assessment data, defect history and test results. This modification can result in the initial health score increasing or decreasing.

9.31 In order to forecast degradation of asset health, the CBRM model assumes that future asset health deteriorates with age. A typical degradation curve is shown in figure 1 below. The rate of degradation of health of an individual asset is dependent upon the original construction of the asset along with its locational and duty factors.

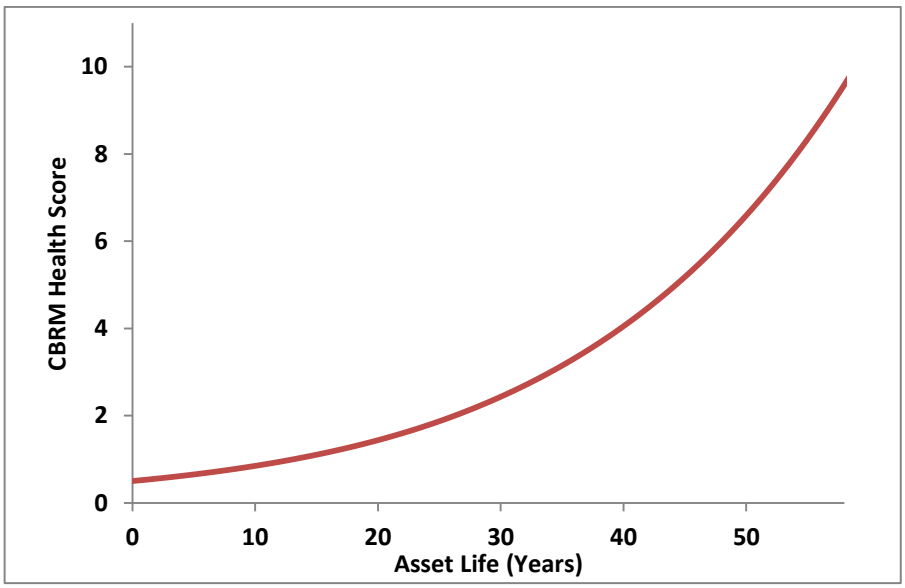


Figure 1: Typical asset health degradation curve.

Probability of condition based failure

9.32 Within the CBRM models, the probability of condition based failure is determined from the asset health score. This probability of failure (POF) is calculated using the following formulae:

for HS > 4:-

$$\text{POF} = \left(1 + (1.35 \times \text{HS}) + \frac{(1.35 \times HS)^2}{2!} + \frac{(1.35 \times HS)^3}{3!}\right) \times k$$

for HS < 4:-

$$\text{POF} = \left(1 + (5.4) + \frac{(5.4)^2}{2!} + \frac{(5.4)^3}{3!}\right) \times k$$

where:-

POF = probability of failure per annum;
HS = CBRM asset health score; and
k is a constant

9.33 For asset types, where condition based failures are managed reactively (e.g. cables, where repairs/ replacement is mainly undertaken in direct response to a failure), the constant 'k' is determined such that the calculated total probability of condition based failure for the asset type approximates to observed failure rates.

9.34 For asset types, where the risk of condition based failure is managed by proactive asset replacement, constant 'k' has been evaluated, using best engineering judgement, to reflect the underlying probability of failure that would be expected if the assets were not managed proactively.

9.35 When standard assumptions for degradation of asset health with age are applied (as shown in figure 1), the resulting probability of failure curve is shown in figure 2. This approximates to the standard 'bath tub distribution' used in the statistical modelling of reliability.

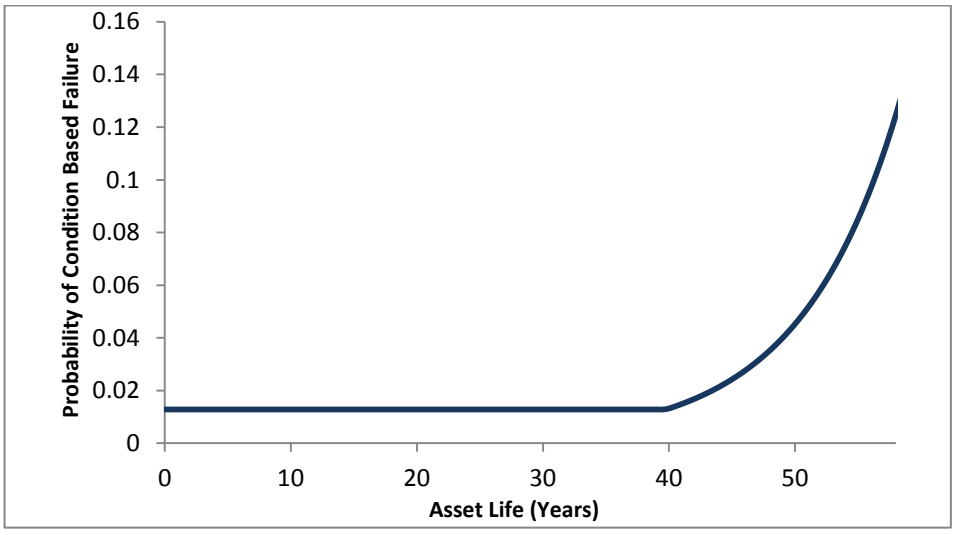


Figure 2: Typical probability of failure curve

Consequence of condition based failure

9.36 Consequence of failure refers to the impact of a condition based asset failure.

9.37 During 2012, WPD worked with the other DNOs to develop a common framework for assessing asset criticality ('criticality' being a relative measure of consequence of failure). This work was undertaken as part of the Criticality and Health subgroup of Ofgem's Reliability & Safety Working Group. The subgroup developed the Criticality Index framework that is used for the reporting of consequence of failure within the RIIO-ED1 BPDT tables, including defining principles for the determination of consequences of failure.

9.38 WPD's risk modelling evaluates consequences of failure consistently with the recommendations developed by the Criticality and Health subgroup.

9.39 Within the CBRM model, the overall consequences of failure are evaluated for each asset, taking into account:

- network performance consequences (i.e. the number of customers interrupted as a result of a failure and the likely duration of the outage);
- safety consequences;
- environmental consequences; and
- financial consequences (i.e. cost of repair).

9.40 All consequences are evaluated as costs (in pounds sterling). This means that:

- the consequences of failure, in each of the above consequence categories, are additive; and
- the cost effectiveness of reductions in the risk of condition based failure can be evaluated against the cost of undertaking asset replacement works.

Consistency with parameters used in Ofgem's stylised cost benefit analysis templates

9.41 WPD has used consistent parameters in the evaluation of consequences of failure to those used in Ofgem's stylised cost benefit analysis templates that DNOs were required to complete and submit as part of the RIIO-ED1 Business Plan (refer to Appendix A2 of Supplementary Annex SA-05 Expenditure).

9.42 For example, in Ofgem's cost benefit analysis template, a value of £36 was specified for the environmental impact of loss of a litre of oil. The same value is used in WPD's CBRM modelling.

9.43 Also, the Ofgem cost benefit analysis template uses a value of £15.44 for a Customer Interrupted and £0.38 for a Customer Minute Lost. These values have been used in the derivation of network performance consequences in WPD's CBRM risk modelling.

9.44 The WPD CBRM based approach inherently embodies cost benefit analysis, but it is separate and distinct from the Ofgem stylised cost benefit analysis template.

Incorporating business improvements

9.45 The number of customers interrupted per asset failure, and likely duration of the outage, are used to determine network performance consequences. Where appropriate, these parameters are evaluated from historic incident data for the relevant asset types.

9.46 Following the acquisition of the West Midlands and East Midlands licence areas, and the introduction of WPD working practises into these areas, WPD has significantly improved the restoration times, during unplanned incidents. As a result, the CBRM models for West

Midlands and East Midlands use a forward looking view of the likely duration of outages when evaluating network performance consequences, rather than historic data.

9.47 Using the forward looking view is important because it determines the asset replacement volumes based upon future consequences of failure. If historic slower restoration times were used this would lead to higher consequences of failure, which in turn would lead to higher volumes of replacement.

Reporting criticality index data within the BPDT

9.48 Work with other DNOs and Ofgem, within the Criticality and Health subgroup of Ofgem's Reliability and Safety Working Group, has developed a process for the categorisation of consequence of failure into a Criticality Index framework.

9.49 The framework uses the average overall consequence of failure, for assets in a given Health Index category, as a reference point and allocates assets to a criticality band using the rules shown in Table 1.

Category	Description	Criticality values included
C1	Low criticality	Less than 75% of the average overall consequence of failure
C2	Average criticality	Greater than, or equal to, 75% and less than 125% of the average overall consequence of failure
C3	High criticality	Greater than, or equal to, 125% and less than 200% of the average overall consequence of failure
C4	Very High criticality	Greater than, or equal to, 200% of the average overall consequence of failure

Table 1: Banding definitions for the Criticality Index reporting framework

Managing condition based asset failure risk

9.50 Condition based asset failure risk is the product of probability of failure and the consequences of failure. Therefore changes to either the probability of failure, or the consequences of failure, will affect risk.

9.51 For any particular asset, the consequences of failure will only change significantly as a result of a discrete event. This may be:

- a specific intervention by the DNO (e.g. the introduction of control measures such as bunding to mitigate oil pollution risk); or
- changes in circumstance external to the DNO's control (e.g. change in adjacent land usage).

9.52 Such events are infrequent and not time specific. The CBRM models assume that the consequences of failure do not change progressively with time.

9.53 Since the future health of an asset deteriorates with age, the future probability of failure for a particular asset will increase as the asset ages.

9.54 The increase in the probability of failure leads to an increase in future condition based risk.

9.55 Figure 3 shows a typical curve that represents how asset failure risk changes as an asset ages. Due to the 'bath tub' shape of the probability of failure curve, the risk during the earlier part of an asset's life remains constant. Asset replacement during this period does not reduce risk, because the replacement asset (assuming 'like for like' replacement) has the same probability of failure as the asset being removed.

9.56 The shaded area under the curve shows the risk that can be managed by asset replacement activity (i.e. the risk that is removed when an asset is replaced with a new asset). It should be noted that this is only the risk that is above the level associated with a new asset.

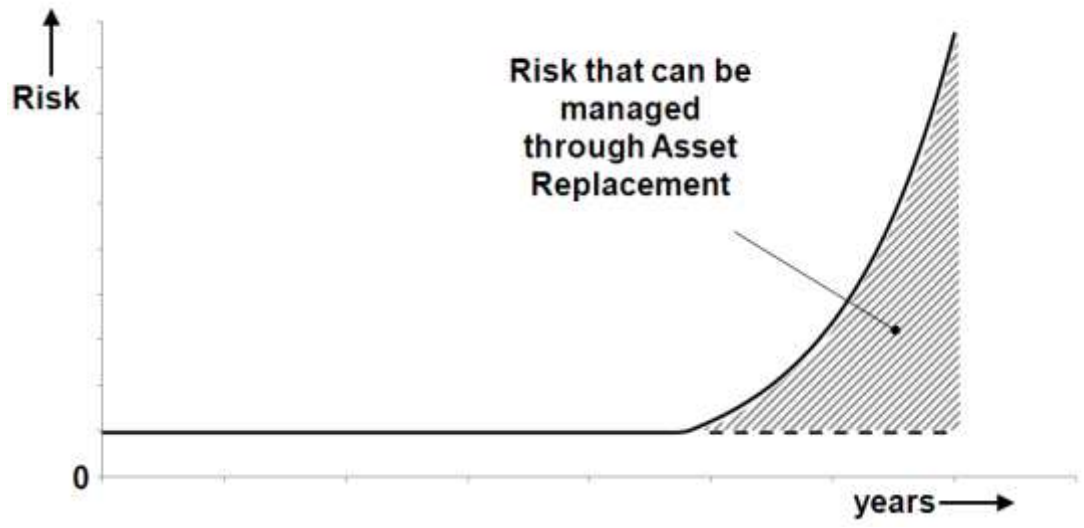


Figure 3: The condition based risk that can be managed through asset replacement

Determining the optimum economic point for asset replacement

9.57 For each asset type at each voltage level, WPD has examined the balance between the present value of the:

- cost of asset replacement; and
- benefits of reduced future risk.

9.58 The analysis determines the costs/ benefits associated with undertaking asset replacement at different points in time during an asset's life. This generates a profile of net benefit and enables the optimum economic point for asset replacement to be determined.

9.59 Due to network differences, the analysis is carried out separately for each asset type at each voltage level in each WPD licence area. This ensures that the optimum economic point for replacement reflects:

- differences in the cost of asset replacement between licence areas; and
- differences in typical consequences of failure between licence areas (e.g. different levels of network performance consequence due to load density, network topology etc.).

9.60 Future asset health is forecast by applying the degradation curve to the current asset health in CBRM. This provides a relationship between probability of failure and asset age, which when combined with the consequences of failure provides a relationship between condition based risk and age.

9.61 The benefit of risk removed in the year of asset replacement is calculated as the difference between the cumulative risk avoided and the risk associated with the new asset.

9.62 For example, assume that an asset is replaced in year 60 of its life. If the original asset has a condition based risk of £1,094.7 in year 60, and the new replacement asset has a condition based risk of £310, then the improvement in risk, in year 60, is £784.70. However, by replacing the asset in year 60, there is also a benefit in reduced risk in the following year, and subsequent years thereafter. This is illustrated in the example shown in Table 2 below.

Year	Condition Based Risk In Year (£) - if original asset retained in service (£)	New asset risk – asset installed in year 60 (£)	Benefit In Year (£): Change In Condition Based Risk (In Year) Delivered By Asset Replacement	Present Value of Benefit In Year (£)
	(a)	*(b)*	*(c) = (a)-(b)*	*discount factor *(c)*
60	1,094.7	310	784.7	99.6
61	1,215.7	310	905.7	111.1
62	1,350.4	310	1,040.4	123.3
63	1,500.2	310	1,190.2	136.3
64	1,666.9	310	1,356.9	184.4
.	.	.	.	.
.	.	.	.	.
100	3,385.4	1,095	2,290.4	73.4
etc.	etc.	etc.	etc.	etc.
	Total Benefit Of Future Risk Removed if asset replacement undertaken in Year 60:			**8,390.9**

Table 2: Example calculation of the benefits of risk removed (where asset replacement is undertaken at year 60)

9.63 In subsequent years the condition based risk increases due to the higher consequences of failure. The risk associated with a new asset initially remains constant, but over time the condition of the new asset will degrade and its associated risk will increase (e.g. new asset risk value is £1,095 in year 100 - when it is 40 year old, which is higher than the initial value of £310 in year 60 – when it is installed).

9.64 Taking the present value of the benefit in each future year (using a discount factor of 3.5%), an overall cumulative benefit in reduction of future years' risk can be calculated in present value terms at £8,390.90. This benefit can be compared to the present value of the cost of replacement in year 60, to determine the cost effectiveness of replacement undertaken at that point in the asset's life.

9.65 In this way, the costs and benefits have been evaluated, in present value terms, for undertaking asset replacement at each year of an asset's life. Figure 4 shows an example of the curve for the present value cost of asset replacement (shown in red) considering each year that the replacement could be undertaken. The cumulative present value benefit of future risk avoided is also shown (by the green curve) for each year that asset replacement could be undertaken. By summating the cost and benefit curves for undertaking asset replacement at each year of an asset's life (shown by the black curve), it is possible to determine the optimum economic point for replacement of the asset. In the example shown in Figure 4, the optimum economic point is where the net benefit/cost curve reaches its maximum value, i.e. around year 60.

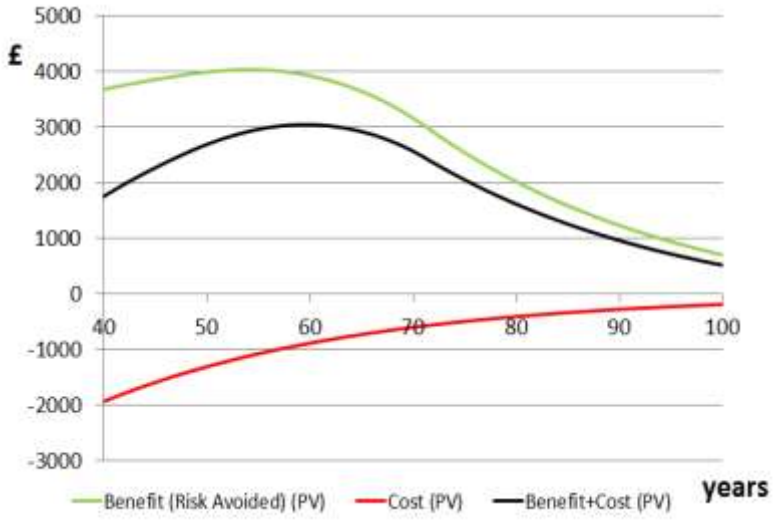


Figure 4: Comparison of cost of replacement and benefit of risk avoided, considering asset replacement across a range of years

9.66 From Figure 4 it can also be seen that the replacement of the asset at any time across the age range shown in the chart would return a positive net present value. Whilst the replacement at such alternative times may be demonstrated as NPV positive, the assets will not be replaced at the optimum economic point in their lifecycles. Therefore these alternatives would not be the most cost effective replacement strategy.

9.67 The determination of an optimum economic point for replacement does not mean that all assets that reach that age are replaced. Instead, this point in time is used to identify the equivalent asset health score by reference to the typical asset health degradation curve. This creates a trigger value of asset health for asset replacement. When an asset's health reaches, or exceeds, the trigger value then the asset should be replaced.

Using criticality to adjust the optimum economic point

9.68 The analysis considers the effect that different levels of consequence of failure have upon the optimum economic point for replacement.

9.69 For each asset type, at each voltage level, in each licence area, the average consequences of failure are determined for the population of the asset type. Individual assets are categorised into four bands, relative to the average consequences of failure for the asset type. These bandings used the same definitions as the Criticality Index bandings, shown in Table 1. The

average consequences of failure for each consequence band are then calculated. This process is illustrated in Figure 5, below.

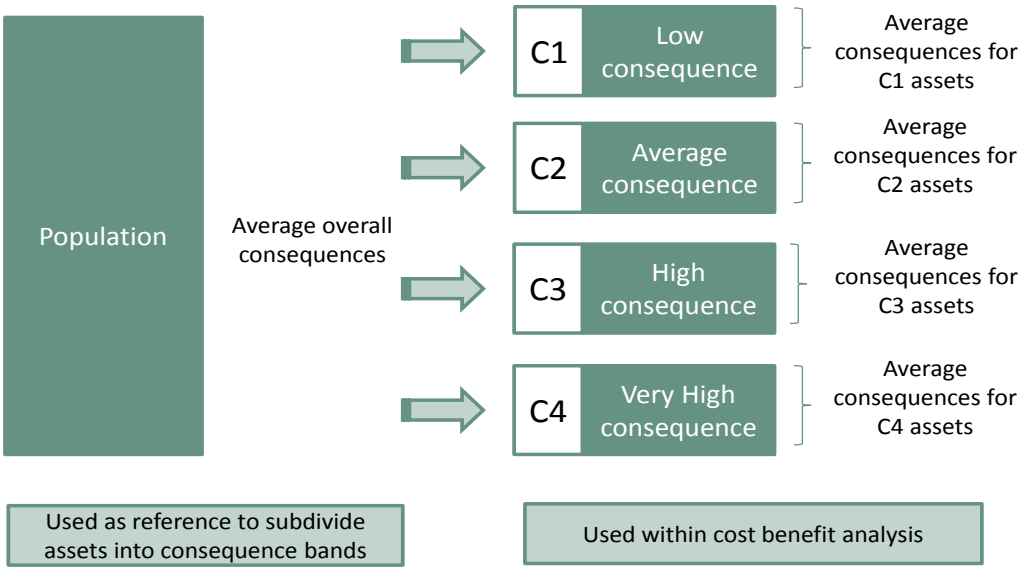


Figure 5: Classification of asset types into consequence bands

9.70 Cost benefit analysis, to determine the optimum economic point of replacement, is then undertaken considering the average consequences of failure for each of the four consequence bands.

9.71 In this way a different optimum point of replacement is determined for each consequence band. This corresponds to a different asset health trigger value for replacement for each consequence band.

9.72 The optimum economic point for assets with lower consequences of failure is later than for assets, of the same type, with higher consequences of failure. This is shown in Figure 6, which shows an example of the net cost benefit curve for four different consequence bands for the same asset type. The optimum point of replacement for assets in the 'Low consequence' band (C1) is shown to be later than for assets in the 'Very High consequence' band (C4).

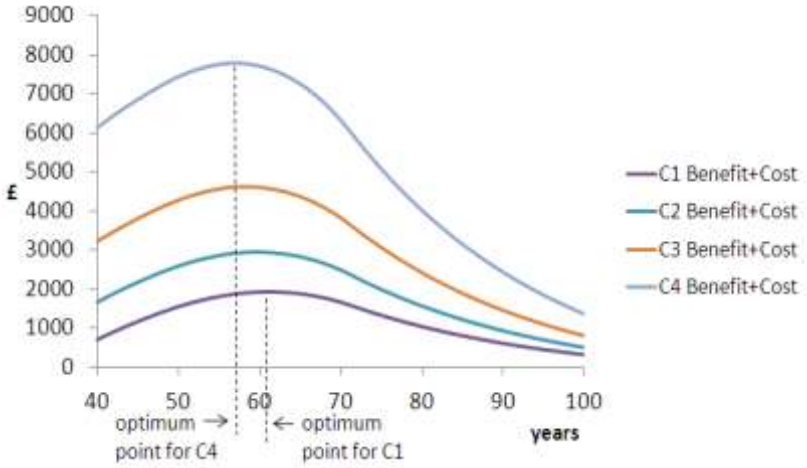


Figure 6: Considering the optimum economic point for replacement for different levels of consequence of failure

9.73 It follows that the asset health trigger value for asset replacement will be greater for assets with lower consequences.

Forecasting asset replacement volumes using the optimum economic point for replacement

9.74 Asset replacement forecasts for RIIO-ED1 are derived from the CBRM models by:

- determining the appropriate consequence band for each individual asset;
- identifying the appropriate trigger value for asset replacement for the appropriate asset type and consequence band;
- determining the asset health score, on the WPD CBRM scale, for each individual asset; and
- comparing the health score for each individual asset against the trigger value to identify those assets where the health score at the end of RIIO-ED1 reaches, or exceeds, the trigger value for replacement.

9.75 This approach determines the optimum volume of assets to cost effectively manage condition based risk. By only replacing those assets that reach the trigger value for asset replacement, the network risk shall migrate to the optimum level. This will lead to the overall optimisation of condition based risk across each of WPD's distribution networks.

9.76 Overall, by refining the asset replacement forecast using risk based modelling, determining the optimum economic point for replacement and optimising condition based risk, WPD's RIIO-ED1 asset replacement expenditure forecast for RIIO-ED1 is reduced to 88% of the expenditure that would be forecast using age based modelling only.

9.77 For some individual asset types, however, risk based modelling has identified higher asset replacement volumes than forecast using age based modelling. These tend to be assets where the ratio of consequences of failure to cost of replacement is relatively high.

Linkage between the asset replacement forecast and the BPDT health index and criticality index tables

Health Index categories

9.78 In DPCR5, Ofgem introduced a system of health index classification that allows categorisation of assets into five bands of health from 'as-new' condition to 'requiring intervention'. The WPD CBRM asset health scale is mapped to the Ofgem categories as follows:

Ofgem Health Index category	Ofgem Description	WPD CBRM health score
HI1	New or as new	0 to 1.5
HI2	Good or serviceable condition	1.5 to 3
HI3	Deterioration requires assessment and monitoring	3 to 6
HI4	Material deterioration, intervention requires consideration	6 to 7
HI5	End of serviceable life, intervention required	Greater than 7

Table 5: Translation of CBRM health scores into Ofgem Health Index categories

DPCR5 output methodology

9.79 In addition to specifying health index categories, Ofgem also introduced an outputs methodology that used the health indices to ensure that DNOs focused on delivering replacement programmes in line with their forecasts. As illustrated in figure 7, DNOs had to determine the health index profile of assets at three points:

- the starting position at the beginning of DPCR5;
- how the health indices will change as a consequence of degradation without any intervention at the end of DPCR5; and
- the impact of proposed replacement programmes on the position at the end of DPCR5.

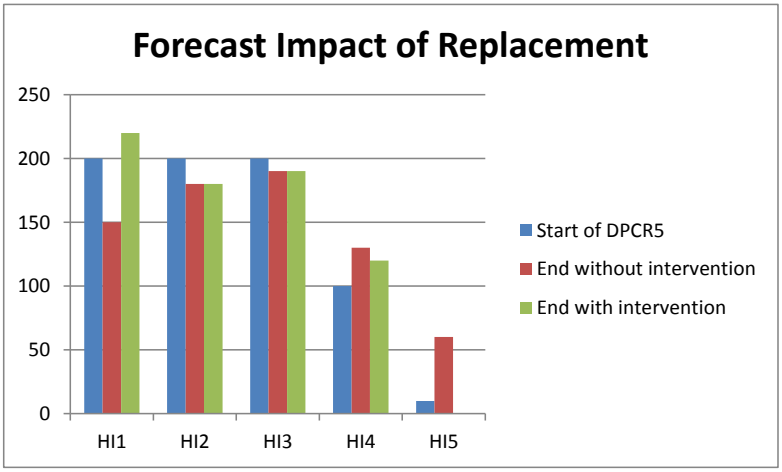


Figure 7: Example of DPCR5 output forecast

9.80 During DPCR5, Ofgem enhanced the assessment by introducing the concept of health index points to assist in calculating whether DNOs had delivered replacement programmes. Health index points are essentially a weighting factor that assigns more points to poor condition assets i.e. HI5 asset generate more points than HI4 assets.

9.81 The health index output forecasts have been converted into a health index points target by assessing the difference between the positions at the end of DPCR5 with and without intervention.

9.82 At the end of DPCR5, Ofgem will compare the number of health index points delivered through asset replacement and refurbishment against the health index points implied by the original forecasts to determine whether DNOs have delivered their work programmes. Where this is not the case Ofgem can invoke a revenue claw back mechanism.

Proposed RIIO-ED1 output methodology

9.83 For RIIO-ED1, Ofgem has extended the concept to also include criticality.

9.84 Health index and criticality index data is presented in a matrix which shows the number of assets that fall into each band as illustrated in table 6 below:

		Heath Index (Probability of failure)				
		HI1	HI2	HI3	HI4	HI5
Criticality	C1	27	16	30	8	6
	C2	35	5	43	12	13
	C3	13	8	9	2	10
	C4	2	-	3	-	6

Table 6: Example of Health Index/ Criticality Index matrix

9.85 The colour coding, proposed by Ofgem, is intended to represent graduations of risk. But, since the WPD assessment of condition based risk has been evaluated on a continuous scale there will be occasions where trigger points for replacement do not align with HI band mapping. This means that there will transitions in some categories in which not all assets will be replaced. For example if the optimum point for replacement is above the Ofgem threshold for the HI5 band, those asset above the band threshold, but below the replacement trigger will not be replaced.

9.86 WPD has populated the supporting BPDT tables for five different situations:

- the starting position at the beginning of RIIO-ED1;
- how the matrix will change as a consequence of degradation without any intervention at the mid-point of RIIO-ED1;
- the impact of proposed intervention programmes on the position at the mid-point of RIIO-ED1;
- how the matrix will change as a consequence of degradation without any intervention at the end of RIIO-ED1;
- the impact of proposed intervention programmes on the position at the end of RIIO-ED1.

9.87 Several sets of matrices have been produced; one set for each health index asset category. WPD has used the matrices to define the outputs that will be delivered as a result of asset replacement and asset refurbishment interventions.

9.88 The outputs are represented by the net difference (the delta) between the position at the end of the period with intervention and the position at the end of the period without intervention. Delivery of the WPD asset replacement and refurbishment programme will be assessed against the net position. Tables of these net positions are provided in the appendix to the Supplementary Annex (SA-04) Outputs.

Further evolution of the methodology in RIIO-ED1

9.89 Each matrix provides an indication of risk. Assets that are in poor condition with the greatest consequences of failure are deemed to be high risk.

9.90 Ofgem has indicated that it will work with the industry to develop a methodology to combine the risk positions for each asset category into an overall risk measure.

9.91 This work will be carried out following submission of the RIIO-ED1 Business Plans.

Impact of trigger points on the population of output matrices

9.92 The population of the Health Index and Criticality Index data for the BPDT uses data from WPD's asset replacement forecasts.

9.93 Assets are assigned into the Criticality Index bandings based on the consequences of failure determined from the CBRM model for each asset type.

9.94 Assets are assigned into the Health Index bandings based on the adjusted CBRM health scores.

9.95 The trigger values for the optimum point for replacement are determined from the WPD CBRM asset health scale, which is a continuous scale. This means that the trigger value for replacement may be 'part way' along the associated Ofgem Health Index Band.

9.96 This means not all assets in parts of the health and criticality matrix will be replaced.

Illustration

9.97 Consider an asset type such as 132kV Transformers in WPD West Midlands. The Health Index/ Criticality Index matrix for this asset, considering the position at the end of RIIO-ED1 without intervention, is shown in Table 7, below.

	End of RIIO-ED1 (31 March 2023) without investment					
	HI 1	**HI 2**	**HI 3**	**HI 4**	**HI 5**	**Total**
C1	27	16	30	8	6	**87**
C2	35	5	43	12	13	**108**
C3	13	8	9	2	10	**42**
C4	2	-	3	-	6	**11**
Total	**77**	**29**	**85**	**22**	**35**	

Table 7: Health Index/ Criticality Index matrix for 132kV transformers in WPD West Midlands

9.98 Assets are assigned into Health Index bandings based on their WPD CBRM asset health scores, which are translated in accordance with table 5.

9.99 For example, all assets with a WPD CBRM health score of greater than 7 are assigned to the Ofgem HI5 category, and all assets with a WPD CBRM health score between 6 and 7 are assigned to the Ofgem HI4 category.

9.100 The trigger values for replacement, determined from WPD's cost benefit analysis, for 132kV transformers in WPD West Midlands are shown in table 8, below:

WPD West Midlands - 132kV transformers	Consequence Banding			
	C1	C2	C3	C4
Trigger value (on WPD CBRM health scale) for replacement	7.42	6.72	6.21	6.08

Table 8: Optimum point for replacement of 132kV Transformers in WPD West Midlands

9.101 Assets in Criticality Index band C1 are forecast to be replaced when their CBRM asset health score reaches 7.42. Consequently, there are some assets shown in Criticality Band C1 and Health Index category HI5, in table 6, that are not forecast to be replaced, because they have yet to reach the optimum economic point for replacement determined from cost benefit analysis (i.e. an asset health score of 7.42).

9.102 This is illustrated in Table 9, which shows the asset movements planned for RIIO-ED1 for 132kV transformers in WPD West Midlands, due to asset replacement (in the first block of data). This shows three assets with a Criticality Index of C1 being replaced. These are all HI5 assets. These assets all have WPD CBRM asset health scores that exceed the trigger value of 7.42.

9.103 The second block of data in Table 9 shows that three of these assets are not planned to be replaced. These are assets that have met the criteria to be assigned to the Ofgem HI5 category, but not yet reached the trigger value for replacement.

	End of RIIO-ED1 (31 March 2023) planned investment (asset replacement only)						End of RIIO-ED1 (31 March 2023) assets not planned to be replaced					
	HI 1	**HI 2**	**HI 3**	**HI 4**	**HI 5**		**HI 1**	**HI 2**	**HI 3**	**HI 4**	**HI 5**	
C1	3	-	-	-	-3	-	27	16	30	8	3	**84**
C2	18	-	-	-5	-13	-	35	5	43	7	0	**90**
C3	11	-	-	-1	-10	-	13	8	9	1	0	**31**
C4	6	-	-	-	-6	-	2	-	3	-	0	**5**
	38	**-**	**-**	**-6**	**-32**		**77**	**29**	**85**	**16**	**3**	

Table 9: Planned asset replacement for 132kV Transformers in WPD West Midlands

Replacement of associated assets with lower HI values

9.104 For some Health Index Asset Categories, the asset replacement intervention forecast includes the replacement of small volumes of assets in lower Health Index bands.

9.105 These relate to assets that are in acceptable condition, but need to be replaced in order to facilitate replacement of poor condition assets. For example, where poor condition circuit breakers that form part of an extensible ground mounted switchboard are required to be replaced, it is likely that this will need the whole switchboard to be replaced in order for this to be achieved.

Asset data used for modelling and outputs

9.106 Asset information is recorded in WPD's CROWN asset management system or EMU mapping system. These are prime asset record systems that incorporate the means for recording data that is pertinent to understanding asset condition and its criticality. This information is utilised as an input into the CBRM model. CBRM is an asset replacement modelling approach that makes use of condition information to forecast how an asset's health and consequently the risk of failure is likely to change with time. CBRM analysis underpins WPD's asset replacement forecasts. For RIIO-ED1 CBRM analysis has been extended to cover the majority of assets.

9.107 The robustness of the CBRM process is dependent upon the accuracy of data inputs (as extracted from CROWN and EMU) as well as the validity of the assumptions built into the CBRM model itself. Condition information has been collected for a number of years. The range of information collected is monitored and refined as the link between condition measures, asset health and probability of failure become better understood.

9.108 CROWN has a number of control features that operate to assist data quality management. Internal KPIs are used to manage the completion of asset related work activity. Work activities are not counted for KPI purposes until the CROWN job is closed. The closing of a CROWN job requires the completion of mandatory data fields. This assists in ensuring that all relevant information is captured.

9.109 Analysis of asset records against expenditure records is carried out to gain assurance over the completeness of asset records updates. Policy initiatives have been implemented to extend the range of condition information captured on-site.

9.110 As new technology permits, further initiatives will be pursued to improve the quality of data capture. These include:

- on-site data capture using handheld devices;
- real time smart assessment of test / inspection results to identify and challenge unusual data entries;
- refining condition assessment to move from subjective interpretation to evidence based fact gathering.

9.111 The CBRM outputs will be validated through assessment and review of proposed candidate replacements by local engineering management. This will help to refine the assumption values used within the model. The CBRM model will continue to be developed and refined as more data is collected and analysed.

Summary of asset replacement forecasting

9.112 WPD has used consistent data in its modelling of asset risk, forecasting of asset volumes and reporting of asset health and criticality.

9.113 WPD's asset replacement forecast for RIIO-ED1 has been developed using both:-

- long term projections to deliver relatively stable activity levels over the longer term; and
- risk based modelling to cost effectively manage of condition based risk through the asset replacement activity.

9.114 WPD's risk based forecasting of asset replacement volumes, derives forecast activity levels that will lead to the cost effective optimisation of condition based network asset risk, whilst maintaining sustainable activity levels in the longer term.

9.115 Since the approach is new for RIIO-ED1, it does not presuppose that the prevailing level of risk is correct or cost effective.

9.116 Overall, the optimisation of risk in the RIIO-ED1 forecast has reduced the forecast expenditure to 88% of the forecast produced by survivor modelling.

Forecasting approach for each asset category

9.117 The approach used to determine the RIIO-ED1 asset replacement programme for each asset category is shown in the table below:

Forecasting approach for each asset category	
Asset Category	**Forecasting Approach**
UG – LV main (Consac)	Forecast fault rates/ historic activity levels
UG – LV main (Paper)	Forecast fault rates/ historic activity levels
UG – LV main (Plastic)	Forecast fault rates/ historic activity levels
UG – LV service replacement	Survivor model
UG – LV service transfers	Derived from forecast LV main asset volumes
UG – HV cable	Combination of CBRM/ survivor model
UG – 33kV, 66kV and 132kV cable (non-pressurised)	Combination of CBRM/ survivor model
UG – 33kV, 66kV and 132kV cable (oil)	Combination of CBRM/ survivor model
UG – 33kV, 66kV and 132kV cable (gas)	Combination of CBRM/ survivor model
OH – Services	Survivor model
OH – LV, HV, 33kV, 66kV and 132kV conductor	Combination of CBRM/ survivor model
OH – LV, HV, 33kV, 66kV and 132kV pole	Combination of CBRM/ survivor model
OH – Pole refurbishment	Combination of asset replacement forecast/ historic activity levels
OH – Tower replacement	Survivor model
OH – Tower refurbishment	Combination of asset replacement forecast/ historic activity levels
OH – Tower fitting replacement	Survivor model
OH – Tower painting	Historic activity levels for routine activity
OH – Tower foundation refurbishment	Combination of asset replacement forecast/ historic activity levels
SG – Cut-out replacement	Survivor model
SG – LV pillar replacement	Combination of CBRM/ survivor model
SG – UGB and pillars not at substations	Combination of CBRM/ survivor model
SG – HV switchgear	Combination of CBRM/ survivor model
SG – 33kV, 66kV and 132kV switchgear	Combination of CBRM/ survivor model
TX – HV ground mounted transformers	Combination of CBRM/ survivor model
TX – HV pole mounted transformers	Combination of CBRM/ survivor model
TX – 33kV, 66kV and 132kV transformers	Combination of CBRM/ survivor model
PR – Batteries	Historic activity levels
Civil driven by asset replacement	Derived from forecast plant asset volumes
Civil driven by civil aspects	Historic activity levels

10 Asset replacement and refurbishment

Background

10.1 The existing network has developed over many years with a large proportion being installed during the 1950s and 1960s.

10.2 Generally as assets get older they deteriorate, but the rate of degradation is dependent upon many factors including quality of manufacture, whether they are installed indoors or outdoors and local environmental conditions (e.g. assets close to the coast suffer from salt corrosion).

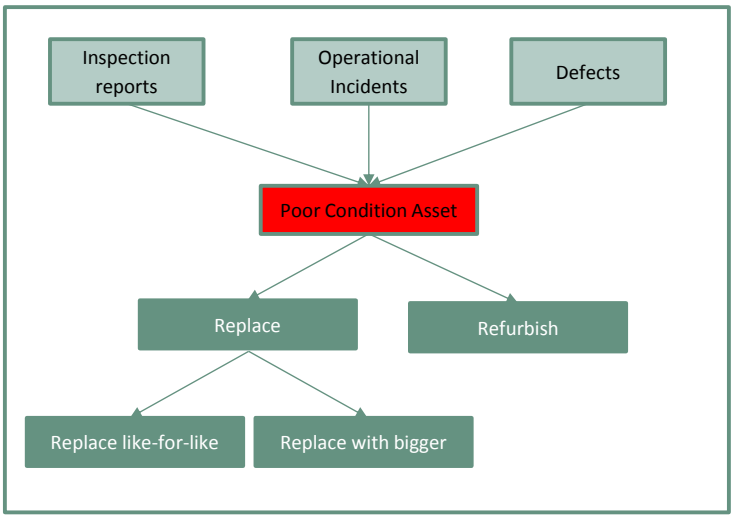
10.3 Actual asset replacement is therefore not undertaken on the basis of age, but on the basis of condition assessment. Condition assessment is carried out during routine inspection and maintenance and is supplemented by more detailed assessments once assets approach expected average lives.

10.4 Equipment, particularly switchgear, may also become embargoed with operational restrictions applied where defective components can lead to dangerous situations. Minor modifications can eliminate some defects, but where defective components cannot be easily remedied the equipment is replaced.

10.5 Generally assets will be replaced on a like-for-like basis using modern equivalents, but refurbishment will be considered where lower cost actions can extend the useful life of an asset by several years.

10.6 In addition, the anticipated load growth from the increased uptake of LCT means that consideration will be given to installing greater capacity assets where there is a strong indication that load growth will take place. This opportunistic reinforcement should negate the need for subsequent reinforcement as load increases. The small incremental increase in material costs will reduce long term costs particularly for cable assets where the majority of the costs arise from excavation and reinstatement.

10.7 In summary, condition and defect information will be used to develop work programmes that are targeted to replace poor condition assets and those with operational restrictions. The overall programme will be a mix of cost effective solutions consisting of like-for-like replacement, refurbishment and opportunistic reinforcement. This can be summarised in a flowchart:

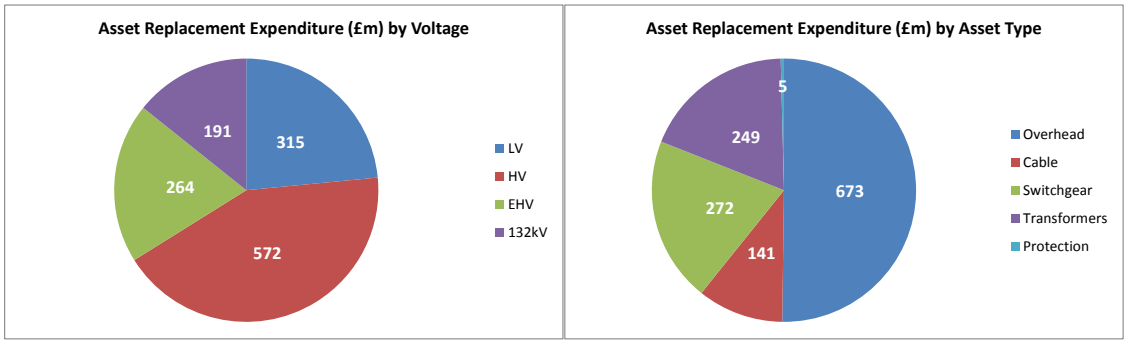


Expenditure forecast summary

10.8 The following tables and charts summarise how much will be spent on each type of asset for asset replacement and asset refurbishment over RIIO-ED1.

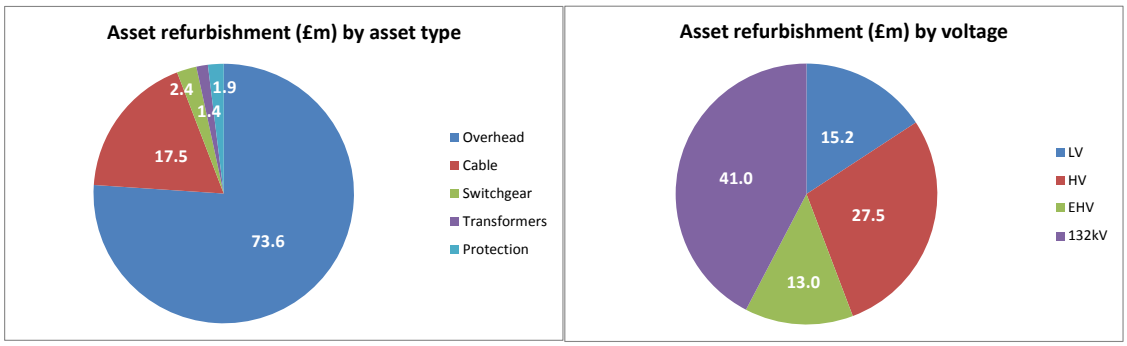
Asset Replacement Expenditure RIIO-ED1 (£m)					
	West Midlands	**East Midlands**	**South Wales**	**South West**	**Total**
LV Overhead Pole Line	72.1	40.4	39.9	77.1	229.5
LV Cable Consac	2.9	0.0	0.0	3.8	6.7
LV Cable Paper/LV Service	6.3	7.6	2.5	4.4	20.8
LV Switchgear	23.3	16.5	7.0	10.6	57.4
HV Overhead Pole Line	86.7	58.7	84.9	87.0	317.3
HV Cable	6.4	15.2	7.1	7.7	36.5
HV Switchgear	43.3	41.7	12.7	33.0	130.6
HV Transformer	24.8	20.0	14.5	26.8	86.0
HV Protection	0.5	0.1	0.0	0.5	1.2
EHV Overhead Pole Line	22.3	13.2	15.4	22.2	73.1
EHV Overhead Tower Line	1.6	2.3	0.2	0.6	4.7
EHV Cable	2.9	15.5	5.8	18.5	42.7
EHV Switchgear	8.7	17.7	8.7	13.3	48.5
EHV Transformer	17.8	31.8	14.7	27.3	91.7
EHV Protection	0.5	1.0	0.4	1.1	3.0
132kV Overhead Pole Line	0.0	0.0	0.5	0.2	0.7
132kV Overhead Tower Line	13.0	18.4	8.8	7.7	47.9
132kV Cable	32.9	0.0	0.0	1.8	34.6
132kV Switchgear	15.1	11.8	2.0	6.2	35.0
132kV Transformer	24.5	26.9	12.2	8.1	71.6
132kV Protection	0.4	0.1	0.2	0.4	1.1
Other Protection	0.0	0.0	0.0	0.0	0.0
TOTAL	**406.0**	**338.9**	**237.5**	**358.3**	**1,340.6**

10.9 Asset replacement is spread broadly across all voltages with most expenditure at HV. The split across assets types shows that most expenditure will be on overhead lines:



Asset Refurbishment RIIO-ED1 (£m)					
	West Midlands	East Midlands	South Wales	South West	Total
LV Overhead Pole Line	3.3	1.2	0.9	3.9	9.3
LV Underground service transfers	2.2	2.4	0.2	1.1	6.0
HV Overhead Pole Line	5.3	3.0	9.1	7.9	25.4
HV Switchgear	0.8	0.7	0.1	0.6	2.2
EHV Overhead Pole Line	1.9	0.4	1.2	2.5	6.0
EHV Overhead Tower Line	2.1	2.0	0.6	0.8	5.5
EHV Cable	0.0	0.0	0.0	0.0	0.0
EHV Switchgear	0.0	0.0	0.0	0.0	0.0
EHV Transformer	0.0	0.0	0.0	0.0	0.0
EHV Protection	0.2	0.6	0.3	0.3	1.4
132kV Overhead Pole Line	0.0	0.0	0.0	0.0	0.0
132kV Overhead Tower Line	5.8	9.8	5.1	6.5	27.3
132kV Cable	5.3	3.6	1.3	1.3	11.6
132kV Switchgear	0.1	0.1	0.0	0.0	0.2
132kV Transformer	0.6	0.4	0.2	0.1	1.4
132kV Protection	0.2	0.2	0.0	0.1	0.5
TOTAL	**28.0**	**24.4**	**19.1**	**25.3**	**96.8**

10.10 The majority of asset refurbishment will be on overhead line networks with the activity spread across the voltage range with work taking place on both wood pole and tower lines.



Longer term requirements

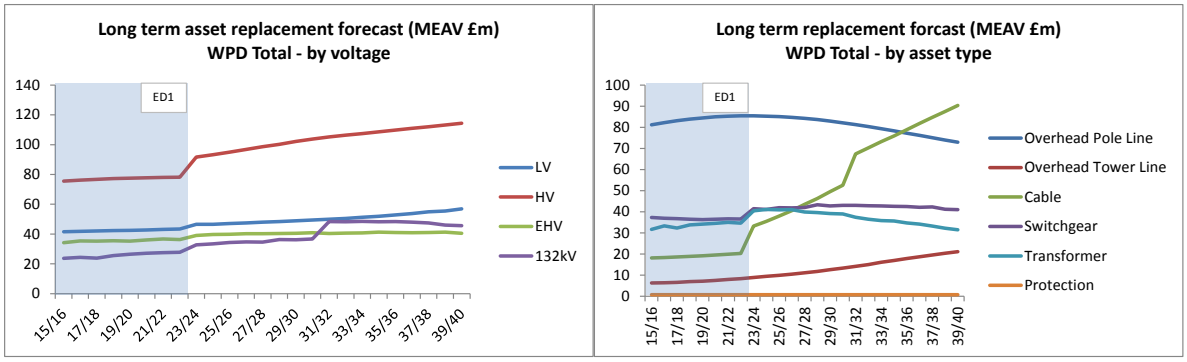
10.11 The volume of asset replacement has been increasing since DPCR3 across all asset types. By the end of RIIO-ED1, the survivor modelling indicates that the volume of replacement activity approaches a plateau for the majority of switchgear, transformers and overhead lines, with cables being the main category where volumes continue to grow from the current low levels.

10.12 The following charts illustrate how the financial expenditure, on asset replacement is forecast to evolve beyond the end of RIIO-ED3 (2040) for each of the licence areas.

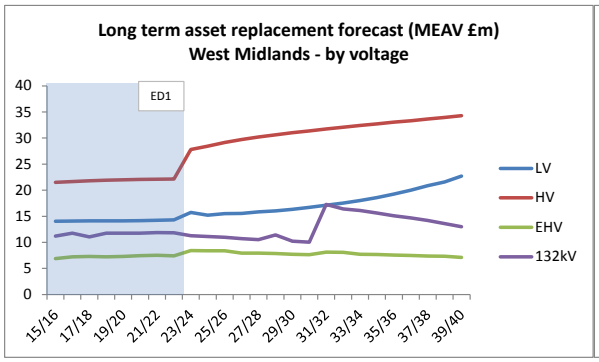
Longer term trends

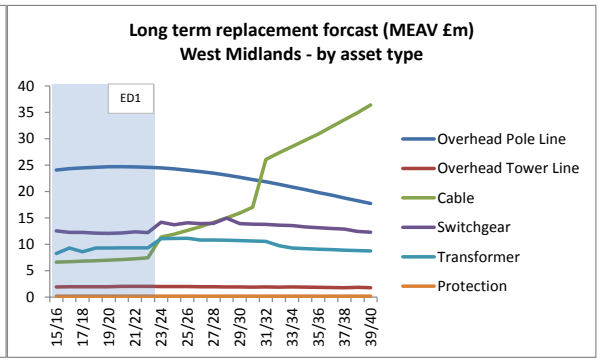
10.13 The following charts combine the forecasts for RIIO-ED1 with a longer term view informed by survivor modeling for subsequent periods. They show that over the next thirty years the main changes are dominated by increases in cable replacement.

WPD Total

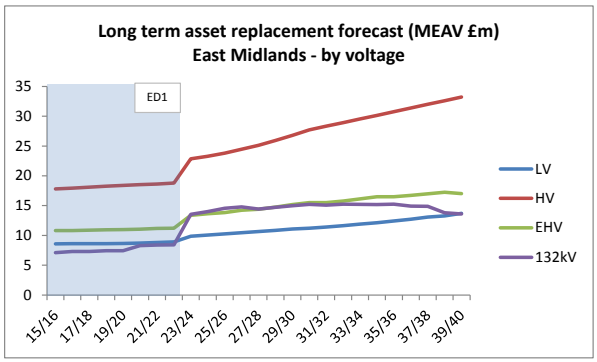


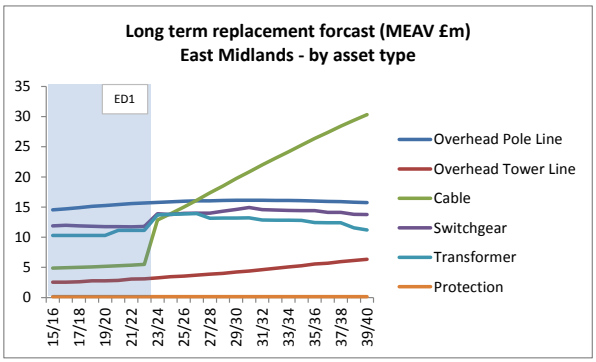
West Midlands



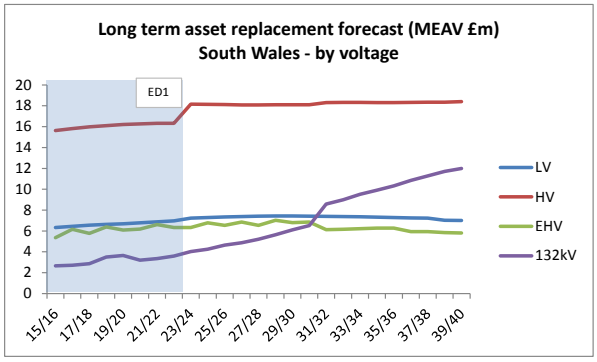


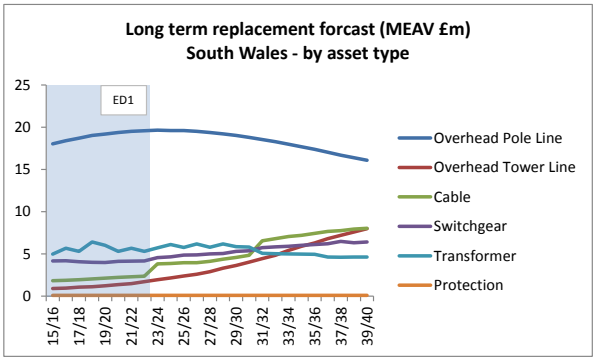
East Midlands



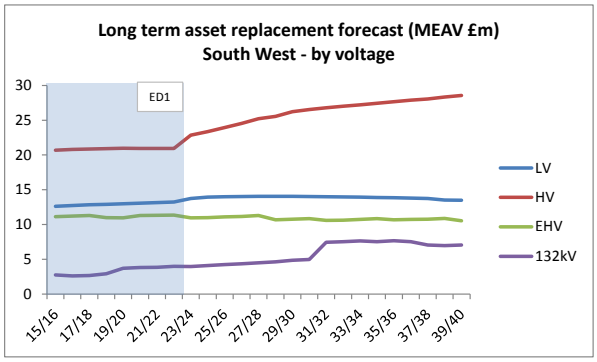


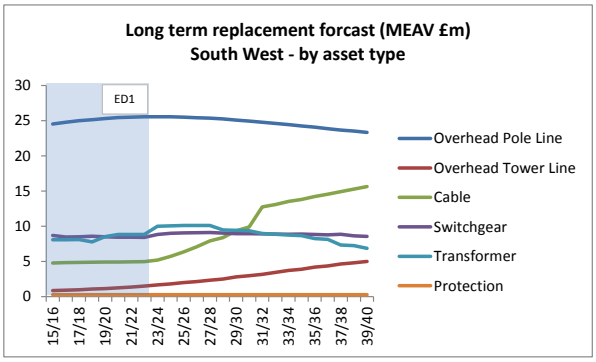
South Wales





South West





Asset replacement details

10.14 The following sections provide specific details, volumes and costs for each asset category.

Underground cables

LV main (underground Consac cable)

10.15 WPD has 6,400km of Consac cable predominantly installed in the West Midlands (3,700km) and the South West (2,700km). This aluminium cable was largely installed in the 1970s as a lower cost alternative cable. Consac cable is prone to faults, mainly caused by water ingress where cables are jointed together. Many joints on an individual cable were installed at the same time meaning faults can occur in geographical clusters causing repeat interruption and nuisance for customers.

10.16 In addition, the cable construction provides limited protection from damage. The outer neutral earth conductor is made from aluminium, covered in a thin layer of bitumen and a PVC oversheath. Protrusions from stones or third party excavations can damage the oversheath leading to corrosion. Where the corrosion affects the integrity of the neutral earth, there is a potential for higher operating voltages to occur that can cause damage to customers' appliances.

10.17 When circuits are beyond their useful life because of their condition (i.e. where there are multiple failures and neutral faults), they will be progressively replaced with modern plastic insulated cables.

LV Main (UG Consac) (Mean life 55 years)				
	RIIO-ED1 Period Assets Removed (km)	Average Population Removed (% per annum)	RIIO-ED1 Period Assets Installed (km)	Forecast Expenditure £m
West Midlands	44	0.1%	0	2.9
East Midlands	0	0.0%	0	0.0
South Wales	0	N/a	0	0.0
South West	33	0.1%	0	3.8
Total	**77**	**0.1%**	**0**	**6.7**

LV main (underground paper insulated cable)

10.18 The majority of the low voltage network built before the 1970s is constructed using paper insulated cables. The robust construction of these cables incorporates lead sheaths and steel tapes wrapped around the lead providing good physical protection. It is expected that these cables will last a long time with average lives of 100 years.

10.19 There are pockets of the network where paper LV cables or the joints on the paper LV cables have deteriorated and cause repeat interruptions to customers. These generally occur during wet weather when water ingress leads to faults. The faults cause substation fuses to blow, but in many circumstances do not lead to a permanent open circuit fault (which means that the faults are difficult to locate). In practice, the fuses are replaced and all customers are restored until the next period of heavy rain where the circuit faults again. After several fuse operations permanent faults develop and only then can they be located, but in the meantime there has been significant nuisance for customers.

10.20 Historically these cables have not been overlaid until several permanent faults have occurred. The increasing reliance on electricity for heating, transport and distributed generation means that the volume of these repeat interruptions needs to be limited and replacement considered earlier. Even so, the volume of replacement is relatively low.

LV Main (UG Paper) (Mean life 100 years)				
	RIIO-ED1 Period Assets Removed (km)	Average Population Removed (% per annum)	RIIO-ED1 Period Assets Installed (km)	Forecast Expenditure £m
West Midlands	39	0.0%	0	2.6
East Midlands	44	0.0%	0	2.9
South Wales	14	0.0%	0	0.9
South West	15	0.0%	0	1.7
Total	**112**	**0.0%**	**0**	**8.1**

LV main (underground plastic insulated cable)

10.21 There are two main types of plastic cables; with the main difference being the material used for the neutral earth waveform wire conductor. The cable currently used throughout WPD has copper as the neutral earth that is laid on top of soft plastic bedding used mainly to hold the waveform wires in place. The alternative (previously installed in South Wales and East Midlands) uses aluminium for the neutral earth, but since aluminium is more susceptible to corrosion it is totally encased in the bedding thereby giving it more protection from moisture. However, if the cable is damaged there can be progressive corrosion of the aluminium neutral earth wires that eventually leads to loss of continuity of the neutral conductor (albeit after a long time).

10.22 A very small volume of the conductor will be replaced where damage is found to have caused corrosion of the neutral.

LV Main (UG Plastic) (Mean life 90 years)				
	RIIO-ED1 Period Assets Removed (km)	Average Population Removed (% per annum)	RIIO-ED1 Period Assets Installed (km)	Forecast Expenditure £m
West Midlands	0	0.0%	83	0.0
East Midlands	0	0.0%	44	0.0
South Wales	0	0.0%	14	0.0
South West	0	0.0%	48	0.0
Total	**0**	**0.0%**	**189**	**0.0**

LV service (underground)

10.23 Service work will generally be carried out in coordination with LV mains cable replacement. Most of the activity involves reconnecting the existing service cable to the new main (service transfers), usually by letting in a new short length of service cable. In some instances it may be found that the existing service cable is in poor condition and the service will be replaced in its entirety. The volume of replacement carried out is a very small proportion of the population.

LV Service (UG) (Mean life 100 years)				
	RIIO-ED1 Period Assets Removed	Average Population Removed (% per annum)	RIIO-ED1 Period Assets Installed	Forecast Expenditure £m
West Midlands	2,974	0.0%	2,974	3.7
East Midlands	3,691	0.0%	3,691	4.7
South Wales	1,274	0.0%	1,274	1.6
South West	2,120	0.0%	2,120	2.7
Total	**10,059**	**0.0%**	**10,059**	**12.7**

LV Underground service transfers			
	RIIO-ED1 Period Assets Refurbished	Average Population Refurbished (% per annum)	Forecast Expenditure £m
West Midlands	5,232	0.0%	2.2
East Midlands	5,576	0.0%	2.4
South Wales	472	0.0%	0.2
South West	2,696	0.0%	1.1
Total	**13,976**	**0.0%**	**6.0**

Rising & lateral mains (RLM)

10.24 During DPCR5 negotiations, several DNOs forecast costs for the inspection and replacement of rising and lateral mains located in housing blocks constructed by local authorities. Ofgem recognised that the extent of issues with RLM varied widely across the licensed areas, as did the extent to which ownership of the RLM has been established. (Some RLM are owned by DNOs whilst others are owned by landlords or Councils but it is often not clear who owns them).

10.25 Due to this uncertainty, and with the understanding that the associated costs could be significant, Ofgem proposed to include an ex-ante allowance (for those companies requesting investment) to provide interim funding after which allowances would be reassessed through a reopener in July 2012. This did not apply to the four licences operated by WPD because no funding requests were made either at the start of DPCR5 or at the re-opener window.

10.26 To date, no issues have come to light and therefore there are no plans to carry out replacement programmes during RIIO-ED1.

HV underground cable

10.27 Before the 1990s most HV cable was paper insulated, but since then both cross linked polyethylene (XLPE) and ethylene propylene rubber (EPR) insulated cables have been used.

10.28 The main problems encountered in HV paper cables relate to the drying out of the oil based mineral from paper insulation, causing discharge to occur and a fault to develop.

10.29 XLPE cables can be susceptible to deterioration of the insulation. The deterioration weakens the insulating strength and leads to failure. The deterioration is accelerated where impurities have been introduced into the insulating material during the manufacturing process. The degree of contamination in the insulating will determine whether there are individual point defects or whether whole cable lengths are affected.

10.30 In the past 6.6kV networks have been uprated to 11kV by changing transformers but leaving old cables in situ, thereby providing greater network capacity without the cost of replacing cables. However due to prolonged increase in capacity these cables are now showing signs of stress and are also showing signs of insulation degradation.

10.31 HV cable replacement will be considered where there is a history of faults or where condition assessment at time of fault identifies that the insulation is in poor condition.

6.6/11kV UG Cable (Mean life 87 years)				
	RIIO-ED1 Period Assets Removed (km)	Average Population Removed (% per annum)	RIIO-ED1 Period Assets Installed (km)	Forecast Expenditure £m
West Midlands	75	0.1%	75	6.4
East Midlands	176	0.2%	176	15.2
South Wales	82	0.2%	82	7.1
South West	66	0.1%	66	7.1
Total	**400**	**0.1%**	**400**	**35.8**

33kV, 66kV and 132kV underground cable (non-pressurised)

10.32 Older types of non-pressurised cables are constructed using paper insulation. Insulation degradation, such as observed in HV cables, is the main reason for any replacement. Most of the activity will however be replacing 33kV cable.

33kV,66kV and 132kV UG Cable (Non pressurised) (Mean life 75/70/65 years)				
	RIIO-ED1 Period Assets Removed (km)	Average Population Removed (% per annum)	RIIO-ED1 Period Assets Installed (km)	Forecast Expenditure £m
West Midlands	15	0.5%	48	2.7
East Midlands	84	0.5%	84	15.5
South Wales	24	0.6%	28	4.3
South West	48	0.7%	93	8.5
Total	**172**	**0.6%**	**254**	**31.0**

33kV, 66kV and 132kV underground cable (oil filled)

10.33 A large proportion of 33kV, 66kV and 132kV underground cables are constructed using a biodegradable oil based fluid that enhances the insulating properties by filling any voids between paper insulation reducing the likelihood of electrical discharge. This construction makes the cables extremely reliable electrically but does pose the risk of fluid leakage. The potential environmental impact of fluid leakage necessitates proactive management of fluid filled cables.

10.34 Prioritised replacement programmes are derived using information on leakage rates, the cause of leaks and their environmental impact. Priority is given to those cables with condition deficiencies such as porous lead sheathing and those that pass through Environment Agency 'Source Protection Zones'.

33kV,66kV and 132kV UG Cable (Oil) (Mean life 70/70/65 years)				
	RIIO-ED1 Period Assets Removed (km)	Average Population Removed (% per annum)	RIIO-ED1 Period Assets Installed (km)	Forecast Expenditure £m
West Midlands	24	0.8%	0	24.2
East Midlands	0	0.0%	0	0.0
South Wales	0	0.0%	0	0.0
South West	15	1.3%	0	4.3
Total	**39**	**0.5%**	**0**	**28.5**

33kV, 66kV and 132kV underground cable (gas filled)

10.35 As an alternative to using fluid, some cables use inert gas under pressure to fill any voids between papers within the insulation. Internal gas pressure cables incorporate porous pipes within their construction to distribute the gas along the cable length. The cable is prevented from bursting by being wrapped with springy metal tapes. These tapes corrode causing weak points and gas leaks. Leaks can also develop at joint interfaces.

10.36 An alternative construction uses an external steel pipeline with sections welded together to create a homogenous tube for the cores to be laid in. The whole pipeline is pressurised with the gas filling the voids between the paper insulation by external pressure on the cores. The main problem with this cable arises when the pipeline becomes depressurised as a result of damage, leaks or during a fault repair. Once depressurised, moist air may enter the pipeline and penetrate into the cores leading to increased likelihood of failure. Once a failure occurs, repeat failures become common causing severe risk to network security.

10.37 The proposals for RIIO-ED1 include:

- West Midlands – gas filled cable to be replaced in two circuits;
- East Midlands – no gas filled cables exist;
- South Wales – gas filled cable to be replaced in two circuits;
- South West – all gas filled cable to be replaced (fourteen circuits).

33kV,66kV and 132kV UG Cable (Gas) (Mean life 70/70/65 years)				
	RIIO-ED1 Period Assets Removed (km)	Average Population Removed (% per annum)	RIIO-ED1 Period Assets Installed (km)	Forecast Expenditure £m
West Midlands	9	3.0%	0	8.9
East Midlands	0	N/a	0	0.0
South Wales	4	5.6%	0	0.8
South West	34	11.1%	0	6.0
Total	**47**	**7.0%**	**0**	**15.6**

Overhead lines

10.38 Overhead lines can be subdivided into five main sub elements:

- the conductor;
- the support, either a steel tower or wooden, metal or concrete pole;
- pole fittings, including pole top steelwork, insulators, stays and anti-climbing devices;
- tower fittings, including insulator strings, vibration dampers, shackles and clamps;
- tower access and security measures, including anti-climbing devices, access gates and step-bolts.

10.39 The wholesale replacement of conductor, a support (pole or tower) and tower fittings is classified as asset replacement.

10.40 Where pole top fittings are replaced at the same time as the pole itself this work is incorporated into the asset replacement costs.

10.41 Costs are classified as refurbishment where pole top fittings are replaced without changing the pole or where sections of tower steelwork are renewed without wholesale tower replacement or where components such as tower access and security measures are replaced.

10.42 Costs for both replacement and refurbishment activity are detailed below.

LV service (overhead)

10.43 Overhead line services provide connections to properties from overhead main lines. They are generally supported on wall brackets before being clipped down or along external walls for entry into service positions mounted on buildings. Overhead line services will be replaced where they are found to be in poor condition during main line replacement or where supports are found to be defective.

10.44 Some properties are serviced by undereave installations (sometimes referred to as house service overhead system (HSOS)) where a main line, either underground or overhead, terminates in a wall mounted distribution box and service cables are cleated along property walls, sometimes crossing a number of properties. The insulation on older cables is made from jute-covered or hessian-covered vulcanised india rubber that perishes, becomes brittle and cracks over time. The insulation can easily be dislodged by homeowners using ladders thereby causing a safety hazard. Undereaves services that are in poor condition will either be replaced with modern service cables or the service arrangements changed to feed them from underground cables.

LV Service (OHL) (Mean life 55 years)				
	RIIO-ED1 Period Assets Removed	Average Population Removed (% per annum)	RIIO-ED1 Period Assets Installed	Forecast Expenditure £m
West Midlands	19,760	1.0%	19,760	7.5
East Midlands	7,487	0.7%	7,487	2.8
South Wales	28,764	1.1%	28,764	10.8
South West	47,098	1.3%	47,098	17.8
Total	**103,109**	**1.0%**	**103,109**	**38.9**

LV, HV, 33kV, 66kV and 132kV poles

10.45 The majority of the overhead network is supported on wooden poles. They have been impregnated with creosote to slow down the rate of degradation. Whilst this provides them with prolonged life they do progressively decay at ground level and are susceptible to woodpecker damage.

10.46 Within WPD, a very high priority is placed on the replacement of poor condition wooden poles. This activity removes weak points from overhead line networks that not only reduces safety risks and but also reduces the likelihood of failure during severe weather conditions (therefore limiting the impact of storms on customers).

10.47 WPD's target is to remove poor condition poles from the network within a year of them being identified. This activity forms one of the voluntary secondary deliverables for reliability outputs in RIIO-ED1.

10.48 When poles are replaced the associated steelwork, insulators, anti-climbing devices and stays are also renewed. Where a line is upgraded, not all poles will need to be replaced but the pole top equipment may be in poor condition: in these instances the replacement of pole top equipment will be treated as pole refurbishment.

10.49 EU legislation, The Biocidal Products Directive, has resulted in a review of the use of creosote as a wood preserver. Under current regulations, the electricity industry is allowed to use creosote impregnated poles up to 2018, but their use could be banned during the RIIO-ED1 period. One alternative may be a hybrid pole being developed in Sweden made from a fibreglass inner and UV protective polyethylene outer layer, but this is still under development and not ready for the UK market. The alternatives to wooden poles are more expensive; the hybrid pole is estimated to be two to three times the cost of wooden pole and concrete poles being five times the cost.

10.50 WPD's cost forecasts are based upon the continued use of the creosote impregnated poles. It does not include any additional costs for alternative types.

LV,HV,33kV,66kV and 132kV pole replacement (Mean life 60 years)				
	RIIO-ED1 Period Assets Removed	Average Population Removed (% per annum)	RIIO-ED1 Period Assets Installed	Forecast Expenditure £m
West Midlands	78,139	2.3%	78,139	128.1
East Midlands	54,915	2.1%	54,915	89.7
South Wales	48,990	1.9%	48,990	81.5
South West	65,144	1.6%	65,144	105.0
Total	**247,188**	**2.0%**	**247,188**	**404.3**

LV,HV,33kV,66kV and 132kV pole refurbishment			
	RIIO-ED1 Period Assets Refurbished	Average Population Refurbished (% per annum)	Forecast Expenditure £m
West Midlands	45,050	1.3%	10.5
East Midlands	19,188	0.7%	4.6
South Wales	38,234	1.5%	11.2
South West	59,754	1.5%	14.4
Total	**162,226**	**1.3%**	**40.7**

LV main (overhead conductor)

10.51 Low voltage overhead lines have traditionally been constructed with bare conductors spaced in an open vertical formation supported on wooden poles. The bare conductor has been either been made up of one solid conductor or made from a number of strands. Whilst it is generally robust it can be prone to damage from trees and windborne materials.

10.52 WPD's current design standard is to use insulated conductors that are twisted together (known as Aerial Bundled Conductor (ABC)). ABC is used because it is safer and more resilient

10.53 Low voltage conductor found to be damaged or deteriorated will wherever possible be replaced with ABC.

LV Main (OHL) Conductor (Mean life undefined)				
	RIIO-ED1 Period Assets Removed (km)	Average Population Removed (% per annum)	RIIO-ED1 Period Assets Installed (km)	Forecast Expenditure £m
West Midlands	1,134	2.4%	1,134	15.0
East Midlands	400	1.1%	400	5.3
South Wales	304	1.2%	304	4.0
South West	1,353	2.3%	1,353	18.1
Total	**3,191**	**1.7%**	**3,191**	**42.5**

HV main (overhead conductor)

10.54 HV conductor is generally robust and can last a long time. Strong winds can cause the conductor to vibrate which causes wear near to the points where the conductor is bound onto insulators. Conductors with small cross-sectional area can also be more prone to damage because of its lower tensile strength and this has been progressively phased out since snow storms caused severe damage to the UK network in December 1981.

10.55 Conductors will be replaced on those circuits delivering poorest performance or where the conductor has deteriorated significantly. Where economically viable, the opportunity will be taken to reconfigure networks (e.g. installing a remotely operated switch or interconnecting circuits) and increase network flexibility to improve the capability to restore customers' supplies under fault situations.

6.6/11kV OHL (conventional conductor) (Mean life undefined)				
	RIIO-ED1 Period Assets Removed (km)	Average Population Removed (% per annum)	RIIO-ED1 Period Assets Installed (km)	Forecast Expenditure £m
West Midlands	1,443	1.2%	1,443	22.6
East Midlands	819	0.8%	819	12.8
South Wales	2,472	2.5%	2,472	38.8
South West	2,165	1.6%	2,165	34.1
Total	**6,898**	**1.4%**	**6,898**	**108.3**

33kV, 66kV and 132kV overhead (pole line) conductor

10.56 33kV, 66kV and 132kV conductor on wood pole supports can corrode and wear over several decades leading to broken strands and the increased risk of conductor failure. Excessively corroded and worn conductors will be replaced.

33kV,66kV and 132kV pole line conductor (Mean life undefined)				
	RIIO-ED1 Period Assets Removed (km)	Average Population Removed (% per annum)	RIIO-ED1 Period Assets Installed (km)	Forecast Expenditure £m
West Midlands	279	1.9%	279	8.0
East Midlands	56	0.3%	56	1.6
South Wales	189	1.3%	189	5.4
South West	401	1.6%	401	11.6
Total	**924**	**1.3%**	**924**	**26.6**

33kV, 66kV and 132kV overhead (tower line) conductor

10.57 Where steel towers are used to support conductors the distance between towers (span length) is longer than the distance between wood poles. The increased span length makes the conductors more susceptible to wind-induced movement such as vibration, horizontal sway or 'vertical galloping'. This movement can lead to wear of the conductor where it comes into contact with fittings.

10.58 To limit the effect of movement vibration dampers are installed on the lines to dissipate the oscillations. However, the vibration dampers are also subject to corrosion and over time their effectiveness is reduced. When this happens wear occurs at the point of connection.

10.59 Aluminium Conductor Steel Reinforced (ACSR) conductor uses steel inner strands to provide mechanical strength and aluminium outer conductors to carry the current. The aluminium conductor can suffer from bi-metallic corrosion caused by the interaction of the different metals. In order to limit the corrosion the steel core is zinc galvanized and the aluminium strands are greased during manufacture. Over time these protective measures become ineffective and the aluminium degrades and breaks.

10.60 Conductors showing signs of excessive wear, fatigue or corrosion will be replaced.

33kV,66kV and 132kV tower line conductor (Mean life undefined)				
	RIIO-ED1 Period Assets Removed (km)	Average Population Removed (% per annum)	RIIO-ED1 Period Assets Installed (km)	Forecast Expenditure £m
West Midlands	234	1.7%	234	11.0
East Midlands	291	1.0%	291	13.7
South Wales	101	1.0%	101	4.8
South West	99	0.7%	99	4.7
Total	**725**	**1.1%**	**725**	**34.1**

33kV, 66kV and 132kV tower replacement and refurbishment

10.61 Overhead tower steelwork is prone to atmospheric corrosion that is particularly aggressive near coastal regions. The acidity in bird droppings can also produce corrosion at the top of towers where birds roost.

10.62 Routine tower painting, which is carried out on a 20 year cycle, prevents most of the corrosion. Towers can often be refurbished by changing the individual sections of corroded steelwork. Where the corrosion is widespread or affects the main legs or cross arms the replacement of the whole tower will be considered.

10.63 Ground conditions can affect the stability of towers and a small number of towers have fallen over during strong winds. Examination of foundations may identify that there are cracks in the concrete, corrosion of the steel reinforcing bars or corrosion of the tower steelwork within the foundation. Where defective foundations are found they will be removed, tower steelwork refurbished and foundations recast. In the event of excessive steelwork corrosion the towers will be replaced.

10.64 Tower condition will be assessed during routine inspections and by using high-resolution photography taken by cameras mounted on helicopters.

33kV,66kV and 132kV tower replacement (Mean life 110 years)				
	RIIO-ED1 Period Assets Removed	Average Population Removed (% per annum)	RIIO-ED1 Period Assets Installed	Forecast Expenditure £m
West Midlands	0	0.0%	0	0.0
East Midlands	53	0.1%	53	2.9
South Wales	33	0.1%	33	3.0
South West	35	0.1%	35	2.3
Total	**121**	**0.1%**	**121**	**8.2**

33kV,66kV and 132kV tower refurbishment			
	RIIO-ED1 Period Assets Refurbished	Average Population Refurbished (% per annum)	Forecast Expenditure £m
West Midlands	160	0.5%	0.9
East Midlands	232	0.5%	1.3
South Wales	112	0.5%	0.8
South West	144	0.4%	0.8
Total	**648**	**0.5%**	**3.9**

33kV,66kV and 132kV tower painting			
	RIIO-ED1 Period Assets Refurbished	Average Population Refurbished (% per annum)	Forecast Expenditure £m
West Midlands	1,536	4.4%	3.5
East Midlands	2,280	4.4%	5.3
South Wales	1,056	4.5%	2.5
South West	1,435	4.5%	3.3
Total	**6,307**	**4.4%**	**14.6**

33kV,66kV and 132kV tower foundations			
	RIIO-ED1 Period Assets Refurbished	Average Population Refurbished (% per annum)	Forecast Expenditure £m
West Midlands	160	0.5%	3.5
East Midlands	232	0.5%	5.2
South Wales	112	0.5%	2.5
South West	144	0.4%	3.2
Total	**648**	**0.5%**	**14.4**

33kV, 66kV and 132kV tower insulators and fittings

10.65 Tower insulators and fittings are subject to atmospheric corrosion that rusts components.

10.66 Fittings can also be affected by the movement of the line which causes the components to rub and wear. This leads to a reduction in the cross-sectional area of the component and affects its mechanical strength.

10.67 The wear can be exaggerated at support points when other components become seized up by rust. Insulator strings are made up from a number of individual insulators linked together by pin and socket arrangements. As the pin corrodes, the expanding rust causes the pin to jam in the socket reducing the flexing movement of the insulators. Where the links become rigid all the movement is transferred to the supporting fittings connecting the insulator string onto the tower. This transfer of movement causes excessive wear of the fittings leading to potential failure and the possibility of conductors falling to the ground.

10.68 It has been found that anti-fog insulators are particularly prone to rusting of the cap and pin because the extra length of the insulator sheds creates a micro-climate that accelerates the rusting process.

10.69 Damaged components identified by routine inspections and high-resolution photography will be replaced.

33kV,66kV and 132kV tower fittings replacement (Mean life undefined)				
	RIIO-ED1 Period Assets Removed	Average Population Removed (% per annum)	RIIO-ED1 Period Assets Installed	Forecast Expenditure £m
West Midlands	2,683	3.9%	2,683	3.6
East Midlands	3,545	3.5%	3,545	4.8
South Wales	920	1.9%	920	1.3
South West	1,343	2.6%	1,343	1.7
Total	**8,491**	**3.1%**	**8,491**	**11.5**

Switchgear

LV Cutouts

10.70 The vast majority of low voltage supplies terminate in cutouts near the meter point. This means there are over seven million cutouts installed in houses, shops and industrial properties across WPD's area. To maintain safety to the public, damaged, defective and obsolete cutouts are changed when customers report problems or when defects are identified from data flow from suppliers and meter operators.

10.71 The smart meter rollout currently planned to start in 2015 will change meters at around four times the normal rate. It is anticipated that this will lead to a higher volume of defects being identified at service positions that may require the cutout to be changed. The volumes above the routine amount are separately identified in the section on Smart Metering costs.

10.72 The costs below represent the normal volume of cutout asset replacement.

Cutout (metered) (Mean life undefined)				
	RIIO-ED1 Period Assets Removed	Average Population Removed (% per annum)	RIIO-ED1 Period Assets Installed	Forecast Expenditure £m
West Midlands	4,150	0.0%	4,150	0.8
East Midlands	3,620	0.0%	3,620	0.7
South Wales	2,780	0.0%	2,780	0.5
South West	3,000	0.0%	3,000	0.6
Total	**13,550**	**0.0%**	**13,550**	**2.6**

LV substation pillars

10.73 LV Substation pillars are either

- wall mounted with open busbars (installed indoors);
- free standing in metal housings (mostly outdoors);
- transformer mounted as part of package substations (either outdoors or within glass reinforced plastic (GRP) housings).

10.74 The pillars are prone to degradation where cable terminations can deteriorate or contacts can work loose that may cause arcing. Pillars installed outdoors may be subject to corrosion.

LV pillar replacement (Mean life 60/65 years)				
	RIIO-ED1 Period Assets Removed	Average Population Removed (% per annum)	RIIO-ED1 Period Assets Installed	Forecast Expenditure £m
West Midlands	1,772	1.3%	1,772	12.6
East Midlands	1,351	0.8%	1,351	9.7
South Wales	748	1.1%	748	5.4
South West	993	1.0%	993	7.1
Total	**4,864**	**1.0%**	**4,864**	**34.9**

LV underground boxes, pillars (not at substations) and service turrets

10.75 The replacement programmes for link boxes and LV pillars not at substations (sometimes referred to as street pillars) will target the removal of those in poor condition or where there are operational safety concerns (e.g. absence of barriers between phase conductors and earthed metalwork). Where there is a high number of devices in close proximity, we will consider reducing the number of link boxes (to reduce maintenance costs), whilst still maintaining operational flexibility and the capacity to provide load transfer during substation maintenance and fault situations.

10.76 The development of link boxes that can be remotely operated will provide an alternative in circumstances where there is load growth due to LCTs. When link boxes are replaced in LCT hotspots, these new remotely controlled link boxes will be used to provide the means for automatic load transfer.

10.77 There are a small number of service turrets in service. These were used as an above ground alternative to underground service joints on some parts of the network. Their location on street corners can attract vandalism; some have been made unusable due to reinstatement of surfaces around access points; and some are installed in customers' gardens. It is proposed to replace all service turrets with underground joints to remove the risk of damage and improve safety to the public.

LV UGB & LV Pillars (OD not at Substation) (Mean Life undefined)				
	RIIO-ED1 Period Assets Removed	Average Population Removed (% per annum)	RIIO-ED1 Period Assets Installed	Forecast Expenditure £m
West Midlands	2,448	1.4%	2,448	9.9
East Midlands	1,504	0.7%	1,504	6.1
South Wales	256	0.7%	256	1.0
South West	728	0.7%	728	2.9
Total	**4,936**	**0.8%**	**4,936**	**19.9**

Ground mounted (GM) HV switchgear -circuit breakers (CB), switches and ring main units (RMU)

10.78 Switchgear replacement will be focused on those items that have type specific operational restrictions, unit specific defects (such as leakage of the environmentally unfriendly SF_6 gas) or those that are in poor condition. This will remove potential safety risks and increase the availability of network switching points.

10.79 Operational restrictions may arise following a disruptive failure of an item of switchgear anywhere in the industry. The Energy Networks Association (ENA) provides an information sharing service where DNOs are informed of reported dangerous incidents and equipment defects. This allows each DNO to assess the impact on their network. As a consequence, operational restrictions may be applied to limit what can be done with the switchgear. In some cases the restrictions can be removed by changing components during maintenance. In others, it is more cost effective to replace the whole item of switchgear. Where operational restrictions affect a small number of items of equipment, the whole population will be replaced. If a large number is affected a structured programme will be developed.

10.80 Many circuit breaker installations, particularly those at Primary substations, include fixed housings that contain the electrical busbars and protection relays and moving parts that carry out the main fault breaking and switching operations. The moving parts are subject to more wear. It is possible to only replace the moving part with a modern equivalent unit or a factory refurbished exchange. This activity replaces part of the installation and so it is treated as refurbishment (as identified separately below).

HV GM switchgear replacement (Mean life 50/55 years)				
	RIIO-ED1 Period Assets Removed	Average Population Removed (% per annum)	RIIO-ED1 Period Assets Installed	Forecast Expenditure £m
West Midlands	3,614	1.3%	3,356	36.7
East Midlands	4,138	1.4%	3,634	38.0
South Wales	1,235	1.1%	1,155	10.8
South West	3,329	1.9%	2,894	30.1
Total	**12,316**	**1.4%**	**11,039**	**115.5**

HV GM CB refurbishment			
	RIIO-ED1 Period Assets Refurbished	Average Population Refurbished (% per annum)	Forecast Expenditure £m
West Midlands	200	0.2%	0.8
East Midlands	137	0.2%	0.7
South Wales	24	0.1%	0.1
South West	69	0.2%	0.6
Total	**430**	**0.2%**	**2.2**

Pole mounted (PM) HV switchgear circuit breakers, switches, links and fuses

10.81 Pole mounted switchgear is subdivided into three broad categories:

- Circuit breakers – predominantly high speed auto reclosers (HSARs) and metal encased oil circuit breakers.
- Switches – metal encased remote control and manually operated switches.
- Other – including air break switches, drop out fuses and links.

10.82 Most of the metal enclosed equipment is less than 20 years old and the low volumes of replacement represent those units that will become defective and non-operational during RIIO-ED1. The replacement of other types of switchgear will be driven by those that are in poor condition or are removed after failure.

HV PM switchgear replacement (Mean life 45 years)				
	RIIO-ED1 Period Assets Removed	Average Population Removed (% per annum)	RIIO-ED1 Period Assets Installed	Forecast Expenditure £m
West Midlands	2,641	2.0%	2,641	6.6
East Midlands	1,797	1.5%	1,797	3.7
South Wales	798	1.2%	798	1.9
South West	1,953	0.8%	1,953	2.9
Total	**7,189**	**1.3%**	**7,189**	**15.1**

33kV, 66kV and 132kV switchgear

10.83 Material deterioration, moisture ingress, mechanical defects and limited availability of spares can lead to switchgear problems. Whilst rare, catastrophic failures arising anywhere in the industry can lead to operational restrictions being applied to entire populations. In addition local defects (such as distorted housings) may lead to local operational limitations.

10.84 Stakeholders have supported the replacement of leaky SF_6 filled switchgear to reduce the amount of this greenhouse gas released. We will be adopting a "three leaks and replace" regime on higher voltage assets.

33kV switchgear replacement (Mean life 50 years)				
	RIIO-ED1 Period Assets Removed	Average Population Removed (% per annum)	RIIO-ED1 Period Assets Installed	Forecast Expenditure £m
West Midlands	526	1.8%	526	7.2
East Midlands	708	1.4%	708	17.7
South Wales	364	1.2%	364	8.2
South West	927	1.2%	927	13.3
Total	**2,525**	**1.3%**	**2,525**	**46.5**

66kV switchgear replacement (Mean life 50 years)				
	RIIO-ED1 Period Assets Removed	Average Population Removed (% per annum)	RIIO-ED1 Period Assets Installed	Forecast Expenditure £m
West Midlands	146	1.2%	146	1.5
East Midlands	0	N/a	0	0.0
South Wales	56	1.1%	56	0.5
South West	0	N/a	0	0.0
Total	**202**	**1.0%**	**202**	**2.0**

132kV switchgear replacement (Mean life 50 years)				
	RIIO-ED1 Period Assets Removed	Average Population Removed (% per annum)	RIIO-ED1 Period Assets Installed	Forecast Expenditure £m
West Midlands	541	1.5%	541	15.1
East Midlands	411	1.2%	411	11.8
South Wales	66	0.4%	82	2.0
South West	236	1.3%	236	6.2
Total	**1,254**	**1.1%**	**1,270**	**35.0**

Transformers

HV transformers (ground and pole mounted)

10.85 There are over 180,000 distribution transformers across the four WPD licence areas, with two thirds of these being installed in ground mounted substations.

10.86 Ground mounted distribution transformers are robust items of plant that have limited moving parts. Therefore, the main problems encountered with ground mounted transformers are caused by external corrosion, insulation degradation caused by excessive loads or moisture ingress. Replacement decisions will be based upon condition assessments and oil test results.

10.87 Pole mounted distribution transformers are more susceptible to damage from inclement weather such as lightning strikes that cause internal failure or flash-over across insulators. Since the impact of an incident on pole mounted transformers affects a limited number of people they are generally run to failure and replaced once they experience a fault.

6.6/11kV transformer (GM) (Mean life 60 years)				
	RIIO-ED1 Period Assets Removed	Average Population Removed (% per annum)	RIIO-ED1 Period Assets Installed	Forecast Expenditure £m
West Midlands	2,011	1.6%	2,011	16.1
East Midlands	1,675	1.1%	1,675	13.5
South Wales	870	1.3%	870	7.0
South West	1,529	1.5%	1,529	12.3
Total	**6,085**	**1.2%**	**6,085**	**48.9**

6.6/11kV transformer (PM) (Mean life 55 years)				
	RIIO-ED1 Period Assets Removed	Average Population Removed (% per annum)	RIIO-ED1 Period Assets Installed	Forecast Expenditure £m
West Midlands	3,354	1.2%	3,354	8.7
East Midlands	2,048	1.1%	2,048	6.5
South Wales	3,927	1.6%	3,927	7.5
South West	5,582	1.8%	5,582	14.5
Total	**14,911**	**1.3%**	**14,911**	**37.1**

33kV, 66kV and 132kV transformers

10.88 The failure of grid and primary transformers can have a significant impact on network security. Degradation is driven by a combination of the demand placed upon transformers, the effect of moisture ingress, corrosion of steelwork and degradation of seals.

10.89 Transformer insulation is constructed from cellulose paper submersed in oil. Excessive loads on the transformer can lead to high operating temperatures that cause the creation of acids in the oil. In addition moisture ingress can occur. The moisture ingress combined with the acid can lead to degradation of the paper insulation. As the insulation weakens, discharges may arise causing further damage and potential failure.

10.90 Condition assessment is used to assess the external integrity of the oil tanks, coolers and connecting pipework. Oil testing is used to assess the internal condition of the insulation and measure the amount of acid, dissolved gasses (caused by discharges) and concentration of furfuraldehyde (released as a by-product of paper insulation breakdown).

10.91 Transformers will be changed where they exhibit excessive oil leakage or where oil tests suggest evidence of electrical discharge or significant insulation degradation.

10.92 In a limited number of cases transformers will be refurbished. This will be limited to repair of localised corrosion (e.g. changing cooling fins), stemming of leaks by replacement of seals or application of sealing agents and retrofitting of tap-changers.

10.93 Processes to remove moisture and acidity from the insulating oil may be used in limited cases, but these are very short term measures that temporarily improve the condition of the oil. Such actions would not have a marked impact on the health of the transformer.

10.94 We have considered returning transformers to manufacturers to be refurbished in their workshops but this will not be pursued because the costs of dismantlement, transport, fees and reconnection outweigh the benefits.

33kV,66kV and 132kV transformer replacement (Mean life 50/60 years)				
	RIIO-ED1 Period Assets Removed	Average Population Removed (% per annum)	RIIO-ED1 Period Assets Installed	Forecast Expenditure £m
West Midlands	93	2.0%	93	42.3
East Midlands	131	1.6%	131	58.7
South Wales	68	1.8%	68	26.8
South West	106	1.7%	106	35.3
Total	**398**	**1.8%**	**398**	**163.2**

33kV,66kV and 132kV transformer refurbishment			
	RIIO-ED1 Period Assets Refurbished	Average Population Refurbished (% per annum)	Forecast Expenditure £m
West Midlands	6	0.1%	0.6
East Midlands	5	0.1%	0.5
South Wales	2	0.1%	0.2
South West	2	0.0%	0.2
Total	**15**	**0.1%**	**1.5**

Batteries (protection)

Batteries at HV, EHV and 132kV substations

10.95 Batteries are used for protection systems, switchgear tripping and closing functionality as well as for SCADA communications.

10.96 The consequences of insufficient battery capacity are that the protection of the network would be degraded and operation of switchgear would be unreliable. The absence of protection would mean that faults on the distribution networks will not be identified and disconnected which could endanger people and lead to catastrophic failure of equipment.

10.97 SCADA batteries enable remote control of switchgear and provide a means to communicate the status of the network to control rooms. Without remote control, site visits would be required to switch manually. The absence of information about network status could extend restoration times for faults and may also result in overloaded circuits.

10.98 Batteries can become defective and suffer from a range of problems, including:

- cracked cases;
- contamination of the electrolyte;
- build-up of sediment;
- internal short circuits;
- excessive corrosion.

10.99 Battery cells found to be in poor condition during routine testing will either be replaced or refurbished.

Batteries at GM HV substations (Mean life undefined)				
	RIIO-ED1 Period Assets Removed	Average Population Removed (% per annum)	RIIO-ED1 Period Assets Installed	Forecast Expenditure £m
West Midlands	200	2.2%	200	0.5
East Midlands	56	0.6%	56	0.1
South Wales	16	1.8%	16	0.0
South West	192	10.7%	192	0.5
Total	**464**	**2.0%**	**464**	**1.2**

Replacement of batteries at 33kV,66kV and 132kV substations (Mean life undefined)				
	RIIO-ED1 Period Assets Removed	Average Population Removed (% per annum)	RIIO-ED1 Period Assets Installed	Forecast Expenditure £m
West Midlands	136	2.6%	136	0.9
East Midlands	160	1.9%	160	1.1
South Wales	88	2.8%	88	0.6
South West	224	6.1%	224	1.5
Total	**608**	**3.0%**	**608**	**4.1**

Refurbishment of batteries at 33kV,66kV and 132kV substations			
	RIIO-ED1 Period Assets Refurbished	Average Population Refurbished (% per annum)	Forecast Expenditure £m
West Midlands	17	0.3%	0.4
East Midlands	40	0.5%	0.8
South Wales	16	0.5%	0.3
South West	18	0.5%	0.4
Total	**91**	**0.4%**	**1.9**

Civil works

Civil works driven by condition of plant items

10.100 There will be a range of changes to civil structures resulting from replacement of electrical network assets (e.g. new plinths and structures for switchgear, modifications to trenches, and alterations to buildings). Changes may also be dictated by policy, for example, providing enclosures for switchgear that was previously installed outdoors.

10.101 The forecasts assume that the replacement of switchgear and primary transformers will require modifications to civil structures in all cases.

Civils expenditure driven by the condition of plant items summary (£m)					
	West Midlands	East Midlands	South Wales	South West	WPD Total
DPCR5 Annual Average	1.9	1.8	0.9	1.4	6.0
RIIO-ED1 Annual Average	1.4	1.9	0.7	1.3	5.3
RIIO-ED1 Total (8 years)	**11.1**	**14.2**	**5.5**	**10.2**	**41.0**

Civil works driven by condition of civil items

10.102 It is important that substation sites and buildings remain secure, protect network assets and provide a safe working environment for staff.

10.103 Substation land is segregated using different types of fences depending upon the local security requirements. Fences can become damaged and wooden fences may need replacement to the extent that they are decayed.

10.104 Defects in substation roofs can lead to water ingress affecting network assets. Damp can also affect roof structures and in some cases require the replacement of the full roof.

10.105 Defective substation doors provide a security risk, particularly where they are subject to vandalism. Whilst the majority of doors are repaired during site maintenance, some need to be replaced.

10.106 Many substation buildings are over forty years old and the electrical wiring for heating and lighting is from the original installation. Individual components (e.g. heaters) are replaced as part of building maintenance but in some cases complete rewiring of building services is undertaken where fitments have deteriorated or wiring is found to be in poor condition.

10.107 The infrequent but destructive nature of transformer fires has led to the installation of fire screens between primary transformers especially where a fire in one transformer could affect another. In some cases transformers have been enclosed within housings for either fire protection or noise reduction. Over time these structures can deteriorate and need to be replaced or refurbished.

10.108 Whilst rare, there have been occasions where subsidence has undermined concrete plinths causing damage to network assets. Where subsidence is identified the civil aspects will be rebuilt and equipment re-sited on a new plinth.

10.109 The following tables provide a snapshot view of the current health indices of civil structures in 132kV and EHV substations.

West Midlands – Civil asset Health Indices snapshot 2013						
	HI1	HI2	HI3	HI4	HI5	Total
Compound	46	125	30	42	7	250
Perimeter fence	43	134	29	28	15	249
Substation building	54	120	66	44	23	307
Transformer foundation and bund	46	115	16	6	64	247
Total	189	494	141	120	109	1,053

East Midlands – Civil asset Health Indices snapshot 2013						
	HI1	HI2	HI3	HI4	HI5	Total
Compound	112	244	98	85	23	562
Perimeter fence	116	231	89	75	50	561
Substation building	129	256	144	64	23	616
Transformer foundation and bund	213	272	67	44	25	621
Total	570	1,003	398	268	121	2,360

South Wales – Civil asset Health Indices snapshot 2013						
	HI1	HI2	HI3	HI4	HI5	Total
Compound	71	90	30	32	5	228
Perimeter fence	95	109	21	6	5	236
Substation building	89	98	37	42	5	271
Transformer foundation and bund	172	103	39	14	4	332
Total	427	400	127	94	19	1,067

South West – Civil asset Health Indices snapshot 2013						
	HI1	HI2	HI3	HI4	HI5	Total
Compound	31	237	64	32	6	370
Perimeter fence	48	258	43	15	3	367
Substation building	46	212	56	27	27	368
Transformer foundation and bund	76	207	52	18	8	361
Total	201	914	215	92	44	1,466

Cable tunnels

10.110 Some substations are located on former power station sites that included networks of tunnels for cable runs and these tunnels continue to be used for distribution cables. There are also tunnels where WPD still has a responsibility even though the assets have been decommissioned e.g. the tunnel under Portishead dock near Bristol that was used for a now abandoned 132kV internal pressure gas cable.

10.111 There are no known structural issues with cable tunnels and the asset replacement forecast is £nil.

Cable bridges

10.112 Cable bridges have been used extensively throughout the West Midlands to cross canals and rivers. Many are constructed from lattice steelwork encased in cladding.

10.113 Whilst they are generally secure, some have been subject to determined attempts of metal theft. Attempted theft can lead to many customers' supplies being affected, especially of several cables are damaged at the same time. Cable bridges will have any defective cladding refurbished or replaced to ensure they remain secure.

10.114 Where lattice steelwork has corroded, it will be replaced but there are no know structural issues with cable bridges and the forecast is £nil.

Forecast expenditure

10.115 The expenditure forecasts for civil work driven by condition of civil assets is shown in the table below. The costs take account of the size of substation building and compounds so for example whilst the volume of poor condition EHV and 132kV civil assets is higher in East Midlands the costs in West Midlands are higher due to the larger nature of the assets.

Civil expenditure driven by the condition of civil assets in RIIO-ED1 (£m)					
	West Midlands	East Midlands	South Wales	South West	WPD Total
HV indoor substation – doors only	2.1	0.4	1.8	4.2	8.5
HV indoor substation – roofs only	6.4	1.3	0.9	2.1	10.7
HV indoor substation – other civil works	4.1	0.8	1.8	4.2	10.9
HV indoor substation - enclosures and surrounds	2.3	0.5	4.1	9.4	16.3
HV indoor substation - plinths and groundworks	0.3	0.1	0.5	1.0	1.9
HV outdoor substation - surrounds	20.2	20.0	1.8	1.7	43.8
HV outdoor substation - plinths and groundworks	2.2	2.2	0.8	0.7	5.9
EHV substation civil works	8.0	11.8	4.5	8.3	32.6
132kV substation civil workds	5.5	3.3	1.8	1.5	12.1
Cable tunnels	-	-	-	-	-
Cable bridges	-	-	-	-	-
LV street furniture	-	-	-	-	-
Total	**51.3**	**40.2**	**18.0**	**33.1**	**142.6**

Civils expenditure driven by the condition of civil assets summary (£m)					
	West Midlands	East Midlands	South Wales	South West	WPD Total
DPCR5 Annual Average	4.1	2.7	1.3	2.5	10.6
RIIO-ED1 Annual Average	6.4	5.0	2.2	4.1	17.7
RIIO-ED1 Total (8 years)	**51.3**	**40.2**	**18.0**	**33.1**	**142.6**

Total civils expenditure

Total civils expenditure (£m)					
	West Midlands	East Midlands	South Wales	South West	WPD Total
DPCR5 Annual Average	6.0	4.6	2.2	3.9	16.7
RIIO-ED1 Annual Average	7.8	6.8	2.9	5.4	22.9
RIIO-ED1 Total (8 years)	**62.4**	**54.4**	**23.4**	**43.2**	**183.5**

11 Quality of supply

11.1 WPD has improved network performance more than any other DNO group.

11.2 Stakeholders have indicated that current performance is good but they have also made clear that they would like to see improvement.

11.3 Ofgem has indicated that there will be no ex-ante allowances for performance improvement in the RIIO-ED1 period; continuing with its position that investment decisions should be determined by the value of reward available from the Interruption Incentive Scheme (IIS). WPD will therefore use some of the rewards earned during DPCR5 to invest in further network performance improvement initiatives in anticipation that this will continue to lead to rewards generated by outperforming regulatory targets.

11.4 Preliminary regulatory targets published by Ofgem in the Strategy Decision document suggest that future targets will be tougher, making it harder to outperform them. Our proposals produce performance that continues to be better than the targets derived from industry benchmarking.

11.5 WPD's investment programme will increase the number of automated devices, to enable computer controlled reconfiguration of the network when a fault occurs, reducing the number of customers affected by faults and speeding up the restoration of supplies.

11.6 Network automation is a valuable tool for improving network performance. The use of high speed auto-reclosing circuit breakers introduces additional protection stages that subdivide circuits into smaller sections, which reduces the number of customer affected by faults. Remotely controlled switches enable speedy network reconfiguration to restore supplies. These devices can be controlled centrally by automated sequence switching schemes in the network management system. These schemes learn the state of the network in real time and automatically reconfigure running arrangements to isolate faulty sections within minutes.

Quality of supply expenditure (£m)					
	West Midlands	East Midlands	South Wales	South West	WPD Total
DPCR5 Annual Average	3.7	3.7	2.4	2.8	12.5
RIIO-ED1 Annual Average	1.9	1.1	0.4	0.4	3.7
RIIO-ED1 Total (8 years)	**15.3**	**8.6**	**2.9**	**2.9**	**29.7**

11.7 In response to supplementary questions from Ofgem , WPD confirmed that the expenditure on quality of supply was to be included within allowed Totex for RIIO-ED1.

12 Worst served customers

12.1 There are a small number of customers that experience high numbers of faults. These customers are generally located on the end of long circuits or on remote parts of the network, with limited alternative networks available to provide supplies when faults occur.

12.2 Ofgem has redefined a worst served customer to be one that experiences 12 or more (previously 15 or more), higher voltage interruptions over a three year period, with a minimum of three in each year. This means that worst served customers are those that have sustained poor network performance. For WPD there are approximately 20,000 worst served customers meeting the new definition.

12.3 Stakeholders have indicated they support investment to reduce the number of worst served customers by 20%. They have also stated a preference that where investment is carried it should yield a 20% reduction in the number of faults and that the expenditure should be limited to £800 per benefiting worst served customer.

12.4 Combining the change in definition and the expected improvement means that more customers will benefit from this investment.

12.5 During RIIO-ED1 WPD will target reducing the number of worst served customers by 20% to 16,000.

12.6 WPD will Invest in additional protection equipment to prevent faults affecting worst served customers. Where low cost solutions can be found, network reconfiguration, interconnection and refurbishment will also be carried out to enable supplies to be re-routed quickly when faults occur.

Worst served customer expenditure (£m)					
	West Midlands	East Midlands	South Wales	South West	WPD Total
DPCR5 Annual Average	0.0	0.0	0.2	0.1	0.3
RIIO-ED1 Annual Average	0.1	0.0	0.1	0.1	0.4
RIIO-ED1 Total (8 years)	**1.0**	**0.2**	**1.0**	**1.0**	**3.1**

13 Operational information technology and telecommunications (IT&T)

Introduction

13.1 WPD uses a dedicated communication infrastructure and a network management system to monitor the loads flowing through the electricity network, in order to understand its operational state and also to remotely control devices. This operational IT&T system consists of three elements:

- the devices installed at substations that collect information locally and link to the communications network;
- the communication infrastructure that carries the data between the substations and central control rooms;
- the control centre hardware and software that collates the information and allows engineers to control the network in real-time.

13.2 The proposed expenditure will maintain the integrity of systems, whilst incorporating necessary network expansion and improving reliability and security.

Operational IT&T expenditure in RIIO-ED1 (£m)					
	West Midlands	**East Midlands**	**South Wales**	**South West**	**WPD**
Substation RTUs, marshalling kiosks, receivers	0.3	0.3	3.2	1.1	4.9
Control Centre hardware & software	10.9	11.2	10.5	11.4	44.0
Communications for switching & monitoring	13.2	13.9	9.1	10.9	47.0
Total	**24.3**	**25.4**	**22.9**	**23.4**	**95.9**

Operational IT

13.3 Operational IT incorporates the network management system and remote data collection systems.

13.4 The network management system contains a network model that is used to mimic the real-time state of the higher voltage (6.6kV and above) distribution network. Any work that takes place on the higher voltage network is carried out under permission or instruction from Control Engineers, who use the network management system to assess what actions are required to ensure that staff working on the network are safe and the supplies are maintained.

13.5 It is important that the network model is kept accurate and up-to-date at all times. The system is updated either automatically from Remote Terminal Units (RTUs) in substations or by manual changes by Control Engineers following confirmed reports of manual operations from staff in the field. The network management system records the changes to the network and the related impact on customers.

13.6 The network management system used by WPD is GE Network Solution's ENMAC system. The control of the network is managed through ENMAC, and WPD uses ENMAC as the single point of data capture and analysis of all aspects of network management and the impact of outages on customers. The system provides full co-ordinated facilities to:

- direct, approve and control all operations on the higher voltage electricity network;
- update the network model to mimic changes on the actual network;
- manage the deployment of the operational staff associated with network operation at all voltages;

- provide all of the underlying details associated with faults and planned interruptions on the electricity network so that customers can be kept up to date on progress;
- provide accurate historic information about the performance of the electricity network so that customer queries can be assessed, informed investment decisions can be made and external reporting obligations can be fulfilled.

13.7 The forecasts for Operational IT are focused on two areas:

- Substation RTUs, marshalling kiosks and receivers;
- Control Centre hardware and software.

Substation RTUs, marshalling kiosks and receivers

13.8 Remote Terminal Units (RTUs) are the devices installed at major substation sites that provide vital monitoring information to ENMAC and allow remote operation of the network by Control Engineers.

13.9 RTUs have a life expectancy of approximately 15 years and since an extensive replacement programme across West Midlands and East Midlands was completed in 2012, no further expenditure will be required until RIIO-ED2 in these areas. The replacement of RTUs in the South West and South Wales will be carried out over a five year period between 2014 and 2018. The work in the first half of RIIO-ED1 will include the replacement of 100 RTUs in the South West, together with all 350 RTUs in South Wales.

13.10 In addition to the replacement programme, we install additional devices at substations identified as becoming more strategically important. Experience has shown that on average two such substations are identified every year, and we expect this to continue through the RIIO-ED1 period.

Substation RTUs, marshalling kiosks, receivers RIIO-ED1 (£m)					
	West Midlands	**East Midlands**	**South Wales**	**South West**	**WPD Total**
Replacement of existing RTUs	0.0	0.0	3.0	0.9	3.8
Additional RTUs/Radio Modems at existing sites	0.3	0.3	0.3	0.3	1.1
Total	**0.3**	**0.3**	**3.2**	**1.1**	**4.9**

Control centre hardware and software

13.11 Control centre hardware comprises the various computer servers and devices required for the effective and secure operation of the ENMAC software. It allows Control Engineers, Contact Centre staff and Despatchers to understand and manage events on the electricity network.

13.12 The forecast included in this Business Plan is based upon the operational IT and telecoms in place at the end of the DPCR5 period becoming 'business as usual', which includes some of the elements of the LCNF Project FALCON.

Control centre hardware

13.13 ENMAC is operated in three instances or 'environments': the live environment, a development environment and a training environment. Hardware servers are required to support ENMAC in all three of these environments.

13.14 The servers are associated with the following ENMAC software elements:

- Network Management System (NMS): enables the day to day activities to manage and control the electricity network;
- Outage Management System (OMS): allows effective management of staff and the impact of fault conditions on customers;
- CallTaker - Allowing staff to take and record telephone calls from customers;
- Geoview - a geographically based view of fault information;
- Communications Management with the RTUs.

13.15 In order to ensure resilience and to reduce operational risk, each of the four WPD licence areas has its own individual ENMAC system. To enhance system availability and performance, each ENMAC system operates on a number of servers placed in different physical locations. They are inter-connected by high speed data links supplied via the telecommunications infrastructure.

13.16 Due to its strategic importance, the hardware used for the WPD control system is upgraded at least every five years, to take advantage of technological developments in processing speed and capability. The replacement of hardware also ensures that the latest versions of ENMAC function properly because as ENMAC is developed older hardware is not able to support it.

13.17 It is anticipated that the next generation of hardware will allow continuous calculation of network parameters such as dynamic load flows and fault levels, which will set the foundation for smarter network operational control.

13.18 The server costs represent those that will be incurred by replacing the individual elements currently in place with the next generation equivalent equipment. The costs forecast are based upon recent experience of hardware upgrades in the Midlands licence areas. The replacements will be in 2017/18 and 2022/23.

13.19 It should be noted that there are subtle variations in costs associated with the hardware requirements in each licence area. This is because, although each area uses the same basic software the data quantities, number of users and number of connected RTUs differ between installations.

Hand held devices

13.20 One of the innovations adopted by WPD is the use of ENMAC Mobile on hand held devices. This allows the automatic reporting of progress on network operations and fault restorations direct from the field. This ensures that customers are always provided with the most up-to-date information and also increases the effectiveness of both the Control Centre and field staff in their day to day activities. This system is used extensively in the South West and South Wales and will be implemented in the Midlands before the end of DPCR5.

13.21 Hand held devices have an operational life of 3-4 years, and there is a systematic programme of replacement. Devices purchased during the last refresh in 2011/12 are due for replacement in 2015 and again in 2019.

Software

13.22 GE regularly incorporates the feedback from users of ENMAC to enhance its functionality. WPD monitors the development of the product and adopts them where it is appropriate to business needs. Each extension to functionality is subject to revised licencing charges.

13.23 WPD has a long and successful record of incurring minimal costs for these developments by collaborating with GE. A typical example of such collaboration is the development of the hand held facilities, where WPD took an active role in specifying and subsequently testing both software and hardware.

13.24 The forecast costs are in line with previous developments and licence costs over the past 10 years.

Control centre hardware & software RIIO-ED1 (£m)					
	West Midlands	**East Midlands**	**South Wales**	**South West**	**WPD Total**
Replacement control centre hardware	7.0	7.0	7.1	7.6	28.7
Hand held devices	1.0	1.4	0.7	1.0	4.0
Software changes / enhancements / licences	2.9	2.8	2.8	2.8	11.3
Total	**10.9**	**11.2**	**10.5**	**11.4**	**44.0**

Operational telecommunications

Communications for switching and monitoring

13.25 WPD has developed its own internally managed telecommunications infrastructure for operational data communication. This approach is cost effective, reliable and more resilient than that available from third party providers.

13.26 The main elements of the operational telecommunications infrastructure are as follows:

- supervisory control an data acquisition (SCADA) and Trunk Network for communication to major substations;
- secondary SCADA for communications to distribution substations and devices on the distribution network;
- Network Data Communications to provide data and voice communications between the Control Room and field staff.

Primary SCADA trunk network

13.27 WPD uses a scanning telemetry network to provide real-time monitoring and control of its higher voltage system. This involves the transmission of data from radio transmitters located remotely on a range of network assets to base-stations located at major substations. Microwave and fibre optic communications then transfers the data between the base-stations and our Control centres.

13.28 In order for this communications network to remain operational, we will need to change much of the equipment as it reaches its end of life. In 2018, after a twelve year life, the trunk communication network in the South West and South Wales will be at the end of its life and will be unsupported. An upgrade of the base stations and trunk communications network is planned to start in 2018.

13.29 In addition, as new substations are added to the system to facilitate the connection of distributed generation and to manage load growth, it is expected that a number of the scanning base-stations will reach full capacity. Additional sites will need to be established, and additional capacity will also be required on the communications infrastructure in order to handle the additional data.

Migration from unlicensed radio, PAKNET and mobile systems

13.30 There are a series of smaller RTUs installed on the 6.6kV and 11kV switchgear to assist in monitoring and control of the overall network. These devices use different communications techniques to pass information to ENMAC.

13.31 In the South West and South Wales, data is transmitted on unlicensed radio frequencies between the RTUs and base stations. Other users can broadcast on the same frequencies and may cause interference that causes failure in the communication of data. Cases of interference are increasing and it is therefore proposed that these unlicensed installations will be changed either when they suffer from local interference, or when they reach their end of life. This will prevent deterioration of current levels of reliability. It is estimated that the 4,500 units currently in service would be replaced at the rate of 250 per annum which equates to a cost of £300k each year. This programme will continue through the RIIO-ED1 period and into subsequent price control periods.

13.32 In the Midlands, two separate techniques have been used to return data to ENMAC from remote switchgear. An out-of-date technology known as PAKNET has been in use in the West Midlands since 1994 and is now at the end of its useful life. In the East Midlands GPRS mobile phone technology has been in use since 2004. Both techniques are reliant upon services

outside of WPD's direct control, and the technologies on which they are based are forecast to be removed before the end of the RIIO-ED1 period. In addition, WPD's cyber security work with Idaho National Laboratories has identified both PAKNET and GPRS as insecure and posing significant risks. There are 7,500 devices using these communication techniques in the Midlands, and because of the age profile they will all be replaced in the first three years of the RIIO-ED1 period.

13.33 WPD intends to replace both of these systems with the directly managed standard scanning radio network to create a more secure common platform across the whole of the WPD.

Network data communications

13.34 We operate our own, network data communications systems that provide data and voice communications from the Control Centres and local offices to field operatives and static devices.

13.35 WPD is one of very few companies who continued with these private mobile radio (PMR) communications when others were disposing of PMR assets and replacing them with public mobile phone connectivity.

13.36 The advantages of a self-owned data network include:

- limited or no reliance on 3rd party networks;
- provision of storm, civil emergency, and Black Start resilience;
- faster response and fix times for faults by using in-house resources;
- better reliability from a dedicated system.

13.37 Mobile phone facilities obtained from a third party network do not provide resilience to emergencies or terrorist attacks. The length of time that third party systems remain operational following a power cut can be as low as ten minutes. In addition, geographic coverage is not complete, especially in some of the rural areas in which WPD operates, and when the mobile network is busy calls can be held up or lost.

13.38 The Midlands communication base stations were installed in 2013, however the systems in the South West and South Wales will reach the end of their life in 2018 and require replacement.

Radio traffic encryption

13.39 Work with Idaho National Laboratories regarding security of communications (see section on Cyber security) identified the need to encrypt the radio traffic moving between the major RTUs and ENMAC to prevent unauthorised interception of the data. It is considered that the risk of interception is increasing and it is proposed to install systems that encrypt all radio communication traffic.

Communications for Switching and Monitoring (£m)					
	West Midlands	**East Midlands**	**South Wales**	**South West**	**WPD**
Migration from GPRS/Paknet	8.8	8.8	0.0	0.0	17.5
Migration from unlicenced radio	0.0	0.0	1.1	1.1	2.2
Primary SCADA and trunk comms network	1.5	2.3	3.0	3.7	10.5
Encryption of major RTU traffic	1.9	1.9	1.3	1.4	6.6
Network data comms system	0.0	0.0	2.8	2.8	5.6
Additional comms for smart grids	0.9	0.9	0.9	1.8	4.6
Total	**13.2**	**13.9**	**9.1**	**10.9**	**47.0**

Cyber security

13.40 WPD recognises the increasing threat from cyber security issues. Our simple corporate IT premise that no device connected to core data systems can have direct access to the Internet has meant that the number of cyber-attacks experienced by WPD is currently minimal. As ENMAC is vital to the business, the cyber security associated with it and its associated communications infrastructure needs to be of the highest standard.

13.41 In 2011/12, WPD volunteered to take an active role in a joint evaluation of the ENMAC product in conjunction with Idaho National Laboratories (INL), GE and the Centre for the Protection of National Infrastructure (CPNI). The initial work on ENMAC security was done in the laboratory and then WPD provided a live environment in which to carry out a full evaluation. This live test involved the whole of WPD's internal communications and computer infrastructure as well as the product.

13.42 The major elements of the work in WPD included an evaluation of the ENMAC implementation and the level of general cyber security throughout the company by INL. The following is an extract from INL's report:

> *"During the cyber assessment, the team recognized that WPD had a security-minded philosophy that permeated the entire company, which employed competent staff. Overall, WPD has spent a lot of time analyzing and intentionally configuring their security posture based on a belief that a robust outside barrier would provide the best protection from attackers."*

13.43 There were a number of suggestions for improvements and most of them have been completed in DPCR5. In RIIO-ED1 we will continue with the security enhancements, increasing the security of our radio networks.

13.44 This work was considered to be of such significance and importance that it was submitted to the SANS EU SCADA and Process Control Summit where WPD received an award for Security Innovation.

13.45 WPD also has representation on the Council for the Protection of National Infrastructure (CPNI) SCADA Control System Information Exchange (SCSIE) panel and takes part in the SCSIE Assessment for security.

13.46 It is within this context that our proposals for increased operational IT&T security measures have been developed.

Expenditure summary

Operational IT&T expenditure (£m)					
	West Midlands	East Midlands	South Wales	South West	WPD Total
DPCR5 Annual Average	5.0	5.7	1.2	2.2	14.1
RIIO-ED1 Annual Average	3.0	3.2	2.9	2.9	12.0
RIIO-ED1 Total (8 years)	**24.3**	**25.4**	**22.9**	**23.4**	**95.9**

BT 21st Century (BT 21CN)

13.47 WPD rents a number of telecommunication circuits from BT which are used for electricity network protection systems and SCADA.

13.48 Dedicated circuits have been used to provide fast fault clearance times to protect network equipment and to maintain the stability of the transmission system, distribution networks and connected generators. They have also been used for SCADA to send analogue status information from substations to ENMAC and allow equipment and switchgear to be controlled remotely.

13.49 These circuits are based on analogue four wire technology operating on dedicated copper cables. Whilst this is old technology it has been generally reliable and proven to be adequate for use.

13.50 BT is in the process of converting these circuits and others to a more modern internet protocol system known as the BT 21st Century Network (BT 21CN). BT states that BT 21CN should improve the resilience of the overall communication network by introducing multiple communication paths. However, since the communication path is not determined, there could be time delays which may cause electricity distribution network protection systems to function incorrectly.

13.51 BT has confirmed that their network will be unable to meet the requirements of the Energy Networks Association Technical Specification 48-6-7 'DNO and TNO requirements for communication circuits for teleprotection services'.

13.52 Whilst BT is making the transition, it has confirmed that the existing circuits will remain available and supported until 2018 after which they will be replaced by the BT 21CN network.

13.53 WPD proposes to replace all telecommunication circuits affected by BT 21CN with circuits owned and operated by WPD's own telecommunication company, Surf Telecoms. Three generic solutions have been proposed using fibre optic, microwave and UHF radio.

13.54 It is proposed that all work will be completed in South Wales and South West by the end of DPCR5.

13.55 In West Midlands and East Midlands priority has been given to 75 'high impact' protection circuits and these are due to be completed by the end of DPCR5, with the remaining 75 protection circuits and 200 SCADA circuits being completed during RIIO-ED1.

BT 21CN expenditure (£m)					
	West Midlands	East Midlands	South Wales	South West	WPD Total
DPCR5 Annual Average	1.1	2.1	0.8	0.2	4.2
RIIO-ED1 Annual Average	0.7	1.1	-	-	1.8
RIIO-ED1 Total (8 years)	**5.9**	**8.8**	**-**	**-**	**14.7**

14 Flood defences

14.1 Widespread flooding in 2007 affected network assets, interrupting electricity supplies to thousands of customers in Gloucestershire and Yorkshire thereby,highlighting the potential vulnerability of electricity substations to flooding. There are also general concerns over rising sea levels due to global warming which brings into question the adequacy of existing levels of flood protection in coastal areas. Furthermore, climate change predictions suggest that flooding could become a more regular occurrence with an increasing risk from surface water during heavy rains.

14.2 In response to the floods in 2007, the government commissioned an investigation (The Pitt Review) that called for urgent and fundamental changes in the way the country is adapting to the increased risk of flooding and requested a comprehensive assessment of the resilience to flooding of primary and higher voltage substations.

14.3 The Energy Networks Association (ENA) formed the 'Substation Resilience to Flooding Task Group' to lead this work and report to the Energy Emergencies Executive committee (E3C). The ENA produced Engineering Technical Report 138 (ETR 138) to provide guidance on how to improve the resilience of electricity substations to fluvial flooding from coastal and river water to a level that is acceptable to all stakeholders whilst taking into consideration the cost/benefit assessment for each site. The ENA is seeking to extend the scope of ETR 138 to also include pluvial flooding from surface water.

14.4 WPD has been working with the Environment Agency to identify the substations at greatest risk by considering the likelihood of a flood along with the impact, by taking into account the number of customers who would lose supply if the substation were to be shut down and the effect of supply loss to critical infrastructure sites.

14.5 This analysis has led to the identification of a number of substations that require enhanced flood protection and the installation of such defences was started in 2010 and will continue into the RIIO-ED1 period.

14.6 Stakeholders have indicated that investment in flood defences is a high priority and consequently WPD has completed more sites than originally planned for DPCR5. This leaves 75 sites to be completed in the RIIO-ED1 period. Further sites may be identified once more detailed analysis of surface water flooding is available.

Flood defence expenditure (£m)					
	West Midlands	East Midlands	South Wales	South West	WPD Total
DPCR5 Annual Average	0.6	1.5	1.3	0.8	4.2
RIIO-ED1 Annual Average	0.1	0.6	0.9	0.1	1.8
RIIO-ED1 Total (8 years)	**1.1**	**4.9**	**7.5**	**1.1**	**14.6**

15 Black start

Background

15.1 Whilst highly unlikely, a major disturbance to electricity supply could lead to a partial or even total shutdown of the GB transmission system and the associated distribution networks. The actions required to re-establish normal operation of the electricity network, following such an event, are referred to as a 'Black Start'.

15.2 Successful recovery from a Black Start event requires sections of the transmission and distribution networks to be re-energised and reconnected, in a predetermined sequence. These actions need to be undertaken in a co-ordinated and controlled manner, in order to ensure that the reconnection of load and generation remain balanced.

15.3 Following a series of major blackouts across the world, the UK government and the electricity industry, through the Electricity Task Group (ETG) of the Energy Emergencies Executive Committee (E3C), have reviewed the resilience of the GB electricity network to a Black Start event. This has identified that the recovery time for a Black Start, from a total shutdown of the transmission system, is likely to be in the order of 72 hours.

15.4 Engineering Recommendation G91 ('Substation Black Start Resilience') was issued in 2012. This Engineering Recommendation has introduced a requirement upon DNOs to ensure that suitable measures are established at major substations, such that adequate protection and control systems shall be available to permit safe re-energisation of these substations during a Black Start. Such measures must be suitable to cater for a partial or total shutdown of the electricity network lasting up to 72 hours.

Substation resilience

15.5 132kV, EHV and some major HV substations use low voltage supplies for the recharging of batteries. These batteries are used:

- for the operation of power system protection and tripping of circuit breakers at the substation; and
- by substation located telecommunications equipment for SCADA purposes.

15.6 The battery systems used for SCADA equipment are separate to those used for protection and tripping purposes.

15.7 Under Black Start conditions the low voltage supplies to these battery systems would be unavailable. As a consequence the associated batteries would drain due to the standing load of the connected equipment. Typically, batteries installed on the WPD network have sufficient capacity for 24 hours. After this time, without restoration of low voltage supplies, protection, tripping and communications at the major substation may be compromised.

15.8 In order to meet the requirement for 72 hours resilience at major substations, load disconnection schemes shall be installed as part of the battery systems used at each major substation site for power system protection and operation of circuit breakers.

15.9 The resilience of battery systems used for SCADA purposes shall be addressed by increasing the battery capacity at each site to meet the 72 hour requirement.

Resilience of substation protection and tripping batteries

15.10 Load disconnection schemes automatically disconnect the standing load on the battery system during a sustained loss of supply at a substation, removing the drain on the batteries. With the standing load disconnected, the batteries retain their charge and can be reconnected when re-energisation of the substation is required.

15.11 WPD has worked in conjunction with a manufacturer to develop a load disconnection unit that can be fitted as a standalone device, without requiring the replacement of the existing batteries. Field trials have been undertaken in WPD South Wales to develop and prove the design of these units and their interaction with operational control and network management systems. WPD has shared the knowledge gained from this work with other DNOs, by hosting a workshop event in the summer of 2011 that incorporated a site visit to one of the trial installations.

15.12 The load disconnection schemes that have been developed can be controlled via the SCADA system, enabling the protection and tripping batteries to be remotely reconnected prior to the requirement to re-energise a substation.

15.13 The unit cost for installation of the load disconnection unit is £3.1k at EHV sites and £4.1k at 132kV sites. This is less than the increase in cost required to upgrade to a 72 hour capacity battery system (as shown in table below).

Unit cost comparison (£k)				
	Installation Of 24 Hour Capacity Battery & Charger	Installation Of 72 Hour Capacity Battery & Charger	**Differential For Installation Of Larger Capacity Batteries**	**Load Disconnection Scheme**
EHV Site	5.5	9.1	**3.6**	**3.1**
132kV Site	9.5	26.0	**16.5**	**4.1**

15.14 Therefore the load disconnection scheme represents the most cost effective way of establishing Black Start resilience for protection/ tripping batteries, even in cases where the associated battery system requires replacement. In addition, the load disconnection solution offers the capability to ensure resilience of protection/ tripping batteries for events that last longer than 72 hours, because the battery system retains charge whilst the standing load is disconnected.

15.15 The requirements of each major substation site have been examined and the following works for resilience of protection/ tripping batteries during the RIIO-ED1 period identified:

Black start resilience of protection batteries at 132kV sites in RIIO-ED1					
	West Midlands	East Midlands	South Wales	South West	WPD Total
Number of 132kV sites requiring work	77	113	61	54	302
Number of load disconnection schemes to be installed	97	166	61	60	384
Total cost (£m)	**0.4**	**0.6**	**0.2**	**0.2**	**1.4**

Black start resilience of protection batteries at EHV sites in RIIO-ED1					
	West Midlands	East Midlands	South Wales	South West	WPD Total
Number of EHV sites requiring work	163	508	175	312	1149
Number of load disconnection schemes to be installed	167	508	175	314	1164
Total cost (£m)	**0.5**	**1.4**	**0.5**	**0.9**	**3.3**

Resilience of substation SCADA batteries

15.16 During a Black Start event it is essential that remote supervision and control of substations can be maintained via the SCADA system. This ensures that:

- restoration of supplies can be undertaken in an expedient manner following any request from National Grid;
- network arrangements can be preconfigured in advance of restoration requirements;
- the requirement for deployment of staff to site is minimised;
- the status of each substation can be continuously monitored, assisting coordination of the actions required to deliver successful restoration.

15.17 Consequently, load disconnection schemes do not offer an appropriate solution for the resilience of SCADA batteries. Works will be undertaken during the RIIO-ED1 period to increase the capacity of SCADA batteries at each major substation, to meet the requirement for a minimum of 72 hours resilience. Additional capacity can be added to existing SCADA battery installations, generally without modification to the existing equipment.

15.18 The requirements of each major substation site have been examined and the following works for resilience of protection/ tripping batteries during the RIIO-ED1 period identified :

Black start resilience of SCADA batteries at 132kV sites					
	West Midlands	East Midlands	South Wales	South West	WPD Total
Number of 132kV sites requiring work	91	106	44	55	293
Total cost (£m)	**0.5**	**0.8**	**0.2**	**0.3**	**1.8**

Black start resilience of SCADA batteries at EHV sites					
	West Midlands	East Midlands	South Wales	South West	WPD Total
Number of EHV sites requiring work	163	480	146	348	1,120
Total cost (£m)	**1.0**	**2.1**	**0.7**	**2.1**	**5.9**

Telecommunications resilience

15.19 Alongside substation resilience, the Black Start resilience of the key telecommunications systems is required for successful recovery from a Black Start event. These are the telecommunications systems that are essential to the organisation and the coordination of resources in order to implement restoration plans under Black Start conditions.

15.20 The key telecommunications systems include:

- mobile voice communications for the coordination of field staff;
- telephone land lines to key strategic sites, including Control Centres and Customer Contact Centres;
- telecommunications infrastructure for SCADA systems.

15.21 Under Black Start conditions, many third party telecommunications systems do not have suitable resilience to ensure availability for the likely full duration of a Black Start. WPD operates its own independent telecommunications networks, ensuring that the essential communications systems have suitable resilience to cater for major network events. These are the networks used for SCADA and the PMR voice communications system used by field staff.

15.22 In order to meet the 72 hours resilience requirements of a Black Start it is necessary to improve the backup supply capabilities at a number of the telecommunications sites during RIIO-ED1 period. Works are required at 43 telecommunications sites in WPD West Midlands and 66 sites in WPD East Midlands. No works are required during the RIIO-ED1 period at telecommunications sites in WPD South Wales and WPD South West.

15.23 Many of the sites, where resilience works are required, provide a number of telecommunications services. For example a single telecommunications site may provide services for both internal telephony and SCADA. Therefore works to provide resilient power supplies at a single site may provide resilience for mobile voice communications, SCADA and telephony at the same time.

15.24 The works required to secure telecommunications infrastructure for a Black Start event are shown in the table below:

Volumes and costs for black start security of telecommunication infrastructure				
	West Midlands		East Midlands	
	No. of sites	Expenditure (£m)	No. of sites	Expenditure (£m)
Upgrade Of existing site generation	13	0.3	19	0.4
Increased fuel storage facilities	0	0.0	3	0.0
Installation of new generation	12	0.4	14	0.5
Ancillary works	18	0.2	30	0.4
Total	**43**	**0.9**	**66**	**1.3**

15.25 The table below shows the number of sites where the telecommunications usage shall be secured by the resilience works.

Telecommunications services at the sites where resilience works are required		
	West Midlands	East Midlands
Internal telephony	22	39
Mobile voice communications	23	38
SCADA	42	58

Expenditure summary

15.26 The costs for Black Start resilience will be mostly be incurred during RIIO-ED1. The following tables summarises the total costs.

Black start resilience expenditure (£m)					
	West Midlands	East Midlands	South Wales	South West	WPD Total
Protection batteries at 132kV sites	0.4	0.6	0.2	0.2	1.4
Protection batteries at EHV sites	0.5	1.4	0.5	0.9	3.3
SCADA batteries at 132kV sites	0.5	0.8	0.2	0.3	1.8
SCADA batteries at EHV sites	1.0	2.1	0.7	2.1	5.9
Telecommunications	0.9	1.3	0.0	0.0	2.2
Total	**3.3**	**6.4**	**1.6**	**3.5**	**14.8**

16 Substation and network security

Background

16.1 WPD has legal obligations to operate its distribution networks in a safe and reliable manner. In addition to the protection of the general public from dangers of electricity and the reduction of the risk of personal injury to staff there is also a requirement to ensure sites and assets are secure to prevent third party trespassing, vandalism and theft.

16.2 Whilst it is virtually impossible to prevent access by a determined thief, improved measures are required to deter unauthorised access and to make it more difficult to force entry.

16.3 Substation sites and cable bridges/tunnels are managed in line with the requirements of ENA recommendations and a risk based approach is used. The effects of vandalism or theft are rated, along with the potential further risk to the public should vandalism or theft occur.

Major substation security

16.4 Bulk supply substations and primary substations have a concentration of high value plant and assets, where the risk is both the effect of the theft on customer supplies and the residual risk of an unsecured site being accessed by the public after the theft.

16.5 WPD works with the security services and the CPNI to take even more stringent security measures at sites which are key to the UK. All of WPD's security works are planned so that they fit within CPNI guidelines and would allow the easy enhancement of our sites should they become added to the CPNI listings.

16.6 During DPCR4, work was completed in the South West and South Wales areas to enhance the security of all substation sites at 33kV and above. As a minimum, intruder alarms were installed at all primary substations, with CCTV being added to higher risk sites and electric fences being added to very high risk sites. Security specification doors were also added to these sites.

16.7 The pinning of earthing conductors was also employed as a deterrent. This involved increasing the number of fixing points (pins) to make it more difficult to prise the conductor away and cut it.

16.8 The works completed in the South West and South Wales will be extended into the West Midlands and East Midlands during the RIIO-ED1 period.

16.9 The number of sites where enhanced security measures are to be applied are detailed in the table below:

Number of 132kV and EHV substation sites to have security enhancements in RIIO-ED1					
	West Midlands	East Midlands	South Wales	South West	WPD Total
132kV sites	89	154	0	0	243
EHV sites	283	399	0	0	682

132kV & EHV site security expenditure (£m)					
	West Midlands	East Midlands	South Wales	South West	WPD Total
DPCR5 Annual Average	1.6	1.0	1.6	1.0	5.2
RIIO-ED1 Annual Average	0.8	1.4	-	-	2.2
RIIO-ED1 Total (8 years)	**6.3**	**10.8**	**-**	**-**	**17.1**

Application of theft deterrent measures at distribution substations

16.10 At ground mounted distribution substations, of which we have over 56,000 locations in the WPD area, it is more difficult to provide a suitable and proportionate increased set of security measures. For these sites it is more effective to provide measures which deter theft by using higher security fencing and doors.

16.11 Innovative tagging and identification systems can easily be applied to substation assets to deter opportunist thieves. We have been very successful with one system that is applied like paint, making it useful for a variety of situations. Each application is unique and it can be traced to the exact item, location and date it was applied. Other identification methods will also be trialled to ensure that we are using the most effective approaches. The deterrent is enhanced by using signage to inform potential thieves that tagging products are being used and that items with markings can be traced. Scrap metal dealers have been informed that the systems are in use so that they become more reluctant to buy stolen electricity assets. The basic underlying principle is that if the thief cannot sell the stolen property they will not steal it.

16.12 We have begun research work on a system which aims to identify stolen overhead conductors by using the properties of the verdigris which forms on the wire when it is in the air. This is at a very early stage but, if successful, will provide more assistance to the police when stolen conductors are recovered.

Distribution substation security expenditure (£m)					
	West Midlands	East Midlands	South Wales	South West	WPD Total
DPCR5 Annual Average	0.2	0.2	0.0	0.0	0.4
RIIO-ED1 Annual Average	0.3	0.2	0.1	0.1	0.7
RIIO-ED1 Total (8 years)	**2.3**	**1.4**	**0.7**	**0.7**	**5.1**

Cable bridges and tunnels

16.13 Cable bridges or tunnels are structures which are used specifically to get cable routes across roads and waterways. The risk at these sites is the fact that the cables are not buried and become more accessible. As a cable bridge may also have a concentration of cables that serve a wide geographical area so the risk of customer interruptions is heightened.

16.14 All cable bridges have anti-access devices fitted and some are also cladded to prevent access. Where there is evidence of attempted access or the risk of damage will cause major disruption to supplies the security measures will be enhanced.

17 Metal theft remedial actions

Background

17.1 Significant increases in the prices of commodities such as copper and aluminium have resulted in increased incidence of theft, especially that of copper low voltage overhead lines and earthing conductors located within primary and distribution substations.

17.2 In addition to safety risks the consequences of theft are the need for remedial works to replace the stolen assets, repairs to damaged fences and doors, interruptions to supply and inconvenience for customers.

Repair to network equipment

17.3 Where bare copper overhead lines are stolen they are replaced, in most cases, with insulated aerial bundled conductor (ABC) to minimise the likelihood of repeated theft. ABC reduces the likelihood of theft as it requires the insulation to be stripped before it can be sold and it is made using aluminium conductor which has a lower commodity value.

17.4 Missing substation earthing can lead to dangerous voltages arising on equipment, fences and at customers' premises and is therefore reinstated as soon as thefts are identified.

17.5 In some circumstances, thieves are disturbed or they do not find anything they can steal. Whilst these attempted thefts do not cause interruptions to supply, they do require site visits to establish the extent of possible damage and to make sites secure. Costs associated with metal theft are therefore categorised as either causing interruptions to supply or other occurrences that are not covered by the Interruptions Incentive Scheme. Within Business Plan Data Templates, the costs for metal theft remedial measures have been incorporated into the overall costs for Trouble call in line with regulatory guidance.

Repair to customers' equipment

17.6 The theft of neutral conductors can lead to high voltages and the subsequent damage to appliances in customers' properties. Since this occurs as a consequence of third parties interfering with equipment, WPD is not legally liable and does not accept responsibility for any damage. But because the damage to equipment may not be the customer's fault and the customer is being inconvenienced, WPD provides, as a minimum, a 'Heat and Eat' service where damaged boilers and cookers will be repaired or replaced at no cost to the customers. The cost of this service is incorporated into insurance claims expenditure reported against finance and regulation in business support costs.

Working with police forces to reduce theft

17.7 WPD has been working with police forces within the WPD area to assist in crime prevention. We have provided guidance to improve the identification of recovered stolen materials and facilitated meetings with neighbouring forces to ensure that intelligence is shared across police area boundaries. Although this has led to a number of arrests and prosecutions, theft continues to be a problem.

17.8 WPD has been instrumental in getting police forces across the East Midlands and West Midlands to work together to identify suspects and makes arrests. Clothing, tools, mobile phones and vehicles found at the sites of theft have been provided as evidence which have

enabled police forces to be better informed about the thieves. Staff have also accompanied the police in visits to scrap yards to help to identify potentially stolen materials.

17.9 Booklets and charts have been produced to inform the police and scrap merchants about the types of cable and conductor used by the industry. By being more aware, scrap dealers are deterred from handling stolen material and police can quickly make investigations where theft is suspected. Scrap dealers have also been made aware that WPD uses tagging and identification systems that allow stolen equipment to be traced and the location of theft to be identified.

17.10 WPD will continue to work collaboratively with the police to reduce the likelihood of theft. This proactive action will minimise the disruption to customers and consequential costs of repairs.

18 Security of Critical National Infrastructure (CNI)

18.1 WPD works with the security services and the Centre for the Protection of the National Infrastructure (CPNI) to take even more stringent security measures at sites which are key to the UK. The assessments consider the number of customers connected to a specific site, its criticality to the network in general or its role in supporting key installations or customers. When a site is defined as being part of the CPNI list, additional security works are undertaken to increase the protection of the site.

18.2 The measures include the installation of enhanced and electrified fences, alarm systems and CCTV systems. Proposed enhanced security measures need to be approved by the CPNI and once completed an audit is required to demonstrate that the measures have been completed to the appropriate specification.

18.3 Expenditure expectations are forecast to be in the region of £5m during the RIIO-ED1 period with costs being recovered once work is completed. At present there are no firm requirements and therefore this funding will either be requested during a re-opener window or logged up for recovery during RIIO-ED2.

19 High Impact Low Probability (HILP) events

19.1 Although the loss of supply is inconvenient, the majority of faults have a limited impact do not last long. There are, however, situations where an accident, vandalism or a terrorist act could cause widespread impact and long duration outages, particularly if there is a lot of damage to electrical equipment. When such events impact upon the electricity supplies to central business districts (CBDs) there could be a significant detrimental effect on the local economy.

19.2 The risk of such high impact low probability events is mitigated by enhancing network security with additional capacity and reconfiguring existing arrangements to limit the impact of the loss of one site.

19.3 Extensive replacement works are ongoing at a central Birmingham site, and the opportunity is being taken to introduce more physical separation between assets to reduce the impact of a single event.

19.4 Security arrangements will be enhanced at a number of sites and should Government intelligence identify sites at greater risk of attack they will be made more secure under our CNI security programme.

19.5 During RIIO-ED1, WPD does not propose any specific expenditure on HILP events.

20 ESQCR regulation 18

20.1 The Electricity Supply, Quality and Continuity Regulations 2002 govern many DNO activities. When the regulations were launched they introduced a number of new obligations some of which took immediate effect. The requirements of all the regulations have already been embedded within routine inspection and maintenance programmes.

20.2 Regulation 18 of the Electricity Safety, Quality and Continuity Regulations (ESQCR) 2002 specifically deals with the clearances of overhead lines to structures. It requires overhead lines to be clear of buildings and other obstacles to reduce the risk of inadvertent contact. Where existing lines are close to buildings, the regulations require that lines are modified to remove the risk. Longer timescales were allowed for compliance with this regulation to identify the locations and deliver the remedial work.

20.3 WPD has identified the locations where work is required and the majority of the programme will be completed in DPCR5, but, as previously agreed with the HSE, there will be part of the programme in the South West that will continue into RIIO-ED1 and will be completed by March 2018.

ESQCR horizontal clearance expenditure (£m)					
	West Midlands	East Midlands	South Wales	South West	WPD Total
DPCR5 Annual Average	2.0	1.3	1.1	4.1	8.5
RIIO-ED1 Annual Average	-	-	-	1.8	1.8
RIIO-ED1 Total (8 years)	**-**	**-**	**-**	**14.1**	**14.1**

21 ESQCR regulation 17 – overhead line clearance to ground

21.1 The ESQCR specifies ground clearance requirements for overhead lines that cross roads. This is to ensure that vehicles passing under the lines have sufficient clearance without the risk of coming into contact with the lines.

21.2 Advances in line height measurements techniques allow staff to measure the height of road crossings from the side of the road. These new instruments have identified that around 20% of road crossings, mainly overhead services, are non-compliant with clearance requirements.

21.3 Overhead lines that do not meet the requirements will be rebuilt to increase the height across roads. This will require taller poles and overhead line re-conductoring.

21.4 The work to correct any shortcomings will carry on throughout DPCR5, but there will be requirement to continue into RIIO-ED1. The following table shows the costs specifically for this activity.

Legal and safety – overhead line clearance to ground expenditure (£m)					
	West Midlands	East Midlands	South Wales	South West	WPD Total
DPCR5 Annual Average	0.7	0.6	0.5	1.0	2.8
RIIO-ED1 Annual Average	1.8	1.4	1.2	2.3	6.7
RIIO-ED1 Total (8 years)	**14.2**	**11.6**	**9.3**	**18.4**	**53.5**

22 Visual amenity and undergrounding in National Parks and AONBs

22.1 WPD's geographic area includes numerous National Parks and Areas of Outstanding Natural Beauty (AONBs) e.g. the Isles of Scilly, Dartmoor, Pembrokeshire, the Cotswolds, the Peak District and the Lincolnshire Wolds.

22.2 Electricity supplies in rural areas are predominantly provided using overhead lines and this means that overhead lines are installed within National Parks and AONBs, sometimes near important sites. Many overhead lines have been in place for a long time, but there are locations, especially at popular tourist sites, where the removal of selective overhead lines can enhance the visual amenity.

22.3 Stakeholders see value in preserving the visual amenity particularly where this benefits local communities and contributes to tourism, but they do not expect expansive undergrounding of all existing lines stating that the focus should be on important areas.

22.4 WPD will continue to work collaboratively with National Parks, AONB and appropriate interest group representatives, to identify the areas that would benefit the most from the undergrounding of overhead lines. Regular discussions will be held with established steering groups to identify and prioritise projects of this kind.

22.5 The undergrounding projects undertaken during DPCR5 have made it clear that in some parts of the UK interest groups are better placed to promote works than in others parts of the UK. It is a significant task for interest groups to manage the individual projects, including those which do not eventually proceed. Some groups find the scale of the task is a barrier to benefiting fully from the programme. In WPD, this has mostly been a problem for groups in our Midlands area.

22.6 We will try to assist those who find it difficult to participate in the process or those National Parks or AONBs who have not benefitted from this initiative to date. We will work with our stakeholders in this area and we will set out our strategy in a policy document that will also make clear our approach for assessing candidate projects and for supporting and interacting with relevant stakeholders.

Undergrounding in National Parks and AONBs expenditure (£m)					
	West Midlands	East Midlands	South Wales	South West	WPD Total
DPCR5 Annual Average	0.4	0.4	0.1	0.2	1.2
RIIO-ED1 Annual Average	0.3	0.1	0.2	0.4	1.0
RIIO-ED1 Total (8 years)	**2.3**	**0.9**	**1.4**	**3.0**	**7.7**

22.7 In a limited number of instances we will underground overhead lines to improve visual amenity in areas outside AONBs and National Parks. The forecast for general visual amenity expenditure is shown below.

General visual amenity expenditure (£m)					
	West Midlands	East Midlands	South Wales	South West	WPD Total
DPCR5 Annual Average	0.1	0.1	0.1	0.1	0.4
RIIO-ED1 Annual Average	0.1	0.1	0.1	0.1	0.4
RIIO-ED1 Total (8 years)	**1.1**	**1.1**	**0.8**	**0.8**	**3.8**

23 Oil pollution mitigation

Reducing leakage from fluid filled cables

23.1 The design of very high voltage underground cables has evolved over many years and our new cables use a solid plastic insulation. Old designs of 33kV and higher voltage cables used insulation oil inside the cable. Although these cables are normally very reliable, if they are damaged the oil may leak out. The oil is biodegradable in the long-term, but leaks can cause short term environmental damage to land use and water courses.

23.2 The cables are monitored so that we can respond quickly in the event of leaks. Pressure gauges connected to the cable monitor fluid pressure and send alarm signals to control centres when the pressure falls below set thresholds. When alarms are raised, staff are dispatched to make arrangements to top up the oil level. Where the level continues to fall, leak location is instigated.

23.3 Traditional methods of leak location can be slow and expensive. They use liquid nitrogen to freeze the oil so as to determine which side of the frozen position is leaking. This process is combined with pressure calculations to determine where the leak is and usually has to be repeated several times to locate the leak.

23.4 WPD has developed an innovative technique to help pinpoint leaks more quickly, thereby reducing the amount of oil lost in the environment before a cable is repaired. We have been trialling a new techniques called PFT tagging. A tiny amount of perflurocarbon tracer is added to the fluid in the cable and if a leak occurs it can be detected from pavement level with a sensitive detector. This helps to locate a leak quickly and to within a few metres, reducing both the amount of fluid leaking into the environment and the extent of any related excavation. The programme of tagging will be extended to all fluid filled cables that have a history of leakages.

23.5 In addition, the asset replacement programme will target the replacement of the 1% of cables that have the highest leak rates, especially where the leaks are due to the deterioration of the cables.

Oil pollution mitigation from fluid filled cables expenditure (£m)					
	West Midlands	East Midlands	South Wales	South West	WPD Total
DPCR5 Annual Average	0.0	0.0	0.1	0.3	0.4
RIIO-ED1 Annual Average	0.2	0.3	0.1	0.1	0.7
RIIO-ED1 Total (8 years)	**1.8**	**2.3**	**0.8**	**0.6**	**5.5**

Oil pollution mitigation – bunding on operational sites

23.6 A light oil is used in UK DNOs' plant for insulation and for cooling. It is found in all transformers and in older switchgear on the network. At primary sites and above, the transformers hold a significant volume of oil.

23.7 There is the risk that this oil could leak out as a result of a catastrophic failure of the plant item, vandalism or theft.

23.8 At primary sites where the volume of oil used is higher, transformers are bunded so that any loss of oil is contained on the site.

23.9 During RIIO-ED1, bunds that have deteriorated and are no longer effective will be repaired or rebuilt as necessary.

Oil pollution mitigation on operational sites expenditure (£m)					
	West Midlands	East Midlands	South Wales	South West	WPD Total
DPCR5 Annual Average	1.2	1.6	0.2	0.6	3.6
RIIO-ED1 Annual Average	0.1	0.1	0.0	0.1	0.3
RIIO-ED1 Total (8 years)	**0.6**	**0.6**	**0.3**	**0.5**	**2.0**

Oil pollution mitigation – non-operational sites

23.10 At non-operational sites such as local area depots there is a risk associated with the storage of equipment containing oil. Oil will be found within new equipment (e.g. distribution transformers), old equipment that has been returned from operational sites following replacement or failure as well as the barrels of insulating oil used during switchgear maintenance.

23.11 Each depot has an environmental management plan detailing local procedures for dealing with oil and identifying specific environmental considerations such as outfalls into water courses or public drains. Bunded storage areas are used for returned equipment and interceptors are installed between the site and discharge points to capture any oil in the event of an uncontrolled spill.

23.12 Non-operational sites have long-established procedures and systems to deal with oil pollution. As many of the West Midlands and East Midlands sites were extensively refurbished in 2011 and 2012 the further measures required in RIIO-ED1 are limited and the majority of costs incurred in RIIO-ED1 will be to undertake routine inspection, maintenance and interceptor cleaning. No capital expenditure is therefore proposed for the RIIO-ED1 period.

Oil pollution mitigation expenditure summary

Oil pollution mitigation expenditure (£m)					
	West Midlands	East Midlands	South Wales	South West	WPD Total
Fluid filled cables	1.8	2.3	0.8	0.6	5.5
Operational sites	0.6	0.6	0.3	0.5	2.0
Non-operational sites	0.0	0.0	0.0	0.0	0.0
Total	**2.4**	**2.9**	**1.1**	**1.1**	**7.5**

24 Sulphur Hexafluoride (SF_6) losses

24.1 Sulphur Hexafluoride (SF_6) is a gas which is used throughout the electricity industry as an insulation medium in switchgear. The use of SF_6 has has allowed switchgear to be designed into smaller packages, reducing the amount of materials used in the production of switchgear and reducing the physical space needed to build a substation. Although SF_6 has excellent insulating properties, it is a potent greenhouse gas. There is no suitable replacement for this gas at distribution voltages and so it remains in widespread use in the electricity industry.

24.2 When switchgear containing SF_6 is retired from the network, the gas is recovered and recycled in the same way as gas is recovered from old fridges. We are actively supporting research into the replacement of SF_6 as an insulant with the switchgear manufacturing industry.

24.3 During DPCR5 we have been replacing items of switchgear that have proved to be prone to leaks. This includes specific types of pole mounted switchgear with small amounts of gas and larger 132kV substation equipment with large volumes of gas. As this type-specific replacement programme comes to an end, there is currently no next make or model of switchgear that requires a specific targeted replacement programme. In RIIO-ED1, we plan to implement a “leak and replace” regime on 11kV distribution assets and a “three leaks and replace” regime on larger or higher voltage assets.

24.4 The replacement of SF_6 filled switchgear will be carried out under asset replacement so there are no specific additional costs within the environmental expenditure area.

25 Reducing technical losses

What are losses?

25.1 The amount of energy that enters an electricity network is usually greater than the amount that is delivered to customers. The principal reason for this is that an electricity network uses energy in the process of delivering power to customers. This is known as a technical loss.

25.2 Another reason for electricity losses is where there is no meter or supplier at the final connection to record the usage. There are situations where a connection has been made to our system without authority. The energy used in these connections is not metered and does not feature in volumes that suppliers register. As a result it is shown as a loss on our network. This is known as theft in conveyance or illegal abstraction.

25.3 All Distribution Network Operations (DNOs) are obliged to run an efficient and economic system as a condition of their Distribution Licence. Losses are one measure of this efficiency. In addition to the requirements of the Licence, reducing losses is also a key part of the WPD strategy to help us manage our carbon footprint.

Technical losses

25.4 Of the amount lost, a fixed amount is lost dependent upon the network itself, irrespective of the usage of the network and then a further amount is lost depending on the level of load on the network. The energy lost as a result of the network and its usage is usually called “technical losses”. This can further be categorised into fixed losses and variable losses. Variable losses will change as load alters on the network and is further impacted by the effect of network imbalance or power factor.

Fixed losses

25.5 The fixed element of losses is made up of the energy which is required when transformers are energised. As transformers require electrically produced magnetic fields to operate the energy used creating these fields is essentially fixed while they are switched on.

Variable losses

25.6 The variable element of losses is created due to the heating effect of energy passing through cables and wires. These conductors all have a small resistance and when currents are passed through they heat up. This heating effect is logarithmic and the effect of high load (when an item of equipment is running near or at full capacity) is very much more significant than in an item which has a low or part load.

25.7 The resistance of a cable reduces as its cross sectional area increases so the effect of losses is reduced in larger cable sizes. There is a very similar variable element created through the wires and windings which are found in all transformers.

Imbalance

25.8 A network which is not balanced across all three phases will have higher currents than expected in at least one phase. Due to the logarithmic relationship to variable losses, these higher currents can have a significant effect on losses.

25.9 Imbalance is found on all parts of the network due to customers using one or two phases having different load consumptions. In order to rebalance the network there are physical actions that are required on the network. For example, a rural high voltage overhead network could be rebalanced relatively simply by moving the overhead service connection to a different

phase of the overhead main. This is more difficult on an urban underground low voltage network which requires existing service joints to be excavated and new joints made to move customer supplies to different phases.

Power factor

25.10 Another characteristic which will increase losses by increasing currents on the network is the power factor. Where the power factor is less than unity the current has to increase to deliver the required amount of power. This has historically been an issue for installations used by industrial and commercial customers where most motor loads or power electronic loads were seen. Developments in domestic power electronics and the adoption of heat pumps means we will start to see this issue on our domestic networks.

Theft in conveyance

25.11 The detection of situations where there is no registered supplier at a final connection point or no meter installed is very difficult. Often detection comes as a result of investigations for another reason. In many cases theft in conveyance is connected to other illegal activities, which prompt investigation and detection. The normal routine of our visits to premises and the routine of supplier visits to collect meter readings will often expose cases of theft.

Which parts of the network produce the most losses?

25.12 The distribution of electricity at low voltage produces the most losses on our network. The local network supplying electricity to properties and the transformers which support it at 11,000 volts (11kV) account for around 50% of our total losses. The 33,000 volt network (33kV) which sits behind this accounts for another 44% of losses and the higher voltages (EHV) make up the remaining 6% of the total.

Our plans for losses reduction in RIIO-ED1

Improved understanding of losses

25.13 Most of the work undertaken on losses to date has been to better understand network losses rather than the practical options for reducing losses. During the RIIO-ED1 period we will reach a stage where we can apply this knowledge to ways that we can actively reduce losses. In order to see the effect of reducing losses we need to be able to set a baseline of current losses. We plan to do this by using the established highly monitored network in South Wales which supported the Low Carbon Network Fund (LCNF) LV Templates project.

25.14 The LV Templates project provides us with a monitored network covering a wide area of South Wales. It can measure the power supplied into this network at HV and also measure the power delivered from the LV substations. The losses in this section of network will be due to technical losses, as inaccuracies caused by illegal abstraction or meter data issues generally occur at LV. We will investigate ways of extrapolating this data to provide reliable loss baselines for different network types.

Addressing losses in transformers

25.15 To reduce the variable losses in a transformer the resistance of the wires needs to be decreased, which can be done by increasing the cross sectional area of the wires or using materials with a lower resistance. To reduce the fixed losses the efficiency of the magnetism needs to be improved, which can be done by using materials with better magnetic properties.

25.16 Improving both of these elements can result in much bigger transformers. Many of the transformers that we buy are installed as replacements for existing units and so it is usually not

possible to fit larger transformers into the space vacated by their predecessors. We have worked with manufacturers to develop more efficient transformers which retain the same footprint and dimensions as existing units, but since these are significantly more expensive they have not been used.

25.17 The EU are considering a regulation to implement Directive 2009/125/EC regarding the Ecodesign of electrical equipment and if introduced this would lead to a requirement for us to install more efficient transformers. These units are much more expensive and at larger distribution substation level can lead to a doubling of the cost of a transformer. We have not incorporated these increased costs into the forecast because it is uncertain when the regulations would be implemented. We will manage the risk of the impact of the new legislation and therefore do not require an additional uncertainty mechanism.

25.18 The variable losses in a transformer are much lower when the unit is partially loaded and increase greatly as a unit becomes fully loaded. It is therefore possible to reduce the overall losses by oversizing transformers when they are installed. It is not appropriate to do this in all cases, because the societal benefit alone arising from reduced losses is not sufficient justification for the expenditure. However there is a case for oversizing transformers in a targeted way and benefitting from a short term reduction in losses. Using data from the CSE we forecast that there is around 7% of our network where the uptake of LCTs would be likely and the investment to oversize transformers can be justified. We would aim to oversize 109 transformers per annum at a cost of around £0.11m per annum.

Addressing losses in cables

25.19 To reduce the variable losses in a cable the cross sectional area of the conductors needs to be increased. Once a cable is laid and the ground is reinstated, it is uneconomical to make alterations to the cable. Our opportunity to reduce losses only exists at the time that the cable is initially installed. The resistance of a 185mm^2 low voltage cable is around half that of its 95mm^2 equivalent. The additional cost of the cable is less than £10 per metre which is marginal compared to the excavation costs which can be between £50 and £100 per metre.

25.20 Whilst this cost is marginal, it is not appropriate to oversize cables in all of our work. Assuming that 7% of the network will be subject to LCT hotspots, using larger cable in these situations would lead to around 75km per annum being installed with a higher rating and lower losses. The incremental cost is £0.31m per annum.

Network design

25.21 We have completed research into losses with Imperial College and SOHN Associates. The early indications are that we can address losses on new developments by reducing the number of customers per substation and also by increasing the size of the service cables.

Asset replacement

25.22 The majority of our network is already established and there is no cost benefit in replacing it wholesale purely as a method of reducing losses. When we add new assets to the network or replace existing ones we do have an opportunity to consider the effect of losses and take them into account. We have used research from the CSE to show us areas of our network that are highly likely to see an increase in demand as a result of LCTs.

Demand side management (DSM)

25.23 Due to the logarithmic nature of variable losses, assets working at their maximum capacity will lead to significantly more losses than those with a reduced loading. The scale of variable losses can therefore be reduced by simply reducing the demand on the network or by reconfiguring networks to transfer loads from highly loaded circuits to lower loaded circuits.

25.24 In our Lincolnshire Low Carbon Hub, FALCON and FlexDGrid LCNF projects we are trialling methods to monitor and automatically reconfigure networks. Where these networks can be meshed (operated in parallel) and loads transferred it will be possible to reduce the overall losses. We will identify areas of our network where the techniques can be replicated.

Imbalance and power factor

25.25 We are developing a project with a solar generation customer that will investigate the feasibility of addressing imbalance and power factor issues on the 33kV network. The project will use the customer's inverter equipment to alter the phase angle of the generated power. It will also use local storage to set the generated power per phase to reduce overall network imbalance. The storage can also be used to manage the overall utilisation of the network.

Theft in conveyance

25.26 Theft of electricity from our network adds to the level of recorded losses, but is difficult to detect exactly where it is occurring.

25.27 The majority of methods available to detect theft in conveyance relied on visits to the premises to establish the theft. It has not been easy to complete a desktop office based survey of our network to establish which properties were connected to the network and had a registered electricity supplier and those which were not.

25.28 We plan to use the "addresspoint" standard to produce a list of premises which do not have an electricity supply registered to them. By starting from the assumption that most premises in the UK have an electricity supply, we can use this list to establish a subset of premises without a registered supply and which would require a physical inspection. This desktop analysis will make the targeting of potential theft a much more efficient system.

Expenditure

25.29 We propose to cover the cost of the larger size assets through efficiency savings. We therefore have not requested any specific allowances for this activity.

26 Installation of noise/vibration barriers

26.1 Substation assets can be close to residential properties. In some cases, customers find the humming noise from transformers disturbing or equipment may be prone to vibration. This disturbance can be transmitted through the air or via the ground. Simple solutions, such as damper pads, can be installed under transformers, but in some cases more extensive noise barriers/deflectors are erected. Where the equipment is noisy, asset replacement may be carried out especially if other poor asset condition is evident.

26.2 There are rare occasions where customers have built extensions to properties close to substation boundaries that cause the transfer of vibration through building foundations. In these cases it may be necessary to install foundation isolation to limit the transfer of vibration.

Noise mitigation expenditure (£m)					
	West Midlands	East Midlands	South Wales	South West	WPD Total
DPCR5 Annual Average	0.0	0.0	0.0	0.3	0.3
RIIO-ED1 Annual Average	0.1	0.1	0.0	0.1	0.3
RIIO-ED1 Total (8 years)	**0.6**	**0.6**	**0.3**	**0.5**	**2.0**

Network operating costs

27 Inspection and maintenance

Legal obligations

27.1 WPD has a legal obligation to maintain the safety and reliability of the assets that constitute the electricity distribution networks. These legal obligations are contained in the:

- Electricity Safety, Quality and Continuity Regulations (ESQCR) 2002;
- Electricity at Work Regulations 1989; and
- Health and Safety at Work Act 1974.

Inspection and maintenance objectives

27.2 WPD owns and operates an extensive network of assets that have a long working life, with many lasting over 40 years. These lifetimes are achieved by inspecting and maintaining the assets to ensure that they remain in safe operational condition.

27.3 The objectives of inspection are to identify safety and security issues and check the condition of assets.

27.4 The objective of maintenance is to leave the equipment in a condition that will keep it safe and operational until the next maintenance.

Inspection and maintenance strategy

27.5 WPD's overall inspection and maintenance strategy is to:

- undertake proactive time based inspection and maintenance interventions that facilitate the delivery of lowest life time costs;
- collect and record asset "as found" condition data when inspection and maintenance tasks are undertaken. This condition data is subsequently used to inform future interventions, such as reactive maintenance, enhanced inspections, asset refurbishment and asset replacement at the end of the asset's life;
- undertake reactive actions to remedy defects identified during time based inspections.

27.6 WPD's policy documents detail all of the elements of inspection and maintenance required to manage the electricity network. When read together they become the "workshop manual" for maintaining a network.

Life-time cost minimisation

27.7 WPD's maintenance frequencies have been optimised by the consideration of:

- content of maintenance interventions;
- failure mode analysis;
- long run asset condition data;
- knowledge of the deterioration of assets;
- Reliability Centred Maintenance studies;
- the range of maintenance practices in the four DNOs that now comprise the WPD Group.

27.8 We have undertaken research work that has allowed us to determine maintenance activities and their frequency such that we preserve asset condition but do not undertake additional unrequired maintenance tasks.

27.9 An example of this is our investigation of the maintenance intervals that should be applied to certain types of oil filled 11kV switchgear. This switchgear is found in many distribution substations on our network and, in some cases, is only operated on a very small number of occasions between maintenance visits. The main focus of the maintenance is the oil insulation and the switch contacts and with the low level of usage, should remain in a very good condition throughout their lifetime.

27.10 We began to investigate the potential to extend the maintenance intervals from the standard of 12 years. Some selected items of switchgear were left on the network without maintenance being carried out, but were subject to annual oil sampling and analysis to ensure that the integrity of the oil and switch remained intact. This sampling approach has allowed us to move the maintenance interval on this switchgear to 18 years. Some of the switchgear remains on the network for further testing and analysis to establish if the maintenance intervals can be extended further.

WPD asset management system

27.11 We use an in-house asset management system (called CROWN) to manage the inspection and maintenance for all our assets. Although CROWN is our asset database, the system also holds site risk data which is used to increase maintenance and inspection frequencies where there are increased risks e.g. evidence of vandalism.

27.12 Condition data and test results collected on site are recorded in the CROWN system, and these are used with the other asset data to inform condition based replacement requirements.

27.13 When an asset is commissioned in CROWN, the tasks for its first inspection and maintenance visits are generated. This ensures that there is always a record of the work that needs to be completed and allows forward work programmes to be established. When tasks are completed in CROWN, the next task based on interval or condition is applied.

Increases in inspection and maintenance activity

Electronic systems on switchgear

27.14 As networks become more automated there is a greater amount of electronic control equipment in use. Although the maintenance of the actual switchgear is becoming less frequent there is a need to check the automatic actuators, radios and control equipment fitted on the switchgear. This electronic computer based equipment requires testing to ensure it works correctly and whether backup batteries need to be changed. It is also very likely that the computer systems will become redundant and require replacing within the lifetime of the electrical asset.

27.15 Our maintenance tasks will change to include more site visits for testing and reprogramming of electronic control equipment.

Cutouts

27.16 The smart meter roll out provides an opportunity to gain information about the condition of cut-outs and service position equipment.

27.17 We will work with suppliers and their meter operators to capture information about the cut-out, its condition and location, which will help influence condition assessment decisions.

27.18 We will establish a record of this data in our asset register and will supplement it with data provided when new cutouts are installed and when cutouts are visited as a part of our works. Our register will include details of cutout type, fuse size, age, service type and earthing.

Oil regeneration in transformers and tapchangers

27.19 Maintenance of transformers and tapchangers will normally only require oil to be replaced in the tapchanger units. For certain transformers, using a criteria based on age and condition, it is beneficial to recondition (or regenerate) the oil within the main transformer body. The transformer oil is taken from the unit on site and passed through processes to clean it and add an inhibitor. The oil is then replaced into the transformer.

27.20 This process does not improve the health index of the transformer as the physical condition of the transformer is not altered. The regeneration processes improves the condition of the oil by removing moisture and acidity that degenerates the insulation and can extend the life of the asset by around 10 years.

Inspection and maintenance expenditure

27.21 The table below provides a summary of WPD inspection and maintenance expenditure for DPCR5 and RIIO-ED1:

Inspection and maintenance expenditure (£m)					
	West Midlands	East Midlands	South Wales	South West	WPD Total
DPCR5 Annual Average	12.8	12.0	5.7	6.5	37.0
RIIO-ED1 Annual Average	8.0	7.2	4.1	5.4	24.8
RIIO-ED1 Total (8 years)	**64.2**	**57.6**	**33.0**	**43.5**	**198.4**

28 Tree cutting to meet industry standard requirement ENA TS 43-08

Overall Objectives

28.1 Overhead lines are susceptible to damage from growing trees, falling trees and windborne vegetation. Climbable trees near overhead lines also pose a danger where physical contact with conductors is possible. Tree clearance is therefore carried out to reduce the risk of injury to the public and to prevent damage causing interruptions to supply. Clearance distances are specified within industry standard ENA TS 43-8, which requires a minimum of 3m clearance for climbable trees and 0.8m for all others.

Options for maintaining tree clearance

28.2 The majority of tree cutting is a cyclical activity that clears sufficient length from trees to maintain minimum clearance distances between cuts. The activity requires due recognition of different growth rates of tree and shrub species. Tree felling removes the need for repetitive visits, but this is often not acceptable to customers or landowners.

28.3 Where tree preservation orders exist or customers place a high value on the presence of trees, permission to cut may not be granted or severely constrained. Statutory powers are available to oblige the cutting of trees, but WPD favours a collaborative approach with customers. In some cases the cut achieved may not be adequate to maintain clearance distances until the next cyclical cut, so repeat visits and additional cuts may be required.

28.4 Alternatives to cutting the trees include replacing open wire LV lines with Aerial Bundled Covered Conductor, diverting lines (assuming alternative wayleaves can be obtained) or replacing the overhead lines with underground cables. Tree cutting remains the most practical and effective alternative in most cases.

Tree cutting policy

28.5 In South Wales and South West proactive tree cutting programmes associated with 132kV, EHV and HV overhead lines have been in place for many years and is carried out every five years. Prior to 2005/06, tree cutting associated with LV overhead networks was undertaken on a reactive basis. In 2005/06, a proactive tree cutting programme was introduced, on the basis of a seven year cycle. This cycle will be reduced to five years in RIIO-ED1 to make all tree clearance cycles consistent.

28.6 In West Midlands and East Midlands, prior to 2005/06, all tree cutting was undertaken on a reactive basis. The consequence of this reactive approach was that a significant tree cutting backlog had developed. During 2005/06 proactive tree cutting programmes associated with 132kV, EHV and HV overhead line networks were introduced in order to address the tree cutting backlog. Following acquisition by WPD, cyclical tree clearance was implemented at LV to clear the remainder of the backlogs by the end of DPCR5.

28.7 During the RIIO-ED1 period, all cutting in all areas will be completed using a cyclic approach with all voltages being on a five year cycle.

Forecast activity levels

28.8 The current plan is to clear the tree cutting backlogs in West Midlands and East Midlands by the end of 2014/15.

28.9 As stated above, from the start of the RIIO-ED1 period, all circuits will be inspected and cut every five years. Our contractors will inspect each span and either declare it clear of tree proximity or undertake cutting to achieve the required clearance. In the majority of cases, and especially where the circuit has been previously cut, most of this work can be carried out without the need to switch the power off and affect customers' supplies.

28.10 The forecast annual number of spans to be cleared to ENA 43-8 requirements is shown in the table below.

Annual average number of spans to be cut in RIIO-ED1 for ENA 43-8 requirements					
Overhead line voltage	**West Midlands**	**East Midlands**	**South Wales**	**South West**	**WPD Total**
LV	10,550	8,753	7,925	19,868	47,241
HV	13,089	7,409	13,273	14,705	48,476
EHV	1,017	920	1,182	1,567	4,681
132kV	335	448	363	367	1,510

Expenditure forecast

28.11 The table below provides a summary of WPD tree cutting to meet industry standard ENA 43-8 requirements for DPCR5 and RIIO-ED1:

Tree cutting – ENA 43-8 expenditure (£m)					
	West Midlands	**East Midlands**	**South Wales**	**South West**	**WPD Total**
DPCR5 Annual Average	13.1	9.3	7.0	9.2	38.6
RIIO-ED1 Annual Average	5.7	4.2	5.7	7.9	23.5
RIIO-ED1 Total (8 years)	**45.5**	**33.6**	**46.0**	**63.2**	**188.2**

29 Tree clearance to meet industry standard requirement ETR 132

29.1 Following the storms of October 2002, where some customers were left off supply for up to five days, the government embarked on changing legislation to drive DNOs to prevent supply interruptions caused by trees. The changes required DNOs to operate progressive tree cutting and felling programmes to improve network performance in abnormal weather conditions. Working closely with Government, the industry developed standard ENA ETR 132 which outlines a risk-based methodology for targeting resilience tree clearance on strategic overhead line routes.

29.2 The Regulatory Impact Assessment for the amendment to the ESQCR suggested resilience clearance in accordance with ETR 132 should be applied on a modest yet progressive basis, circa 0.8% of 11kV and 33kV networks per annum resulting in 20% of the combined length of these networks meeting the ETR 132 resilient standard after 25 years (by 2034). The main rationale being 80% of issues can be resolved by applying ETR 132 to 20% of the network.

29.3 Stakeholders agree that a tree cutting programme to reduce the risk of power cuts during storms should be a high priority and more clearance should be carried out. WPD will therefore accelerate the programme to deliver the 20% within 20 years.

29.4 There is a slight backlog in the current programme and it is proposed to catch this up by the end of DPCR5. This means that 4.8% (6x0.8%) of the HV and EHV network will be resilient. This will leave 15.2% to be cleared over the following 14 years in RIIO-ED1 and RIIO-ED2.

29.5 Current resilience volumes and cost forecasts are aligned with this requirement and the cutting will primarily be focused on the complete 33kV network and strategic 11kV interconnecting circuits.

Tree cutting – ETR 132 expenditure (£m)					
	West Midlands	**East Midlands**	**South Wales**	**South West**	**WPD Total**
DPCR5 Annual Average	1.3	0.7	1.0	0.8	3.8
RIIO-ED1 Annual Average	2.0	1.8	1.6	2.3	7.6
RIIO-ED1 Total (8 years)	**15.6**	**14.0**	**12.9**	**18.1**	**60.6**

30 Trouble call (faults)

Background

30.1 Although investment programmes seek to minimise their likelihood, there will inevitably still be network faults. Fast and effective fault response is paramount to minimising the impact of supply interruptions.

30.2 WPD uses network automation and additional network protection to reduce the number of customers affected by a fault and the length of time that those customers who are affected are without power. These devices and associated communication infrastructure enable remotely controlled switching, thereby speeding up network reconfiguration during fault switching.

30.3 When faults occur the priority is the restoration of supply so that customers experience minimal inconvenience. Staff are mobilised quickly and internal target mechanisms (e.g. Target 60 - the WPD target to restore as many customers as possible within one hour of an HV fault) are used to drive improvements in response and restoration. Local teams with local knowledge based at local depots respond quickly to faults.

30.4 Fast response minimizes the duration of interruptions, particularly where all supplies are restored following transient faults that cause fuses or circuit breakers to operate.

30.5 Where permanent faults are found the focus remains on supply restoration. Where appropriate, generators and temporary arrangements are provided to restore supplies when a quick repair is not possible. Additional mobile generation will be used during RIIO-ED1 to reduce the number of customers affected by faults lasting longer than 12 hours.

30.6 WPD carries stocks of replacement items so that if repairs are required the network can be rebuilt quickly. Some items are held locally, others within central stores and some are subscribed to via spares clubs.

30.7 Under regulatory reporting there are two main categories of Trouble call activities: incidents covered by the Interruption Incentive Scheme (IIS) and Occurrences Not Incentivised (ONIs).

Incidents under IIS

30.8 The majority of incidents that cause customers to go off supply are included within the IIS (the minor exception being incidents at cut-outs). The extensive nature of the network means that there are around 50,000 incidents each year that are incentivised under IIS.

30.9 The investment programme in the Business Plan has been designed to keep the volume of incidents broadly the same over the DPCR5 and the RIIO-ED1 period, albeit there will be annual variations caused by different weather conditions.

30.10 Some reduction to overhead line faults will result from proactive tree clearance across all voltages.

30.11 The expenditure for IIS incidents includes assets replaced following a fault and remedial action following metal theft that causes interruption to supply.

Expenditure on Trouble call incidents incentivised under IIS (£m)					
	West Midlands	East Midlands	South Wales	South West	WPD Total
DPCR5 Annual Average	26.8	28.3	10.5	19.7	85.3
RIIO-ED1 Annual Average	23.9	28.2	9.6	18.1	79.8
RIIO-ED1 Total (8 years)	**191.0**	**225.3**	**76.8**	**144.8**	**637.9**

Occurrences not incentivised

30.12 Occurrences not incentivised (ONIs) are situations where WPD staff have to attend site in response to reports from customers made via the contact centre. They include where customers have a problem with the supply but they are not off supply (such as reports of flickering lights), call outs to reports of potential break-ins to substations, falling trees that might be near electricity equipment, damaged gates or access doors.

30.13 Each year there are around 80,000 ONIs where some form of site visit is required. The costs of this response and the associated repairs to the network are shown below.

Expenditure on ONIs (£m)					
	West Midlands	East Midlands	South Wales	South West	WPD Total
DPCR5 Annual Average	4.7	3.8	1.5	2.7	12.7
RIIO-ED1 Annual Average	3.8	2.6	1.7	2.3	10.4
RIIO-ED1 Total (8 years)	**30.0**	**20.9**	**13.3**	**18.5**	**82.7**

Total expenditure

30.14 The total expenditure for trouble call is shown below.

Total Trouble call expenditure in RIIO-ED1 (£m)					
	West Midlands	East Midlands	South Wales	South West	WPD Total
Incentivised incidents	191.0	225.3	76.8	144.8	637.9
ONIs	30.0	20.9	13.3	18.5	82.7
Total gross expenditure	**221.0**	**246.2**	**90.0**	**163.3**	**720.6**
Cost recoveries	(23.7)	(16.7)	(3.3)	(7.5)	(51.2)
Total net expenditure	**197.3**	**229.5**	**86.7**	**155.8**	**669.4**

30.15 Net expenditure after cost recoveries (e.g. for cable damages) is funded through DUoS. The following table summarises the DPCR5 and RIIO-ED1 net expenditure.

Total Trouble call net expenditure (£m)					
	West Midlands	East Midlands	South Wales	South West	WPD Total
DPCR5 Annual Average	28.6	30.4	11.6	21.4	91.9
RIIO-ED1 Annual Average	24.7	28.7	10.8	19.5	83.7
RIIO-ED1 Total (8 years)	**197.3**	**229.5**	**86.7**	**155.8**	**669.4**

31 Responding to 1 in 20 year storms

31.1 The South West and South Wales coasts are regularly buffeted by prevailing south-westerly winds and the network is constructed to withstand these weather conditions.

31.2 Each year there are periods of poor weather where storms can lead to network damage, but generally the impact is dealt with quickly even though activity levels are several times normal daily volumes. The impact of these storms may be classes as exceptional events, but the effects are generally dealt with by using WPD staff.

31.3 In very rare cases, the magnitude of the storms can be very severe leading to widespread network damage that requires additional resources to be drafted in from other DNOs to assist in the restoration of supplies. These rare events are known as 1 in 20 year storms.

31.4 Whilst the increased size of WPD helps us to lower our reliance on other DNOs (as we would normally be able to redirect resources internally), the costs for network repairs can be very high. The following table shows the forecast cost for 1 in 20 year storms. The costs have been derived from 8/20th of the estimated cost of a 1 in 20 year event.

1 in 20 year storm expenditure (£m)					
	West Midlands	East Midlands	South Wales	South West	WPD Total
RIIO-ED1 Total (8 years)	**12.6**	**12.6**	**6.3**	**10.3**	**41.8**

Strategic spares

31.5 The failure of major items of equipment can affect the supplies to thousands of customers.

31.6 Over the many years that the network has developed, a wide variety of different assets have been installed and it is not possible to keep spares for all possibilities. This is especially the case for older cable networks, using gas and oil insulated designs that require bespoke repair joints which are only very rarely used.

31.7 For specialised cables and fittings it is proposed to remain a part of the 'spares club' which is managed by National Grid on behalf of the member DNOs. This is a more cost effective way of having access to materials when compared to holding a dedicated stock of equipment.

31.8 Items like transformers are high in value and have long lead times from manufacturers. It is proposed to continue to hold a range of larger transformers in reserve to ensure we have the ability to effect a quick replacement in the case of a failure. This will effectively be a buffer stock where transformers for projects are pre-ordered and available ahead of projects being carried out. This allows them to be available for when a fault occurs but ensures that they do not become redundant as they will be used for routine investment works.

31.9 We will also retain a selection of containerised emergency switchboards at 11kV and 33kV which can be quickly deployed as required in the case of a catastrophic failure of a substation.

32 Other network operating costs

Substation electricity costs

32.1 WPD has contracts in place for the purchase of unmetered electricity consumed at substations. Forecasts assume that expenditure levels will continue in line with current levels; approximately £6m per annum across the WPD Group.

32.2 Future electricity prices are assumed to rise in line with the retail price index.

Substation electricity expenditure (£m)					
	West Midlands	East Midlands	South Wales	South West	WPD Total
DPCR5 Annual Average	1.9	2.2	1.0	0.7	5.8
RIIO-ED1 Annual Average	1.8	2.3	0.9	0.7	5.7
RIIO-ED1 Total (8 years)	**14.4**	**18.3**	**7.4**	**5.5**	**45.6**

Remote location generation

32.3 There are two locations within WPD where the provision of permanent standby generation is needed to provide security of supply to remote networks.

32.4 In South Wales the generation provides security of supply support to the single transformer 33kV substation at Tregaron where there is only limited 11kV interconnection.

32.5 In South West the generation provides security of supply support to the Isles of Scilly, which are connected to the mainland by a single 58km long 33kV submarine cable.

32.6 Although actual costs are subject to the fluctuations in fuel costs, the forecast for operation and maintenance of these generators remains in line with current costs at approximately £1m per annum.

Remote generation expenditure (£m)					
	West Midlands	East Midlands	South Wales	South West	WPD Total
DPCR5 Annual Average	0.0	0.0	0.1	1.0	1.1
RIIO-ED1 Annual Average	0.0	0.0	0.1	1.0	1.1
RIIO-ED1 Total (8 years)	**0.0**	**0.0**	**0.8**	**7.9**	**8.7**

Dismantlement

32.7 In limited situations assets are dismantled, permanently removed and no alternative assets are installed. This can arise where there is no longer a need for an electricity supply or where the progressive development of the network renders other parts as being unnecessary.

32.8 Expenditure within this category is low within South West and South Wales at around £0.1m per year, but within the Midlands, where there is more change of land usage, cost are approximately £1m per annum.

32.9 Historical averages have been used to forecast future costs and no forecast increases have been projected.

Dismantlement expenditure (£m)					
	West Midlands	East Midlands	South Wales	South West	WPD Total
DPCR5 Annual Average	0.5	0.5	0.0	0.1	1.1
RIIO-ED1 Annual Average	0.7	0.7	0.1	0.1	1.5
RIIO-ED1 Total (8 years)	**5.2**	**5.2**	**0.8**	**0.8**	**12.0**

Total expenditure on other network operating costs

Substation electricity, remote generation and dismantlement RIIO-ED1 (£m)					
	West Midlands	East Midlands	South Wales	South West	WPD Total
Substation electricity	14.4	18.3	7.4	5.5	45.6
Remote location generation	0.0	0.0	0.8	7.9	8.7
Dismantlement	5.2	5.2	0.8	0.8	12.0
Total	**19.6**	**23.5**	**9.0**	**14.1**	**66.2**

Closely associated indirect costs

33 Introduction

33.1 The costs of physically carrying out the work on the network are included in the Network Investment sections. This 'direct' work could not go ahead without the support of other 'indirect' engineering management activities such as planning, project management, system records, stores and transport. The expenditure in these support areas is classified as closely associated indirect (CAI) costs.

33.2 Ofgem has suggested that there are eleven categories of CAIs some of which vary in line with work volumes and others that remain broadly static.

33.3 The CAIs that vary with work volumes represent the activities that exist to solely support the delivery of direct activities. They include:

- network design and engineering;
- project management;
- vehicles and transport;
- operational training;
- small tools, equipment, plant and machinery.

33.4 The CAIs that represent the activities that more broadly support the delivery of work and are essentially fixed costs incurred irrespective of the volume of work include:

- engineering management and clerical support (including wayleaves payments);
- control centre;
- contact centre;
- stores;
- network policy;
- system mapping – cartographical.

33.5 The costs for vehicles and transport CAIs are described in the section for vehicles, IT, property and tools. This is to allow comparison of the operational costs of maintenance and hiring vehicles against purchase of vehicles under non-operational capital.

33.6 Small tools, equipment, plant and machinery are also described in the section for vehicles, IT, property and tools.

33.7 Operational training includes workforce renewal and training of additional staff for higher work volumes. The potential requirements for new recruits, training and training facilities are described separately, after the other closely associated direct costs.

33.8 Whilst expenditure for dealing with Traffic Management Act costs for road works are included within the direct costs described under investment, a summary of the impact of these costs and the potential increases to these costs is included towards the end of this chapter.

33.9 The following table summarises the engineering management closely associated indirect costs that are forecast for RIIO-ED1.

Engineering management expenditure RIIO-ED1 (£m)					
	West Midlands	East Midlands	South Wales	South West	WPD Total
Network design and engineering	34.9	34.3	16.5	24.3	110.0
Project management	51.5	49.5	24.6	39.4	165.0
System mapping	11.4	11.6	5.7	9.4	38.0
Engineering management and clerical support	122.7	126.5	64.8	85.8	399.7
Control centre	32.2	33.2	18.2	26.4	110.0
Contact centre	10.9	10.9	5.5	9.0	36.3
Stores	20.5	20.4	10.3	16.8	68.0
Network policy	4.4	4.5	2.2	3.6	14.8
RIIO-ED1 Total (8 years)	**288.5**	**290.9**	**147.8**	**214.7**	**941.8**

33.10 The following sections provide more details about each of the relevant CAI costs.

34 Network design and engineering

34.1 Network design and engineering activity covers both high level planning and detailed project design up to the point of project approval.

34.2 Specific planning and design necessary for individual projects is by far the greater element of network design and engineering cost. The projects relate to all network activities and include examples such as the design for new connections, asset replacement, load reinforcement and quality of supply improvements.

34.3 Within WPD these activities are carried out by central design teams for the primary network and locally based planners (11kV planners, planners, assistant planners and craft planners) who deal with all aspects of secondary network design from substation replacement to new connections for street lights. These planning costs are directly related to the activity volumes.

34.4 High level planning includes the development of network wide analysis, demand forecasting, network modelling and identification of network deficiencies. This activity forms a small part of the network design and engineering costs and is less volatile to the levels of network investment. The costs of this element will remain broadly the same across the RIIO-ED1 period, with some growth in the analysis associated with the assessment of the impact of low carbon technology on the network.

34.5 Since the vast majority of the costs vary with work volumes, the cost forecast for the RIIO-ED1 period rolls forward the current levels of expenditure increasing them in proportion with the overall investment programme volumes.

Network design and engineering expenditure (£m)					
	West Midlands	East Midlands	South Wales	South West	WPD Total
DPCR5 Annual Average	5.4	5.5	2.6	3.3	16.8
RIIO-ED1 Annual Average	4.4	4.3	2.1	3.0	13.8
RIIO-ED1 Total (8 years)	**34.9**	**34.3**	**16.5**	**24.3**	**110.0**

35 Project management

35.1 Project management indirect expenditure relates to the activity of managing network investment projects. It covers all phases from project authorisation, work preparation, construction and physical connection through to ensuring all technical records and projects costs are updated.

35.2 The preparation phase includes the identification of resources, ordering of materials, production of work instructions, liaison with contractors and scheduling of work elements.

35.3 The construction phase requires on-site supervision of staff and contractors, tracking progress against construction timetables, checks on quality of work and liaison with members of the public that may be inconvenienced by the work.

35.4 The physical connection phase includes arranging any shutdowns, issuing of electrical safety documents, organising and carrying out commissioning tests, issuing of completion certificates and coordinating the final connection to the network.

35.5 Following construction, technical closure requires a review of the physical installation and recording of installation details. Financial closure requires the collation of all related costs and correct allocation to budget codes enabling accurate reporting.

35.6 Whilst project management does not include any direct work on the assets, the work would not be able to proceed, or be completed without it and therefore there is a clear link between the volume of work and associated project management costs. The RIIO-ED1 expenditure forecasts therefore roll forward current costs in proportion to the scale of the future work programmes.

Project management expenditure (£m)					
	West Midlands	East Midlands	South Wales	South West	WPD Total
DPCR5 Annual Average	5.6	5.9	3.0	4.3	18.8
RIIO-ED1 Annual Average	6.4	6.2	3.1	4.9	20.6
RIIO-ED1 Total (8 years)	**51.5**	**49.5**	**24.6**	**39.4**	**165.0**

36 System mapping - cartographical

36.1 System mapping - cartographical is the activity of updating network geographical records. The volume of record updating is related to the level of network investment in overhead lines, cables and new connections.

36.2 Whilst there are some fixed costs such as paying licence fees to the Ordnance Survey, other costs are dependent upon the volume of third party requests e.g. providing copies of records under NRSWA requests. It is assumed that these remain at current levels.

36.3 There are some uncertainties about the scale of records required for smart grid deployment, but the impact is assumed to be minimal. Likewise as independent connection providers start to carry out part funded reinforcement there will be an increased need to record details from and interact with third parties, but again the impact is assumed to be minimal.

36.4 It is assumed that the impact of any increased requirements will be minimal and where increases arise they will be accommodated through efficiency savings. The forecast costs for RIIO-ED1 are in line with current expenditure.

System mapping expenditure (£m)					
	West Midlands	East Midlands	South Wales	South West	WPD Total
DPCR5 Annual Average	1.6	1.5	0.7	1.1	4.9
RIIO-ED1 Annual Average	1.4	1.4	0.7	1.2	4.8
RIIO-ED1 Total (8 years)	**11.4**	**11.6**	**5.7**	**9.4**	**38.0**

37 Engineering management & clerical support

37.1 Engineering management and clerical support relates to a wide range of office based activities managing or assisting employees undertaking direct activities, but not directly involved with either planning projects or project managing.

37.2 It includes executive managers, engineering managers, work programmers, resource planners, clerical staff, steetworks administration, wayleave payments and wayleave administration.

37.3 Typical work carried out in this area is:

- Development of strategic network business plans, investment priorities, resourcing requirements, work programme planning and budgeting;
- Line management of staff undertaking direct work;
- Operational performance management including site safety and operational checks, quality compliance checks, authorisation of staff and investigation and reporting of incidents;
- Promoting health and safety policy, establishing procedures, maintenance of health and safety records and provision of advice;
- Street works administration, processing notifications, permit applications, liaison for defect repairs and processing of fines;
- Wayleave payments made to the landowners to cover the financial impact of having equipment on their land and substation rent payments;
- Wayleaves administration costs for obtaining, negotiating, managing and administering wayleaves, substation rents and easements;
- Clerical support including processing of time sheets, customer liaison, preparation of shut down notifications, updating asset inventory and condition databases, preparing plans and other general office duties to support direct activity work.

37.4 Whilst the volume of transactions may change in line with the volume of activity on the network, it is envisaged that any increased requirement will be absorbed through process improvements and efficiencies.

37.5 Significant savings have been achieved through the reorganisation of the East Midlands and West Midland to the WPD operating model and costs will be lower than those in DPCR5.

37.6 There are however two areas of activity where there will be increases in expenditure.

- there will be a requirement to administer a higher volume of service position defects as a result of the smart meter rollout. The activity and processes will be in line with existing processes and it is anticipated that the additional costs of managing this activity will be relatively small;
- there will be increases in expenditure for wayleave payments.

Wayleave costs

Background

37.7 Wayleave payments are negotiated with landowners but as WPD has approximately 800,000 wayleave agreements, we have chosen to use the 'guidance' wayleave rates recommended by the Energy Networks Association (ENA) to its members. These rates are based on statutory compensation principles and negotiated by the ENA with some of the main bodies representing landowners and tenants in England & Wales (these being the Country Landowners Association, National Farmers Union and the Farmers Union for Wales).

37.8 Annual wayleave payments (made to landowners and occupiers where WPD has assets on private land) are made up of two elements: 'owners' payment (also known as 'rental') and 'occupiers' payment (also known as 'compensation').

Owners payment

37.9 WPD pays landowners an annual sum or rent for the wayleave agreement (or licence) to keep, access and maintain equipment on private land.

Occupiers payment

37.10 WPD also makes a separate payment to the person who occupies the land (this is often the owner or could be the owner's tenant) to compensate them for the disturbance and losses which arise from WPD's equipment creating difficulties in farming or use of the land. The degree of disturbance varies depending on land use and the two predominant payments are for losses or disturbance associated with arable land use and also where land is used for grassland pasture or grazing.

37.11 The compensation payments are determined by using a well-founded methodology based on statutory compensation principles. The ENA and the bodies representing landowners use ADAS as an independent environmental and agricultural consultant to assist with setting values.

37.12 The loss and disturbance associated with arable land use is much higher than that associated with land used for pasture.

37.13 The losses on pasture, are mainly associated with the loss of grass crop and yield and the disturbance electricity equipment creates for grazing operations.

37.14 The main factors ADAS considers in assessing the loss and disturbance to the use of arable land are:

- area and yield loss – where the landowner can't grow crops in certain areas due to the obstruction of a pole or tower. This is an area which is greater than just the basic size of the pole or tower, as the size and shape of the electricity equipment will restrict the movement of arable farm machinery such as crop sprayers;
- wasted material inputs – e.g fertilisers and other materials will be wasted in the area around electricity equipment;
- weed control;
- wasted labour and fuel costs – landowners will incur additional time and effort in farming the land due to electricity equipment.

37.15 The compensation payment is therefore heavily influenced by factors affecting the above such as average inflation, but also crop and food prices as well as raw material costs such as oil, fertiliser and fuel which are subject to more volatile price changes and which have a greater affect on the occupier compensation rates than general inflation pressures.

Future increases to wayleave rates

37.16 Prior to DPCR5 and until around 2008, annual wayleave payment rates (both the owner and occupier rate) had been rising closely in line to average longer term inflation.

37.17 Since 2008, there has been an accelerated rise in annual payments and WPD has seen annual increases to its wayleave spend of between 4% and 6% per year over the last four years. This has resulted in an average rise of the wayleave payments over the last 4 years of approximately 2% above inflation. This level of above inflation increases is expected to continue into RIIO-ED1 and the average percentage above inflation is expected to increase even further by another 0.5% to 1% (over the RIIO-ED1 period). The reasons for these increases are described below.

Owners payment

37.18 The Owners payment rates (rental) recommended by the ENA were established in the mid 1990s as a combined payment reflecting statutory compensation and a commercial expediency element to ensure the right level of payment for both parties. The payments have been indexed by negotiation since then. WPD has always opted to use the recommended ENA rates to ensure good relations with landowners. This allows efficient conduct of the day to day distribution activities of accessing and maintaining equipment on private land. It also avoids the additional and unnecessary costs associated with the breakdown of relations with landowners and the ultimate need to utilise statutory powers to access land.

37.19 The rental payment has some relationship to land rents and land values and over a longer term has been rising in line with average RPI. This, to a certain extent, was convenient and made future forecasting more certain.

37.20 In recent years, farming and rural land values have seen large price increases and the prediction is that this will continue. In the last 5 years, the rental element of the wayleave payments has risen by up to 0.5% above the average RPI for the same period.

37.21 The prediction for the coming years is that annual owners (rental) payment increases will continue to exceed inflation. Land value and rents are influenced by a shortage of land, growing populations and increasing demand for food, both in the UK and across the world. There is also a continuing keen demand for agricultural land as an investment. In addition land use is changing, with more and more agricultural land being used for solar farms and energy crops to support UK targets for carbon reduction.

37.22 Agricultural land values have increased by 200% in the last decade (source Knight Frank & Savills) and there was an approximately 8% rise in arable land values in 2012 (according to Savills). A 10% year on year increase is predicted to 2015 (£7.5k/acre in 2012 to £10k/acre in 2015) according to Strutt & Parker (FT article 2012) although in some areas an average £10k/acre has already been reached.

37.23 Farm rents for arable land also rose by 8 to 10% per year over the period 2008 to 2010 (source: Defra). Between 2007-11 the average rise has been 24% for arable land rents (source: Smith Gore).

37.24 Whilst wayleave owners payments are not expected to rise at the same rate (as they are a combination of inflation and land value factors), the high increases in land values and rents is expected to continue the upwards pressure on the payments.

Occupiers payment

37.25 The occupiers (compensation) payment is determined by a number of factors associated with the use of the land and the impact of the distribution assets.

37.26 The payment is heavily influenced by a number of external factors such as oil price, fuel costs, fertiliser prices, crop yields and crop prices. Since 2006 payment rates have been rising above the rate of inflation due to unprecedented and volatile increases in raw materials input costs (oil, fertiliser etc) and crop/food prices.

37.27 Over the last 4 to 5 years, occupiers payments for poles on arable land have increased on average by 13% per annum. The rate on pasture land has also started to rise with the increase over the last year being 8%. We predict a continued rise in these rates at approximately 10% per annum and this will have a large influence on the overall annual percentage rise in total wayleave payments in the future.

37.28 Further increases are expected due to the high prices of crops in 2012/13 caused by extremely wet weather that severely affected crop yields in the UK.

37.29 Pressure of population growth, alternative uses of land to meet climate change, as well as upward pressures on input costs and continued high demand for food is likely to keep the 'compensation' element of annual wayleave payments high and so will continue to increase. Therefore the historic trend is expected to continue and is predicted to continue to increase above RPI.

37.30 In addition to the main issues above, we are also aware that the main organisations representing land users continue to raise other matters that they feel should equate to enhanced compensation in the future. The principal one of these, being the trend for larger farming machinery, which land users feel is likely to create further difficulties in farming operations if they have distribution assets on their land.

Expenditure summary

Engineering management and clerical support (£m)					
	West Midlands	East Midlands	South Wales	South West	WPD Total
DPCR5 Annual Average	20.9	20.8	7.9	10.3	59.9
RIIO-ED1 Annual Average	15.3	15.8	8.1	10.7	50.0
RIIO-ED1 Total (8 years)	**122.7**	**126.5**	**64.8**	**85.8**	**399.7**

38 Control centre

38.1 Control centre activities include the real time operational control and monitoring of the network, outage planning and management, dispatching resources in response to network faults and safety issues, updating network control diagrams, completing fault reports and major incident emergency planning.

38.2 The number of control rooms across WPD will be reduced from three to two during 2013. This consolidation will lead to one control room serving the South West and South Wales and another serving West Midlands and East Midlands. No further major changes are proposed during RIIO-ED1 and therefore once the new structure is established costs will remain generally fixed.

38.3 With the control centres, the majority of activity relates to the volume of faults being experienced on the network and since these will broadly remain the same as a result of the various network investment activities there should be little change in the costs associated with control centre activities.

38.4 Increased work programmes will lead to more planned outage transactions but the impact will be at the margins and will be accommodated by revising processes where necessary.

38.5 During network emergencies, planned work will be suspended to prioritise resources on dealing with the faults. The alternative would be to have more resources available to accommodate all work, but under normal conditions this leads to an underutilised workforce and therefore has been dismissed as an option.

38.6 As networks become smarter control centre staff will carry out different duties. They will need to analyse new forms of data, interact with independent local smart grids and initiate demand side response requests. Whilst these activities will require new skills to be developed they should not lead to the requirement for additional staff. Advances in Control Centre network management systems will enable greater amounts of automation of processes which will offset any additional requirements for resources.

38.7 The expenditure forecasts are in line with current levels with no adjustments for future changes to work volumes. Costs have been allocated across licence areas using the standard cost allocation proportions.

Control centre (£m)					
	West Midlands	East Midlands	South Wales	South West	WPD Total
DPCR5 Annual Average	4.4	4.4	2.2	3.1	14.1
RIIO-ED1 Annual Average	4.0	4.2	2.3	3.3	13.8
RIIO-ED1 Total (8 years)	**32.2**	**33.2**	**18.2**	**26.4**	**110.0**

39 Contact centre

39.1 As previously stated WPD distributes electricity to over 7.8 million customers. It is important for these customers to have the means to contact the company when they go off supply, have a general enquiry or want to complain.

39.2 The contact centre activity relates to managing the main incoming telephone lines used by customers, taking the initial calls, recording details, providing information and forwarding customers on to the relevant parts of the organisation.

39.3 It also incorporates handling and processing Guaranteed Standards of Performance compensation payments, ex gratia compensation payments and ombudsman payments.

Impact of smart meter rollout programme

39.4 During RIIO-ED1 the smart meter roll out programme will lead to additional interactions between Suppliers and customers, resulting in increased volumes of calls where network problems are identified or where customers are unsure who to contact and erroneously call WPD. It is anticipated that this will require an additional two staff in each contact centre.

39.5 One of the benefits of smart meters will be the potential for smart meters to inform DNOs that power has been lost. In the long term, this may reduce incoming call volumes, but this is not anticipated to happen until there is a high number of smart meters installed and when customers gain confidence that the new systems are providing the right information about power outages to DNOs.

39.6 WPD is proposing to offer call backs to all customers who make contact to ensure that their supplies have been restored. Again in the long term this service may be replaced by pinging smart meters to determine if they are back on supply. Staff who may have previously been involved with taking calls and making call backs will become increasingly involved with the interrogation of smart meter reports and use of smart meter related systems.

39.7 Smart meters will also start to provide the information about phase connectivity. Contact centre staff dealing with smart meter data will be redeployed during low call volume activity to update customer records from the smart meter data. This will include allocating customers to feeder phases and updating appropriate records.

39.8 Whilst smart meters may lead to lower volumes of calls in the future, it is unlikely that cost reductions will materialise during RIIO-ED1 due to existing staff carrying out additional duties.

Vulnerable customers

39.9 There will be some increased costs for a new team dedicated to contacting vulnerable customers every two years to ensure that records are accurate. This activity will update the priority services register to ensure that appropriate services are provided for different types of vulnerable customers. Cost forecasts include an addition £0.5m per annum for this activity.

Contact centre expenditure (£m)					
	West Midlands	East Midlands	South Wales	South West	WPD Total
DPCR5 Annual Average	1.4	1.4	0.7	1.1	4.6
RIIO-ED1 Annual Average	1.4	1.4	0.7	1.1	4.5
RIIO-ED1 Total (8 years)	**10.9**	**10.9**	**5.5**	**9.0**	**36.3**

40 Stores

40.1 The majority of work on the network requires the use of a wide range of materials. These can be large items such as transformers, switchgear, underground cable, overhead line conductors and poles, or smaller items such as joints, gaskets, connectors, tapes, rolls of barbed wire and danger notices.

40.2 The materials are held in local depot stores supplied from two central warehouses. Supporting the stores activity are storekeepers, stock checkers and delivery drivers.

40.3 WPD also belongs to the 'NGT spares club', a facility provided by National Grid, for low-volume high-value components. Membership is more efficient than holding and managing dedicated stock for items that are needed infrequently.

40.4 The development of smart grids will expand the range of materials required to be held, with more monitoring and analysis equipment and new types of assets.

40.5 The volume of network investment drives the amount of throughput in the stores, but the facilities do not change. Likewise the increase in the types of materials driven by smart networks can be accommodated within existing facilities. As work volumes increase there may be an impact on deliveries but any increased requirements will be accommodated through efficiencies.

40.6 The stores arrangements in West Midlands and East Midlands were reorganised following the acquisition of Central Networks by WPD. This reduced costs by moving away from an expensive contracted out service. During RIIO-ED1 the expenditure will remain in line with these lower costs.

Stores expenditure (£m)					
	West Midlands	East Midlands	South Wales	South West	WPD Total
DPCR5 Annual Average	3.9	4.0	1.3	1.9	11.0
RIIO-ED1 Annual Average	2.6	2.5	1.3	2.1	8.5
RIIO-ED1 Total (8 years)	**20.5**	**20.4**	**10.3**	**16.8**	**68.0**

41 Network policy

41.1 Network Policy relates to the development and review of environmental, technical and engineering policies that set out what needs to be done and the procedures to follow.

41.2 Network Policy can by influenced by:

- changes to legislation;
- improved condition information;
- operational experience;
- investigation of defects;
- learning from incidents;
- development of new equipment and materials;
- research and development;
- changes to contracts.

41.3 Consequently, all WPD policies are reviewed periodically or in response to new issues.

41.4 The network policy activity was previously treated as a business support cost in DPCR5, but as it is related to the direct activity on the network it will be treated as a closely associated indirect in RIIO–ED1.

41.5 During RIIO-ED1 there will be a need for the development of new policy resulting from the learning from Low Carbon Network Fund projects and Network Innovation Competition projects. It is anticipated that the majority of policy requirements will be developed within the projects. This will reduce the impact on resources within network policy.

41.6 During RIIO-ED1 expenditure on network policy will be in line with current levels with any increases in activity due to the adoption of smart grids being integrated through efficiency savings.

Network policy expenditure (£m)					
	West Midlands	East Midlands	South Wales	South West	WPD Total
DPCR5 Annual Average	0.9	0.8	0.3	0.4	2.4
RIIO-ED1 Annual Average	0.6	0.6	0.3	0.5	1.8
RIIO-ED1 Total (8 years)	**4.4**	**4.5**	**2.2**	**3.6**	**14.8**

42 Workforce renewal (operational training)

Introduction

42.1 Working and operating on the electricity network requires a strong awareness of potential dangers. Staff need to be trained and competent to undertake the required activities following prescribed procedures.

42.2 In addition to the specific training received when staff first join WPD, the introduction of new equipment or revised procedures requires that we also provide regular updates and refresher training to our staff.

42.3 As staff change roles their responsibilities change and additional operational and upskill training may be required to allow them to fulfill a wider range of responsibilities.

42.4 The costs of attending training courses and the provision of trainers, course material and training centres are therefore dependent upon the level of recruitment and the need for refresher and upskill training.

42.5 Routine recruitment and training of new staff is managed on the basis of periodic assessment of the numbers of staff who are predicted to leave the business in the next three to four year period.

42.6 New apprentices, students and skills trainees are appointed into training schemes so that they are competent and ready to fill these predicted future vacancies as and when they arise.

42.7 Predominantly our craft staff (jointers, fitters and overhead line staff) are trained through our apprenticeship scheme.

42.8 We have recruited 225 apprentices in the last two years.

42.9 We invest in further education and training for staff who have the potential to fill more technical roles and we operate a formal Technical Staff Trainee (TST) scheme to meet identified succession needs. Staff required for higher technical roles also come from our graduate development programme utilising the Institute of Engineering and Technology (IET) 'Power Academy' combined with our own in-house training.

42.10 We recruit a number of staff as skills trainees who generally replace staff that have left the business unexpectedly. These trainees will undertake similar training to that received by craft staff. They will initially become craft support staff with a number having the opportunity to progress to the full craft role over a period of time and in line with business need.

42.11 Using this simple methodology WPD South West and WPD South Wales have a proven track record of successfully managing workforce renewal since 2000. In the last five years from 2007 to 2012 WPD South West and WPD South Wales has recruited and trained 307 new staff to replace retirees and natural wastage. A further 265 additional staff were recruited and trained in order to deliver the increased work programmes for DPCR5.

42.12 These staff were all trained in craft or operations skills at our own training facilities in Taunton.

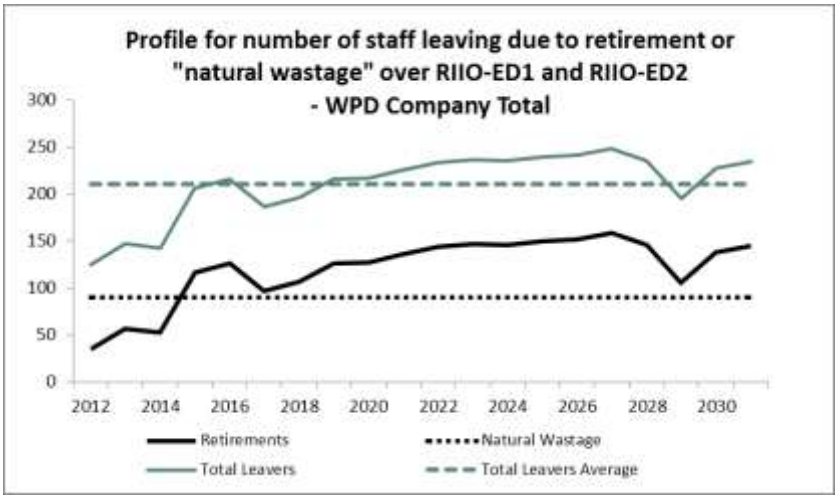
Overall planning

42.13 WPD staff resource planning looks through both RIIO-ED1 and into the early years of RIIO-ED2 (in particular 2023/24/25). This is to ensure that we recruit sufficient numbers of new staff through RIIO-ED1 and train them such that we have the right number and mix of craft and technical skills for RIIO-ED1 and into the early years of RIIO-ED2.

42.14 In addition to specific changes in workload volumes (which are discussed later) there are two key sources of data that are regularly reviewed in respect of workforce numbers;

- the forward age profile of staff across our business and the skill sets that they possess (allowing the future anticipated number of retirees to be assessed);
- the long run average number of staff that have left WPD through natural wastage with any forward adjustment for significant known events e.g. an "Olympic Park" type development. (At this stage we do not anticipate any major change in our natural wastage numbers going forward and the line is therefore flat throughout RIIO-ED1).

42.15 These requirements are combined to establish the staff resource requirement and are used to feed into our recruitment and training plans.



The solid green line is the sum total of retirees and staff who leave through natural wastage.
The dashed green line is the average total of all leavers over the period - representing a smoothing of the actual annual numbers.

42.16 In total we need to recruit and train 210 staff per annum (1,680 staff through the RIIO-ED1 period) to allow us to maintain our current DPCR5 staff numbers. As we currently recruit and train 190 staff per year in DPCR5 this represents a small additional replacement need of 20 staff per year (or 160 staff through the RIIO-ED1 period).

42.17 To meet this additional need through RIIO-ED1 and into RIIO-ED2 we plan to increase our recruitment of apprentices from 100 to 120 per annum.

42.18 In addition to these apprentices we will also continue to recruit and train a further 80 new skills trainees each year to replace the average number of people who leave the business through natural wastage.

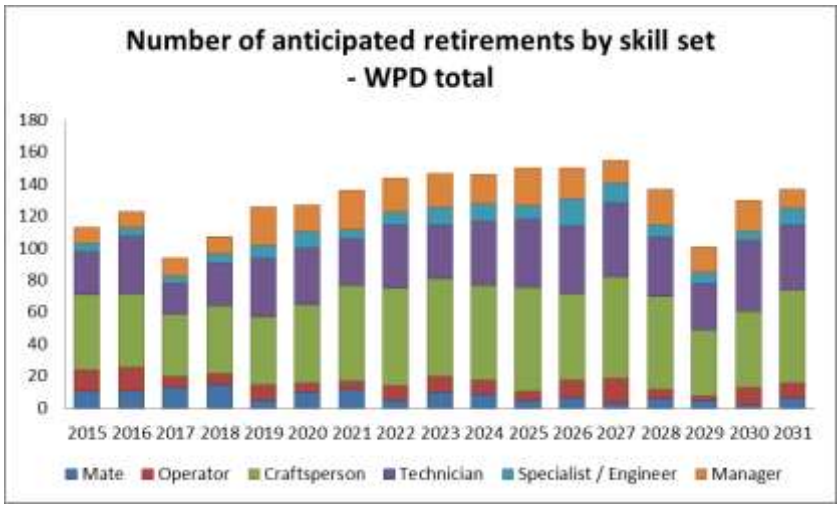
42.19 Through DPCR5 we have provided upskill training to an average of 80 staff per year (predominantly training craft staff to technician or technician to specialist/team manager roles). This number will remain constant throughout RIIO-ED1.

42.20 Our graduate recruitment will continue at the same rate as that in DPCR5 at around 10 per annum.

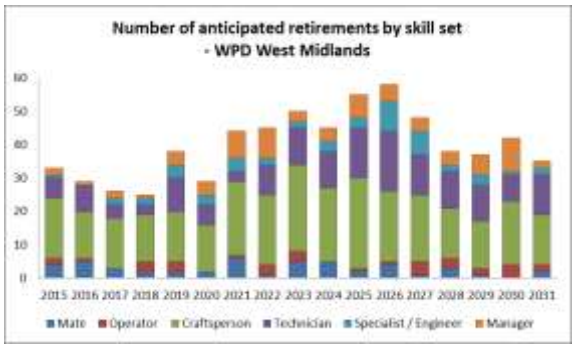
42.21 All of these staff will be trained in the skills sets as appropriate for replacing those who have left or who are forecast to leave WPD.

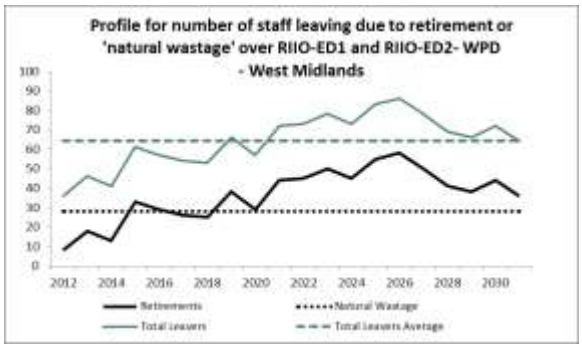
Skills planning

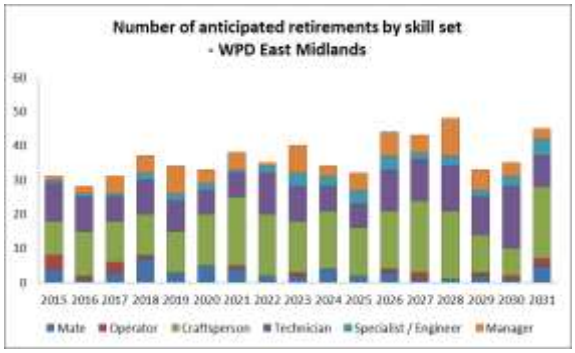
42.22 To ensure the overall business has the right numbers of staff with the right skill sets the overall analysis is broken down further to determine the skills of the staff due to leave through retirement.

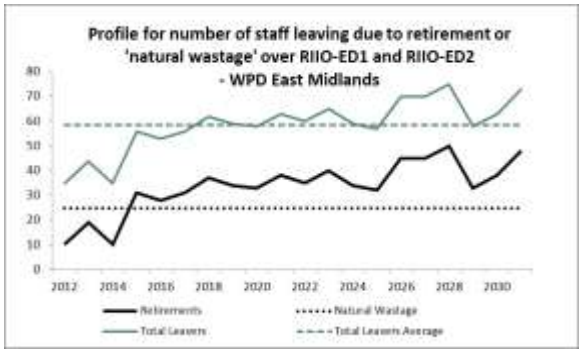


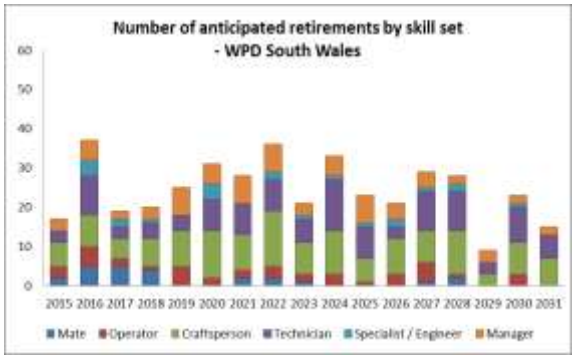
42.23 Our recruitment plans are also checked to take account of any regional variances across our four areas. We have completed analysis on an individual WPD licence basis to ensure that there are no specific skill sets or staff number issues that would give rise to the requirement for any special or area specific training.

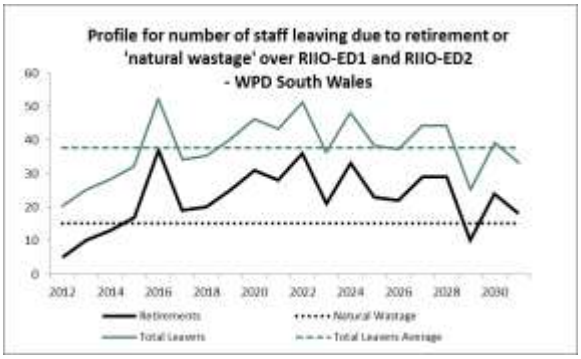


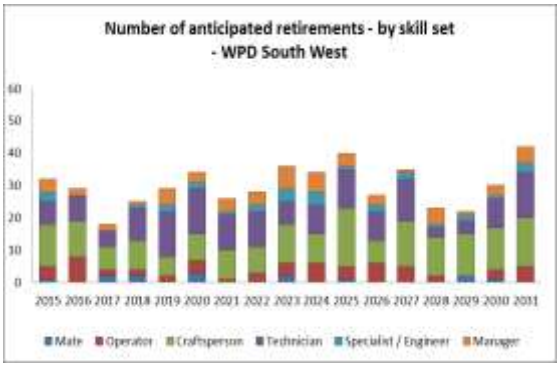


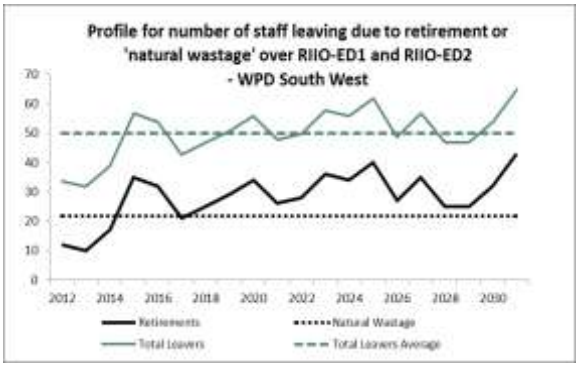












Impact on workforce renewal requirements due to workload changes

42.24 In addition to the requirements to ensure sufficient resources are employed to align with the number of retirees and natural wastage we must also consider any changes in workload demand placed on resources as we transition from DPCR5 into RIIO-ED1 and RIIO-ED2. Our plans are established against two differing scenarios.

42.25 The first scenario is the business model developed for our Business Plan and is referred to as the WPD 'Best View' scenario. This best view scenario plan sets out the position that WPD has established as the most likely to occur over the RIIO-ED1 period. From this we are able to establish the forward workforce requirements for all categories of work including the impact of Low Carbon Technology (LCT) uptake.

42.26 The second scenario we have modelled for RIIO-ED1 is the workload requirement of the 'Ofgem Reference Case' (DECC 'Scenario 1') . This establishes the forward workforce requirement for all categories of work but also takes account of the highest change in workload resulting from the much greater forecast uptake of LCTs under that scenario.

42.27 By analysing these scenarios we can establish the staff resources required to ensure we can deliver the workload demands irrespective of the eventual uptake of LCTs in RIIO-ED1.

42.28 For both scenarios we have also factored in the requirement of the 'one-off' activity of the smart meter rollout.

42.29 The roll out of smart meters requires electricity suppliers to offer to install a new meter in all of their domestic customer's premises. These new meters allow significant additional functionality over the types of meter currently installed. The installation programme is planned to commence in 2015 with and complete by 2020.

42.30 As a consequence of this programme there will be additional workload for DNOs as a result of any issues found at service positions in properties. This workload will be significantly higher than the normal rate of work due to the shortened timeframe of five years to complete all meter

installations (as compared to the traditional meter change programme of approximately 20 years).

42.31 Analysis undertaken by the National Skills Academy for Power (as part of an industry wide evaluation) concluded that WPD would need an additional 120 cable jointers as a direct result of the smart meter rollout programme. This assessment is based on an anticipated defect rate of 4% of all installations. The National Skills academy report can be found at the following link http://www.westernpower.co.uk/docs/About-us/Stakeholder-information/Our-future-business-plan/Supporting-Expenditure-information/National-Skills-Academy-Workforce-renewal-report.aspx

42.32 Based on knowledge of our assets at the meter position we believe that a more accurate forecast of locations requiring remedial work to be 2%. This would equate to a requirement for an additional 60 cable jointers if this activity were to be undertaken in isolation.

42.33 Given the volume of meters per area this would equate to around 20 staff in both the WPD West Midlands and WPD East Midlands licence areas, 12 in WPD South West and 8 in WPD South Wales in total. This represents a 1% increase in overall operational staff numbers.

WPD 'Best view' scenario

42.34 The analysis of asset replacement, general network reinforcement and LCT reinforcement required during RIIO-ED1 combined with the relatively small impact of smart metering results in a resource demand that remains broadly in line with our existing requirements for delivery of our work programme for DPCR5.

42.35 With respect to phasing of work, whilst towards the latter years of RIIO-ED1 the LCT workload shows some increase this coincides with the completion of the ESQCR works required to ensure horizontal safety clearances to buildings.

42.36 This ESQCR work will be completed in WPD South Wales and in both the WPD Midlands licence areas in 2015 and in WPD South West in 2018. Resources that become available from the ESQCR works can be readily deployed to meet increased LCT workload or other programmes as appropriate with minor geographical adjustments made to replace staff following retirements or natural wastage as necessary to meet specific work demands.

42.37 It should also be noted that the level of upskill training also remains broadly flat through RIIO-ED1 and in line with the DPCR5 period.

'Ofgem Reference Case' scenario

42.38 For this scenario the difference in work volumes and the consequential impact on workforce requirements is driven by the requirement to complete additional LCT reinforcement work.

42.39 Based on this scenario (which creates the highest level of potential work) we will require an additional 770 field staff over and above our existing DPCR5 numbers.

42.40 Analysis of the nature and types of additional works required allows us to establish the following additional skills requirement;

- 200 overhead line staff;
- 345 plant fitters;
- 135 cable jointers;
- 90 additional graduates or technical trainees.

42.41 Within this number we have also made allowance for the promotion of 180 existing staff who will upskill from their craft roles into technician, technical planning or project management roles as follows;

Additional staff and upskill training required for 'Ofgem Reference Case'					
	West Midlands	**East Midlands**	**South Wales**	**South West**	**Total**
Overhead	16	125	55	4	200
Fitting	28	212	98	7	345
Jointing	13	77	42	3	135
Graduate / Technical Trainee	7	43	40	0	90
Total	**64**	**457**	**235**	**14**	**770**
Plus Technician (upskill existing craft)	*15*	*83*	*82*	*0*	*180*

42.42 Under the Ofgem Reference Case the additional staff required would be recruited over 6 years commencing 2015. This provides for sufficient time to ensure that resources are trained and in post ready to meet the forecast increase in the demands of the LCT.

42.43 Regular reviews will continue to allow us to match the numbers of new recruits required to meet general variations that occur year on year. This also ensures that we can adjust the recruitment numbers to cater for the additional unpredictability created by the recent removal of a 'default retirement age' (i.e. some staff may choose to stay in work longer).

Recruitment

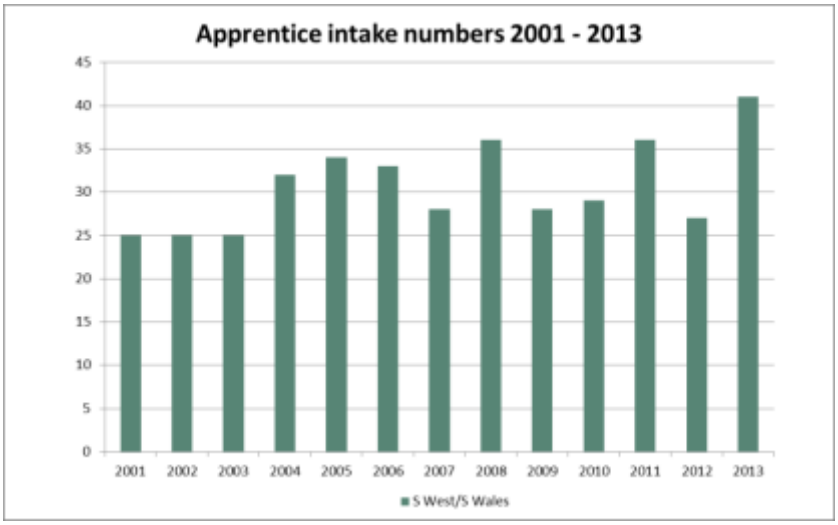
42.44 Recruitment is undertaken in three main ways;

- apprentices - via the WPD apprenticeship scheme;
- graduates - generally via the IET Power Academy;
- skills trainees - via local recruitment initiatives.

42.45 In addition to external recruitment we also ensure existing staff are given opportunities to develop within the business and to develop new skills and capability. We conduct upskill training of staff from craft to technician, planning or project management roles.

Apprentices

42.46 WPD has consistently recruited apprentices throughout the last decade. Since 2001 WPD South West and WPD South Wales have recruited 400 new staff as apprentices. This has ensured that we have retained the ability to train and deliver motivated and competent craft staff into our business.



42.47 This approach has continued since the acquisition of the Midlands businesses with the total recruitment numbers for 2012 and 2013 combined reaching 225 new apprentice starters.

42.48 Our approach to the apprenticeship scheme is to make sure that it meets the needs of our business. Following an initial induction programme, which includes an introduction to the business, health and safety training, customer service awareness and a week-long practical community project (to develop team building and social skills awareness) our apprentices go through a series of formal training courses.

42.49 These formal training courses are interspersed with hands-on practical experience on the distribution network working under the guidance and supervision of our experienced craft staff. The apprentices experience, knowledge and overall competency is developed over time as they complete a series of relevant practical tasks in the field whilst continuing to work under the guidance of experienced staff.

42.50 During this time apprentices are required to log all of their work through a diary based record book which allows their progress to be monitored on a weekly basis. They are also required to complete a series of formal reports to demonstrate the work that they have done. These reports include details of both the practical aspects of that work and also how it relates to specific safety, policy and procedural requirements.

42.51 Apprentices will be assigned to a WPD team and their Team Manager will conduct weekly reviews of the apprentice diary sheets and task reports. Distribution Managers are required to conduct reviews with their apprentices on a quarterly basis or more frequently if additional guidance or help is required. 'Diaries' and 'Task Reports' are reviewed and assessed by our training assessment staff to ensure they achieve a level of consistency. Appropriate support is provided to all of our apprentices as required.

42.52 When apprentices are judged to have reached a suitable standard they are able to apply to be tested via a formal 'Trade Test'. This test is undertaken at either Taunton or Tipton and is supervised and monitored by our training centre staff. Apprentices who are judged to have sufficient skills and overall competency are then progressed into a craft development role.

42.53 This craft development role provides the opportunity for the apprentice to continue to develop their skills as part of a WPD team but also to provide further hands-on training which prepares them to receive appropriate authorisations to work independently on the WPD network.

42.54 We have facilitated visits by other DNOs, engineering based companies, HSE representatives and Ofgem to demonstrate our approach and to discuss our philosophy to apprentice training.

Graduates and technical skills trainees (TST)

42.55 WPD has recruited around 5 to 10 graduates each year to fill highly technical roles within the business. These staff are generally appointed through the IET Power Academy but we have also sought out candidates directly through universities.

42.56 The graduate development programme consists of formal training-school courses interspersed with practical field experience where graduates are able to gain an appreciation of the nature of the works undertaken within the business.

42.57 Graduates will also spend significant time working under the guidance of experienced electrical engineers who are typically based in one of our three major offices at Bristol, Tipton or Castle Donington. In addition they will spend time with the Project Engineers who have responsibility for delivering EHV major projects across our geographical area.

42.58 In addition to recruiting and developing new graduates we also develop a number of our existing staff into the higher technical roles through our TST programme. These staff generally already have significant experience of more complex engineering work and often possess higher technical qualifications which have been gained as part of our on-going training and development programme.

42.59 Staff on the TST programme are provided with additional training and development and are given the opportunity to undertake further education as necessary to help them fulfill the defined future roles. In addition, wherever possible, they are appointed to the TST programme with sufficient time to allow them to overlap with the experienced staff they are due to replace.

Skills trainees

42.60 In addition to the development of our staff via our apprentice programme we also recruit a number of new staff to fulfill lower skilled support roles such as operators or mates. In these roles staff undertake a more limited range of hands-on skills work and provide support to the craft staff (including being a second trained person on site as required during live working operations).

42.61 Generally we make use of external recruitment agencies to find these potential operators and mates for interview by relevant WPD managers. The agencies are tasked with providing people with existing skills that are readily deployable into WPD. Examples of these skills would include being HGV authorised, trained for use of mechanical excavation machinery or people with general mechanical and other hand skills.

42.62 We have negotiated special rates with the relevant recruitment companies. This ensures that we only pay a small fee during the first 14 weeks of employment of the new staff whilst they are initially employed by the agency. At this point, subject to satisfactory performance by the new staff, WPD then employ them directly as WPD employees and cease paying any fees to the agency.

42.63 This recruitment process has proven to provide an effective and efficient source of new staff and is an innovative way of providing us with a low risk, low cost process for employing people who are right for our business.

Training resources

42.64 To support the additional resources being recruited it is important that WPD has sufficient trainers and training facilities.

Trainers

42.65 The following table shows the number of WPD trainers, their skill and their base location.

Number of training staff		
Skill	**Taunton**	**Tipton**
Overhead	5	6
Fitting	3	3
Jointing	3	5
Metering / Other	1	1
Operations	2	3
TOTAL	14	18

42.66 Training for new staff is generally delivered by one trainer per group of eight trainees. Each trainer is capable of delivering approximately 40 weeks of training per year.

42.67 Each trainer is therefore effectively capable of delivering 320 (8 x 40) 'trainee weeks' per year.

42.68 New craft staff require approximately 14 weeks of formal training, graduate and TSTs require 7 weeks and for upskill training requires up to 18 weeks (reflecting the higher technical skills and knowledge training required).

42.69 Using these average number of training weeks per skillset allows us to derive the overall formal training requirements based on the additional highest case numbers from the Ofgem Reference Case as follows:

New skillset to recruit and train	Ofgem Reference Case	Training requirement
Overhead	200	2,800 weeks
Fitting	345	4,830 weeks
Jointing	135	1,890 weeks
Additional 20 craft staff per annum during RIIO-ED1 over and above the number in DPCR5	160	2,240 weeks
Graduate / TST	90	630 weeks
Technician/ Planning / Project Mgt (upskilled from existing)	*180*	*3,240 weeks*
Total additional training weeks required over RIIO-ED1 period		**15,630 weeks**
Trainer requirements - total weeks / 8 years / 320 trainee weeks per trainer per annum (rounded down for efficiency).		**6**

42.70 This analysis results in the requirement for 6 additional trainers over the average number employed in DPCR5 to meet the requirements for the Ofgem Reference Case.

42.71 We will continue to monitor our trainer resources against the demand in the knowledge that we may require these additional 6 trainers should LCT works increase beyond the WPD 'Best view' scenario.

42.72 WPD has a successful track record of recruiting trainers from within its existing skills base and will deliver the additional trainer resources required for this scenario in sufficient time to meet the required output.

Facilities

42.73 WPD currently operate two principle training centres based at Taunton in Somerset and Tipton in the West Midlands. These principal sites are supplemented by additional satellite training facilities located within our service territory.

Taunton training centre

42.74 The facilities at Taunton cover an area of approximately 3.8 hectares and are owned and maintained by Western Power Distribution. The facilities include:

- 14 class rooms;
- jointing workshops;
- metering and small wiring workshops;
- fitting workshops;
- an outdoor operational network for 33kV, 11kV and LV operations training;
- an indoor overhead line training facility;
- an outdoor overhead line training field.

Tipton training centre

42.75 The facilities at Tipton cover an area of approximately 4.6 hectares and are owned and maintained by Western Power Distribution. The facilities include:

- 16 class rooms;
- jointing workshops;
- metering and small wiring workshops;
- fitting workshops;
- a 33kV, 11kV and LV operations training network;
- an overhead line training field.

42.76 Both the Taunton and the Tipton facilities include a fully operational electricity distribution network allowing for full operations training up to and including 33kV for technicians and other operational staff.

42.77 Both training centres are therefore able to deliver all of the skills training of jointing, fitting and overhead line works together with operational training utilising directly employed trainers.

Other remote training facilities

42.78 There are a number of small satellite training facilities which are used to maximise the efficiency of training delivery by allowing locally based training of skills. These facilities are parts of existing operational sites, therefore making efficient use of available accommodation. These facilities include:

- **Dunkeswell** training facility in East Devon - the 3.4 hectare facility at Dunkeswell operates as a satellite to our main Taunton site and was acquired to deliver the additional overhead line skills training requirements for DPCR5 which is now complete. This facility will become the location for any additional RIIO-ED1 overhead line training requirements.
- **Cwmbran** in South Wales - use is made of the WPD Central Plant Unit for the training of fitting skills, and a local primary substation and adjoining field is used for overhead line training.
- **St Mellons**, Cardiff - WPD owns a 1 hectare field which allows us to effectively deliver 33kV and 11kV 'heavy construction' overhead line training.
- **Norton**, Worcester - a primary substation is used for the delivery of EHV plant and fitting courses.
- **Alfreton** - land adjoining a new WPD office has been allocated to small scale overhead line training / assessment activity.

42.79 These facilities allow us to minimise the travel time for staff. This is of particular benefit for short duration courses and refresher training. For these short duration courses; travel to the main Taunton or Tipton sites becomes significant in relation to the course duration and it is more efficient to move the trainer rather than the trainees where possible.

Development options for training facilities

42.80 The current facilities utilisation rate at Taunton means that to meet the additional training requirements of the Ofgem Reference Case scenario would necessitate the development of further workshop and classroom facilities.

42.81 In anticipation of this we have recently taken the opportunity to purchase a small adjacent site allowing simple expansion of our existing facilities to create 3 new workshops, a new EHV fitting training facility and associated class room space.

42.82 In addition, planning permission had already been sought and obtained for the construction of extra facilities within the existing site boundary if required. This planning permission was secured in 2011 against the possibility of not obtaining the adjacent site.

42.83 Whilst the training requirements under either scenario do not suggest we will need to progress this option to construction, we will seek to retain the planning permission as a contingency to allow us to respond quickly to any increased requirements for competent skilled staff training.

42.84 The newly acquired workshops can serve as either fitting or jointing facilities and would allow the appointment and accommodation of three new jointing or fitting trainers. This creates capacity to train a minimum of 540 new jointing or fitting craftsmen over the RIIO-ED1 period in Taunton.

42.85 At Tipton training centre; in order to facilitate the introduction of new HV jointing techniques into both WPD West Midlands and WPD East Midlands and to address the additional demand for ongoing jointing refresher training in these locations (to ensure consistency across the business) two jointing trainer posts were created and recently filled.

42.86 Minor building alteration work at Tipton has converted recently vacated space into training workshops for the two new trainers.

42.87 Provision has also been made in the plans to allow for the construction of two further workshops and classroom space if required during RIIO-ED1 (this provision was low cost enabling works – more costly fit out works will only be undertaken if necessary).

42.88 As with the proposed workshops at Taunton, both the new workshops and the enabling works for additional availability at Tipton were undertaken on the basis of allowing either jointing or fitting workshops to be created.

42.89 This provides the potential for a further two new workshops in Tipton adding capacity to train a further 360 craft staff if required.

42.90 Overhead line skills training is covered by the Dunkeswell facility. This site has the capacity for the training of up to 360 additional overhead line staff in RIIO-ED1.

42.91 Should demand become higher than currently envisaged we are still able to expand our facilities by the creation of a third overhead line training area, similar to those already at Dunkeswell. This would have the capacity for a further 180 overhead line staff and accommodation of one further overhead line trainer.

Summary

42.92 Based on the WPD 'Best view' scenario there will be no requirement to recruit and train additional staff over and above those who we are planning to recruit in order to replace retiring staff or staff who have left through natural wastage.

42.93 Whilst the number forecast to retire in RIIO-ED1 has increased by 160 over DPCR5 the additional training requirements will be absorbed as part of our efficiency improvements.

42.94 Should the LCT take up increase towards the Ofgem Reference Case levels then we will need to recruit and train up to 770 additional staff and upskill a further 180 staff.

42.95 We have already made provision to allow the quick adaptation of existing facility space to create a further 5 workshops and classrooms.

42.96 The additional workshop and classroom space allows us to train an additional 900 fitting or jointing staff over current levels. Our Dunkeswell facility allows us to train 360 additional linesman with the option to train a further 180.

42.97 We have a proven record of being able to recruit and 'train the trainer' and the creation of a further 6 trainers will be a straightforward process.

42.98 Our track record of dealing with routine staff replacement is proven. We have maintained a significant apprentice programme throughout the DPCR3, DPCR4 and DPCR5 timeframes.

42.99 Our existing apprenticeship, skills trainee, graduate and technical staff trainee programmes have ensured that the business has maintained the right numbers and mix of staff to deliver our programmes of work successfully.

42.100 In addition we have demonstrated our ability to manage any specific step change in workload with the addition of 265 staff required to deliver the ESQCR programmes of work commencing in DPCR5.

42.101 Our current planning and early action will ensure that we continue to match our recruitment and skills training to deliver the skilled staff required to meet the business need whether that be the WPD 'Best view' scenario or the Ofgem Reference Case.

Operational training expenditure (£m)					
	West Midlands	**East Midlands**	**South Wales**	**South West**	**WPD Total**
DPCR5 Annual Average	4.6	4.9	4.4	6.4	20.3
RIIO-ED1 Annual Average	6.0	6.0	4.4	5.9	22.2
RIIO-ED1 Total (8 years)	**47.8**	**47.7**	**35.3**	**46.8**	**177.5**

43 Traffic Management Act

43.1 The New Roads and Street Works Act 1991 (NRSWA) and the Traffic Management Act 2004 require utilities to notify Local Authorities and Highways Authorities of work that will be carried out on public highways.

43.2 There are three systems in operation: Notices, Permits and Lane Rental.

Notices, Permits and Lane Rental

43.3 Notices describe the work location, when the work will take place and how long it will take. They are the main method for notification and do not require any payment. Unless the Highway Authority objects, the work can go ahead as notified.

43.4 Permits are similar to Notices, with the main differences being that the Highway Authority will grant permission or refuse permission based upon assessment of the submitted permit request. In addition the Highway Authority can levy charges. The Department for Transport (DfT) is actively encouraging Highway Authorities to implement Permit schemes, specifically for strategic traffic routes.

43.5 Lane Rental is a scheme where Highway Authorities charge a daily fee for access to work in the highway. These can only be implemented once an Highway Authority has operated a Permit scheme for at least two years. Consequently only a limited number of authorities have currently either implemented or are seeking to implement a Lane Rental scheme. However, over the RIIO-ED1 period it is envisaged that more authorities will implement them and that there could be a significant impact on costs.

Applicable legislation

43.6 NRSWA gave powers to Highway Authorities to ensure that works are co-ordinated in the highway and the use of Notices has been the default process since the introduction of the legislation in 1991.

43.7 Notices are served via an Electronic Transfer of Notifications (EToN) protocol that allows two-way communication between Works Promoters (such as WPD) and Highway Authorities. The processes and information requirements are detailed in the Code of Practice for the Co-ordination of Street Works and Works for Road Purposes.

43.8 The introduction of the Traffic Management Act (TMA) in 2004 gave additional powers to Highway Authorities allowing them the option of implementing Permit schemes.

43.9 The Code of Practice for Permits sets out the framework that schemes should fit into, and all schemes must comply with EToN requirements to enable the two way submission and approval process to take place. Each Highway Authority is able to design a Permit scheme that suits their individual requirements, which leads to different administrative requirements for each authority. Examples of different scheme elements are:

- The streets covered by the scheme (all streets, or just selected streets);
- The type of work included (all works, or just certain types of work);
- The requirements for immediate works (such as fault works);
- Additional information required (e.g. plans);
- Conditions that must be complied with when undertaking works;
- Levels of permit fees to be charged (subject to a cap set by the DfT).

43.10 When authorities seek to implement a Permit scheme there is usually a consultation process with key stakeholders, allowing opportunity for utilities to respond and providing the trigger for review of those street works processes that the authority will need to change.

43.11 The Secretary of State for Transport is responsible for approving each Permit scheme at present, but there is a possibility that this power of approval may be devolved to local government after 2015.

43.12 The Permit scheme is enacted through a Statutory Instrument which gives the scheme a legal basis, as well as dis-applying certain elements of NRSWA that would no longer be relevant. It is important to note that even for an 'all-streets' Permit scheme, there is still a requirement to serve certain notices and elements of NRSWA legislation e.g. Section 74 charges for unreasonably prolonged occupation of the highway.

43.13 As well as having to pay a fee for a Permit, any failures to comply with the requirements of the Permit scheme can lead to a fixed penalty fine or ultimately prosecution.

Legislation in Wales

43.14 Street works legislation in Wales is a devolved power and not governed by the DfT.

43.15 The primary legislation (Traffic Management Act 2004) to allow Permit Schemes does exist in Wales, but the approval of individual schemes sits with the Welsh Government and not the DfT.

43.16 The Welsh Assembly is currently developing its own Street Works Strategy. It states that without robust evidence to prove the need for and success of Permit schemes the Welsh Assembly would not support their implementation in Wales. However if this evidence was provided to the satisfaction of the Welsh Assembly then Permit schemes may get implemented in Wales. This is different from England where the DfT is actively encouraging Permit schemes.

43.17 Due to this approach it is unlikely that a Permit Scheme would be approved in Wales before 2018, and this would only be with specific authorities. A change in Assembly policy in Wales may bring this date forward and our estimate is based on the current understanding of the Welsh view through the Welsh Highway Authorities and Utilities Committee.

Department for Transport directive

43.18 The Government believes that roadworks affect economic growth.

43.19 Part of the DfT's support of the Government objectives to drive economic growth is the effective management of the road networks. The DfT is actively encouraging Highway Authorities in England to implement Permit Schemes, and wrote to all Highway Authority Chief Executives in 2012 to highlight this objective.

43.20 Further guidance ('Traffic Management Act 2004 (part 3 permit schemes) Additional Advice Note – for developing and operating future Permit Schemes') was published by the DfT in January 2013. It focused on the essential issues that need to be considered when developing a Permit scheme. These were:

- how the Permit scheme will improve overall transport network management;
- how the Highway Authority will operate the scheme focusing on works on strategically significant streets;
- the scheme design should demonstrate improved co-ordination between all works promoters;
- that the fees and costs are proportionate to the value added by issuing the permit.

Scope of Permit scheme charges

43.21 The DfT has clarified in the January 2013 advice note that any new Permit schemes should be focused on strategic routes including traffic sensitive streets and streets that fall into reinstatement categories 0,1,and 2 (as defined in Section 1.3 of the Statutory Reinstatement of Highways 2010).

43.22 This does not preclude a Highway Authority from introducing a Permit scheme for all streets, but under these circumstances fees would most probably only be applicable to the traffic sensitive and strategic routes.

43.23 The legislation will still allow for permit fees to be charged on all streets and some Highway Authorities have indicated they want to implement a full scheme.

Highway Authority positions on Permit schemes

43.24 Some Highway Authorities have political, shared service and geographical alliances with each other and this may influence the timing and scope of Permit schemes. This could lead to the implementation of a scheme used by another Highway Authority (a Common Scheme), the development of a scheme in conjunction with another Highway Authority (a Joint Scheme) or implementation of an individual scheme. There is also the possibility of a 'domino effect' where, one-by-one, authorities view permits to be the future of managing works on the highway.

43.25 As Permit schemes apply to all works carried out in the highway, including the Highway Authority own works, the decision to implement a scheme is one for the elected members of the Local Authority.

43.26 Similarly a change in Government or Government policy will be another influencing factor on the scope and spread of Permit schemes.

43.27 The positions of the local authorities within WPD licence areas is summarised below and a more detailed breakdown by authority is available at the end of this chapter.

Highway Authority positions on implementation of Permit schemes (at 31 May 2013)				
	West Midlands	**East Midlands**	**South Wales**	**South West**
Permit schemes in operation	0	4	0	0
Permit schemes post consultation, not yet approved	0	2	0	0
Permit schemes at consultation	1	1	0	0
Permit schemes being prepared for consultation	1	3	0	0
Permit scheme to be developed in the future	11	4	0	1
No plans announced	2	6	19	9

Permit scheme costs

43.28 Assumptions have been made on both the likelihood and timescales of Permit scheme implementations, based on 2015 being a key date for possible devolution of approval. Consideration has also been given to the schemes in the pipeline that may influence other Highway Authorities to follow suit once schemes are approved and implemented.

43.29 Due to the DfT stated focus on traffic sensitive and strategic routes, it has been assumed that any further schemes would only charge for Permits on these routes. Where a Highway Authority has already stated that they are aiming for an 'all streets' Permit scheme then this is the assumption used.

43.30 The following values have been used for the cost of individual permits.

Assumed permit fee charges		
Type of Works Notice	**Permit fee for traffic sensitive road**	**Permit fee for non traffic sensitive road**
Major (>10 days)	£345	£225
Major (4-10 days)	£235	£150
Major (<3 days)	£170	£120
Standard	£130	£75
Minor	£65	£45
Immediate (faults)	£60	£40
Permit Variations	£45	£35

43.31 The overall costs of permit fees have been calculated by considering the annual volume of Notices that apply to traffic sensitive routes and 20% of the non-traffic sensitive (corresponding to those with specific reinstatement requirements). The annual costs during RIIO-ED1 are shown below:

Forecast annual Permit fee costs for RIIO-ED1	
License Area	**Annual £m**
West Midlands	0.37
East Midlands	0.45
South Wales	0.12*
South West	0.14

* South Wales costs would not be incurred until half way through RIIO-ED1, once the Welsh Assembly had determined the strategy.

Variations

43.32 Alterations to planned works are inevitable and therefore costs will be incurred to vary the terms of the Permits. It has been assumed that 10% of all Permits will incur a variation fee. This leads to the following costs for variation fees.

Forecast annual permit fee variation costs	
Licence Area	**Annual £m**
West Midlands	0.02
East Midlands	0.02
South Wales	0.01
South West	0.02

Permit condition costs

43.33 Highway Authorities may specify certain conditions, such as night time working, when approving a Permit. The majority of conditions are in line with how WPD would expect to undertake works, i.e. safely, promptly, considering the customer/public. WPD already undertakes works out of hours, or at weekends to satisfy the Highway Authorities' transport network management duties.

43.34 There are no specific identifiable additional costs for compliance with Permit conditions.

Lane Rental costs

43.35 NRSWA as amended by the Transport Act 2000 and the Traffic Management Act 2004 contains provision for Highway Authorities to operate schemes that involve charging Works Promoters for the time their works occupy the highway. These charges, normally levied on a daily basis, are known as Lane Rental charges.

43.36 In order to operate a Lane Rental scheme the Highway Authority must have operated a Permit Scheme for 2 years before applying. It is unlikely that all Permit Scheme operators will seek to implement full Lane Rental Schemes applicable to all roads. It is more likely that Highway Authority will apply Lane Rental to traffic sensitive routes only.

43.37 There is currently one Lane Rental scheme in operation in England, operated by Transport for London. In addition, Kent County Council is eligible to operate a scheme and has submitted a proposal to the DfT. These are both outside WPD's geographical area. The only Highway Authority within the WPD boundary currently eligible to operate a Lane Rental scheme is Northamptonshire County Council, but it has stated it does not want to operate a Lane Rental scheme at this time.

43.38 At the point of developing this Business Plan no Highway Authorities in any of the WPD licence areas have indicated they are planning to operate Lane Rental in the near future. But, it is conceivable that during RIIO-ED1, many Lane Rental schemes could be in operation, leading to high costs for works in the highway.

43.39 Potential costs have been estimated for Lane Rental on traffic sensitive routes only by considering the annual number of Notices, the average duration of works and daily rate chargeable. This has been calculated for different notice types of work - Major, Standard, Minor and Immediate - since the average duration of works varies for each type. The calculation assumes that all authorities introduce Lane Rentals and results are shown for each licence area in the following tables.

West Midlands – Estimated annual Lane Rental charges for all work on traffic sensitive routes					
Parameter	**Major**	**Standard**	**Minor**	**Immediate**	**Total**
Volume of notices (number per annum)	75	402	100	423	
Average duration of works (days)	35.3	6.7	2.3	6.4	
Daily Permit Fee (£)	2,500	2,500	2,500	2,500	
Total Annual Cost (£m)	6.6	6.7	0.6	6.8	20.7

East Midlands – Estimated annual Lane Rental charges for all work on traffic sensitive routes					
Parameter	**Major**	**Standard**	**Minor**	**Immediate**	**Total**
Volume of notices (number per annum)	70	458	196	527	
Average duration of works (days)	35.3	6.7	2.3	6.4	
Daily Permit Fee (£)	2,500	2,500	2,500	2,500	
Total Annual Cost (£m)	6.2	7.7	1.1	8.4	23.4

South Wales – Estimated annual Lane Rental charges for all work on traffic sensitive routes					
Parameter	**Major**	**Standard**	**Minor**	**Immediate**	**Total**
Volume of notices (number per annum)	13	136	63	78	
Average duration of works (days)	9.3	6.5	2.4	5.9	
Daily Permit Fee (£)	2,500	2,500	2,500	2,500	
Total Annual Cost (£m)	0.3	2.2	0.4	1.2	4.1

South West – Estimated annual Lane Rental charges for all work on traffic sensitive routes					
Parameter	**Major**	**Standard**	**Minor**	**Immediate**	**Total**
Volume of notices (number per annum)	12	175	177	165	
Average duration of works (days)	7.6	6.5	1.4	6.9	
Daily Permit Fee (£)	2,500	2,500	2,500	2,500	
Total Annual Cost (£m)	0.2	2.8	0.6	2.8	6.4

Lane Rental reopener

43.40 There is significant uncertainty about the number of Lane Rental schemes that will ultimately be adopted and how they will be implemented. The potential costs of Lane Rental are so high that if a Highway Authority indicated they would operate such a scheme across all their roads a review of WPD's work delivery model would be required. It is therefore important that a price control reopener is available to amend allowances should Lane Rental schemes be introduced.

Sample inspection of work costs

43.41 Highway Authorities carry out sample inspections of road works to ensure that the processes for traffic management are adequate and the quality of reinstatement meets the required standard. There are three main categories of inspection:

- Category A – signing, lighting & guarding;
- Category B – reinstatement within 6 months of completion;
- Category C – reinstatement 3 months before the end of guarantee period (usually 2 years from completion).

43.42 Cost forecasts are based upon 30% of works being inspected at a fixed unit cost of inspection of £50. This gives the following annual costs of inspection.

Forecast annual inspection fee costs for RIIO-ED1	
Licence Area	**Annual £m**
West Midlands	0.20
East Midlands	0.21
South Wales	0.06
South West	0.09

Additional cost considerations

Systems and Processes

43.43 WPD's internal works management system (CROWN) has been updated during 2013 to allow better management of street works Permits. It is not anticipated that significant costs will be incurred for further system changes.

Resources

43.44 The changes made to the IT systems already support the introduction of further permit schemes without the need to increase resources to administer the schemes, based on current work volumes.

Congestion charging

43.45 No Local Authorities in the WPD licence areas have indicated that they plan to introduce a Congestion Charging scheme. No costs have therefore been included for congestion charging.

Legislative change – safety code

43.46 There is a proposed change to the Code of Practice for Safety at Street Works for England. The consultation draft issued in 2010 has been altered to ensure that it doesn't have an unnecessary burden of cost to comply. The final document has not been approved and has not

been circulated outside of the Chairs of the working group and the DfT. It is anticipated that there will not be any increase in sample inspection fee costs, but there is uncertainty about whether there are any other additional costs until the document is published. The safety code is currently also being reviewed by the Welsh Assembly and the DfT is awaiting the outcome of this before proceeding with implementation in England.

Legislative change – contributions to making good long term damage

43.47 Section 78 of NRSWA (Contributions to costs of making good long term damage) is currently an un-enacted piece of legislation. This legislation allows Highway Authorities to levy a fee for the 'scarring' of the highway to cover future costs of repair and resurfacing. There is currently no indication from Government that this will be implemented, but there is lobbying from some Highway Authorities and it is being discussed at street works co-ordination meetings.

43.48 The enactment of this legislation could lead to significant cost implications, but currently there is no clear understanding of the form these regulations would take or the suggested value of contribution and timescale for implementation.

43.49 The potential for the introduction of these costs needs to be factored into any price control re-opener for Traffic Management Act costs.

Individual Highway Authority positions on Permits

43.50 The following tables show the position on the introduction of Permits for each of the Highway Authorities within the boundaries of each licence area.

43.51 The current known status of each authority is given. However from indicating an intention to introduce a Permit scheme to actual implementation can take approximately 12 months. The assessment provides information on geographical coverage and potential impact on costs using the categories below.

WPD licence areas coverage categories:

- Complete – the WPD licence area is the only DNO operating in the Highway Authority area;
- Majority – the WPD licence area operates in the majority of the Highway Authority area, but another DNO also operates in a minimal area;
- Partial – the WPD licence area is a significant presence but shares the area with another DNO;
- Minimal – the WPD licence area operates in a small area of the Highway Authority (less than average of 50 initial notices a year).

Status categories:

- Implemented – a Permit scheme is already in operation;
- Consultation – a Permit scheme is either at consultation or post consultation awaiting Secretary of State approval;
- Preparation – a Permit scheme is being prepared for consultation
- Planned – a Permit scheme is planned for the future
- No plan – the local authority has not stated it has a plan

43.52 There is a joint Permit scheme under-development across the Midlands called the West and Shires Permit Scheme (WASPS) where a number of local authorities could operate under the same scheme.

West Midlands

Permit system status for Highway Authorities in the West Midlands			
Highway Authority	**Coverage**	**Status as at May 2013**	**Status**
Birmingham City Council	Complete	Preparing strategic routes scheme. Planned implementation 2014	Preparation
Borough of Telford & Wrekin Council	Complete	Will introduce permit scheme but no timescale or detail announced	Planned
Cheshire East Council	Minimal	May be part of WASPs – subject to cabinet approval	Planned
Dudley Metropolitan Borough Council	Complete	May be part of WASPs – subject to cabinet approval	Planned
Gloucestershire County Council	Complete	Will introduce permit scheme but no timescale or detail announced	Planned
Herefordshire County Council	Complete	Will introduce permit scheme but no timescale or detail announced	Planned
Oxfordshire County Council	Partial	No plans announced	No Plan
Sandwell Metropolitan Borough Council	Complete	Will introduce permit scheme but no timescale or detail announced	Planned
Shropshire County Council	Majority	Preparing All Streets scheme as a common scheme WASPS April 2014	Consultation
South Gloucestershire County Council	Partial	No plans announced	No Plan
Staffordshire County Council	Majority	May be part of WASPs – subject to cabinet approval	Planned
Stoke-on-Trent City Council	Complete	May be part of WASPs – subject to cabinet approval	Planned
Walsall Metropolitan Borough Council	Complete	Will introduce permit scheme but no timescale or detail announced	Planned
Wolverhampton City Council	Complete	Will introduce permit scheme but no timescale or detail announced	Planned
Worcestershire County Council	Complete	Will introduce permit scheme but no timescale or detail announced	Planned

East Midlands

Permit system status for Highway Authorities in the East Midlands			
Highway Authority	**Coverage**	**Status as at May 2013**	**Status**
Bedfordshire Borough Council	Minimal	All Streets Scheme implemented Nov 2012	Implemented
Buckinghamshire County Council	Partial	Consultation on strategic routes scheme ended Jan 2013, Planned implementation Autumn 2013	Post Consultation
Cambridgeshire County Council	Minimal	No plans announced	No Plan
Central Bedfordshire	Minimal	No plans announced	No Plan
Coventry City Council	Complete	May be part of WASPs – subject to cabinet approval	Planned
Derby City Council	Complete	Awaiting Secretary of State approval on strategic routes scheme. Planned implementation Autumn 2013	Post Consultation
Derbyshire County Council	Majority	Preparing strategic all streets scheme (may change). Planned implementation Autumn 2013	Preparation
Doncaster Metropolitan Borough Council	Minimal	Strategic routes scheme implemented June 2012.	Implemented
Leicester City Council	Complete	Preparing All Streets scheme. Planned implementation 2014	Preparation
Leicestershire County Council	Complete	No plans announced	No Plan
Lincolnshire County Council	Complete	No plans announced	No Plan
Milton Keynes Council	Complete	Strategic scheme out for consultation. Planned implementation 2014	Consultation
Northamptonshire County Council	Complete	Strategic routes scheme implemented Jan 2011	Implemented
Nottingham City Council	Complete	Preparing All Streets scheme. Planned implementation 2014	Preparation
Peterborough City Council	Minimal	No plans announced	No Plan
Rutland County Council	Complete	No plans announced	No Plan
Sheffield City Council	Minimal	Strategic routes scheme implemented June 2012.	Implemented
Solihull Metropolitan Borough Council	Partial	Will introduce permit scheme but no timescale or detail announced	Planned
Staffordshire County Council	Partial	May be part of WASPs – subject to cabinet approval	Planned
Warwickshire County Council	Partial	May be part of WASPs – subject to cabinet approval	Planned

South Wales

Permit system status for Highway Authorities in South Wales			
Highway Authority	**Coverage**	**Status as at May 2013**	**Status**
Blaenau Gwent	Complete	No plans announced	No Plan
Bridgend	Complete	No plans announced	No Plan
Caerphilly	Complete	No plans announced	No Plan
Cardiff	Complete	No plans announced	No Plan
Carmarthenshire	Complete	No plans announced	No Plan
Ceridigion	Complete	No plans announced	No Plan
Denbighshire	Minimal	No plans announced	No Plan
Gwynedd	Minimal	No plans announced	No Plan
Merthyr Tydfil	Complete	No plans announced	No Plan
Monmouthshire	Complete	No plans announced	No Plan
Neath Port Talbot	Complete	No plans announced	No Plan
Newport	Complete	No plans announced	No Plan
Pembrokeshire	Complete	No plans announced	No Plan
Powys	Partial	No plans announced	No Plan
Rhondda Cynon Taf	Complete	No plans announced	No Plan
Swansea	Complete	No plans announced	No Plan
Torfaen	Complete	No plans announced	No Plan
Vale of Glamorgan	Complete	No plans announced	No Plan
Wrexham	Minimal	No plans announced	No Plan

South West

Permit system status for Highway Authorities in the South West			
Highway Authority	**Coverage**	**Status as at May 2013**	**Status**
Bath & North East Somerset	Complete	No plans announced	No Plan
Bristol City	Complete	Mayor has announced desire for Permit Scheme, no further detail at this point	Planned
Cornwall County Council	Complete	No plans announced	No Plan
Devon County Council	Complete	No plans announced	No Plan
Dorset County Council	Partial	No plans announced	No Plan
North Somerset	Complete	No plans announced	No Plan
Plymouth City Council	Complete	No plans announced	No Plan
Somerset County Council	Complete	No plans announced	No Plan
South Gloucestershire County Council	Partial	No plans announced	No Plan
Torbay	Complete	No plans announced	No Plan

Business support costs

44 Introduction

44.1 Business support costs include a number of corporate activities that are provided by central functions for all licence areas.

44.2 WPD operates a low overhead business and there are no plans to change this philosophy. Generally, where increased requirements arise, these will be absorbed within the existing resources, accommodated through process improvements and efficiencies.

44.3 The following table summarises the corporate activity business support costs that are forecast for RIIO-ED1.

Corporate activities expenditure RIIO-ED1 (£m)					
	West Midlands	East Midlands	South Wales	South West	WPD Total
HR and non-operational training	6.1	6.2	3.6	5.0	20.9
Finance and regulation	62.9	57.9	35.7	57.9	214.4
CEO and corporate communication	18.0	19.0	8.0	12.9	57.9
RIIO-ED1 Total (8 years)	**87.0**	**83.1**	**47.3**	**75.8**	**293.2**

44.4 The following sections provide more details about each category of costs.

45 Human resources and non-operational training

45.1 The expenditure on human resources covers all the costs associated with the human resources function including development of HR policy and procedures, employee relations, payroll management, costs of recruiting non-operational staff and communicating to staff through letters and staff magazines.

45.2 The costs for non-operational training include the preparation and provision of non-engineering training courses and IT and telecoms training. The majority of training provided in WPD focusses on operational requirements and therefore expenditure in this area is low.

45.3 There are no anticipated increased requirements for either human resources and non-operational training. Efficiencies will be introduced into processing of payroll once current paper systems are replaced with electronic timesheets for staff involved in delivering direct activities (i.e. those that are directly involved with inspecting, maintaining, repairing, installing and replacing network assets).

45.4 Expenditure forecasts are broadly in line with current levels. The generic 1% per annum efficiencies that have been applied across expenditure forecasts will be partly achieved in Human Resources costs through the move to electronic timesheets.

Human resources and non-operational training expenditure (£m)					
	West Midlands	East Midlands	South Wales	South West	WPD Total
DPCR5 Annual Average	1.4	1.2	0.6	0.8	3.9
RIIO-ED1 Annual Average	0.8	0.8	0.4	0.6	2.6
RIIO-ED1 Total (8 years)	**6.1**	**6.2**	**3.6**	**5.0**	**20.9**

46 Finance & regulation

46.1 Finance and Regulation expenditure covers a wide range of activities that are grouped into five main categories:

- Finance;
- Insurance;
- Network Regulation;
- Procurement;
- Fines and penalties.

46.2 Finance activities include statutory and regulatory accounting. Whilst statutory accounting is not expected to change, the scale of regulatory reporting has grown with each price control as a consequence of the evolving maturity of the regulators understanding of DNOs. Increasingly sophisticated and detailed reporting templates are being introduced and require additional information to be extracted from DNO systems, translated into the required regulatory format and entered into predefined templates. WPD has implemented data analysis software (Hyperion) to make the extraction of data and population of templates less resource intensive, more consistent and faster. This means that as the burden of regulatory reporting increases, the impact on resource requirements is minimised, with more time dedicated to checking and validating rather than data handling.

46.3 Insurance includes the costs of insuring against events and the claims against DNOs for any damage that may have been caused during routine work activities. WPD works hard to ensure that customers are not inconvenienced and deals with genuine complaints and claims quickly. This avoids the need for protracted negotiations and the additional costs involved.

46.4 Regulatory obligations change with each price control, but once they are set they remain broadly unchanged. The role of the regulatory function is to ensure there is compliance with requirements and that obligations are met. Work is also carried out on the development of price control mechanisms through industry working groups to gain a better understanding of performance and establish new mechanisms for future price controls. The introduction of an eight year price control will mean that there should be more stability for a longer period of time.

46.5 There are no expected major changes to the requirements for procurement. WPD will continue to integrate contracts, incorporating requirements from the two Midlands DNOs into South West and South Wales contracts, to gain better efficiencies of scale. New contracts will need to be established for smart grid devices, but the impact of this will be minimal.

46.6 Cost forecasts remain broadly in line with current expenditure.

Finance and regulation expenditure (£m)					
	West Midlands	East Midlands	South Wales	South West	WPD Total
DPCR5 Annual Average	7.4	6.7	4.4	7.0	25.5
RIIO-ED1 Annual Average	7.9	7.2	4.5	7.2	26.8
RIIO-ED1 Total (8 years)	**62.9**	**57.9**	**35.7**	**57.9**	**214.4**

47 CEO, group directors and corporate communication

47.1 The expenditure classed under CEO include the cost of directors, board meeting costs, corporate communications, community awareness, legal services and company secretarial. There are no anticipated changes to CEO, director, legal and secretarial costs during the RIIO-ED1 period.

47.2 WPD supports numerous community initiatives, working with schools, children's sport teams, and community groups, providing information and sponsorship. Every year all customers receive a copy of the Power for Life publication, a four page A4 document, containing information about the company and promoting the existence of Guaranteed Standards of Service. This is supplemented by a TV advertising campaign that runs for a month on ITV and S4C, at various times of the day, to increase the awareness of who WPD are and what we do. We propose to continue with these initiatives to support local communities and make customers more aware of WPD. The costs of these activities are forecast to remain broadly in line with current expenditure.

47.3 There will be an additional £0.5m spent each year on raising the awareness of services available for vulnerable customers and provision of those services.

CEO, group directors and corporate communication expenditure (£m)					
	West Midlands	East Midlands	South Wales	South West	WPD Total
DPCR5 Annual Average	2.0	2.2	1.3	2.2	7.7
RIIO-ED1 Annual Average	2.3	2.4	1.0	1.6	7.2
RIIO-ED1 Total (8 years)	**18.0**	**19.0**	**8.0**	**12.9**	**57.9**

Vehicles, IT, property and tools

48 Introduction

48.1 The following four categories of expenditure have been historically classed as non-operational capex:

- Purchase of vehicles;
- Purchase of IT systems;
- Purchase and refurbishment of properties;
- Purchase of small tools, equipment, plant and machinery.

48.2 This section covers these costs, but also considers the costs that are classed as closely associated indirect costs for vehicles and business support costs for IT and property.

48.3 The following table summarises the costs for non-operational capital expenditure. It also shows the related costs for closely associated indirect costs or business support costs.

Vehicles, IT, property and tools expenditure RIIO-ED1 (£m)					
	West Midlands	**East Midlands**	**South Wales**	**South West**	**WPD Total**
Vehicles closely associated indirects	34.1	26.2	17.2	29.9	107.5
Vehicles capital	30.3	23.3	15.2	26.3	95.2
IT&T business support costs	78.9	78.9	39.8	65.4	263.0
IT&T capital	33.9	33.9	17.1	27.8	112.6
Property business support costs	33.6	44.6	16.2	28.0	122.3
Property capital	3.4	3.3	2.3	5.4	14.3
Tools and equipment capital	22.9	22.9	12.6	19.0	77.4
RIIO-ED1 Total (8 years)	**237.1**	**233.1**	**120.4**	**201.8**	**792.3**

48.4 The following sections provide more details about each category of costs.

49 Vehicles & transport

49.1 WPD requires a fleet of vehicles and mobile plant to access and maintain the electricity distribution network. Historically in the West Midlands and East Midlands vehicles have been leased, but in South Wales and South West vehicles have been purchased. Vehicles in the Midlands will be progressively replaced with purchased items as the leases expire.

49.2 Fleet management is undertaken by a dedicated in-house WPD team, consisting of a Transport Manager and regional controllers for day to day fleet management. Vehicle specification and purchasing is undertaken by a technical specialist. Compliance and administration is covered by a small section based at two sites.

49.3 Regulatory cost reporting treats leased vehicles as closely associated indirects, whereas purchased vehicles are treated as non-operational capital. In recognition of the potential impact on cost benchmarking, Ofgem is analysing all the costs together and therefore for ease of reference all vehicle costs are included within this section.

Closely associated indirect vehicle costs

49.4 Closely associated indirect vehicle costs cover the activities of managing, operating and maintaining the commercial vehicle fleet and mobile plant (including generators). This includes lease costs, maintenance and repair, and fuel costs.

49.5 These costs are related to the amount of activity being carried out on the network. Expenditure forecasts have been rolled forward in proportion to the changes in the work programme with the application of the following cost reductions.

49.6 Cost benefit analysis demonstrates that it is better to purchase vehicles than lease them. Reductions have been applied to cost forecasts for the West Midlands and East Midlands to take account of the move from leased vehicles to purchased vehicles. These changes will be progressive and will apply when existing vehicles reach the end of their lease periods.

49.7 Reductions have also been incorporated for cost savings resulting from better fuel economy. When vehicles reach the end of their useful lives they will be replaced with modern vehicle that have more fuel efficient engines. In addition, having already trialled electric commercial vehicles for some time, we have placed orders for the new Renault Kangoo electric vans. Whilst the vehicles will be purchased outright, the battery units will be leased. This will reduce the overall operating costs of these vehicles, particularly as the battery upgrade costs can be significant

49.8 The maintenance and repair activity is completed by our own directly staffed workshops in the South West and by outsourced workshops in the other WPD areas. To ensure that our operating model remains the most cost effective, we have recently commenced a pilot project to compare costs between in house and out sourced facilities by opening a WPD operated workshop in Gloucester. Cost benefit analysis shows that having internal, flexible maintenance facilities provides a lower overall cost for vehicle maintenance. Facilities will be developed over the RIIO-ED1 period for more in-house maintenance

Vehicles closely associated indirect expenditure (£m)					
	West Midlands	East Midlands	South Wales	South West	WPD Total
DPCR5 Annual Average	9.6	8.9	3.9	6.1	28.6
RIIO-ED1 Annual Average	4.3	3.3	2.2	3.7	13.4
RIIO-ED1 Total (8 years)	**34.1**	**26.2**	**17.2**	**29.9**	**107.5**

Non-operational capital vehicle costs

49.9 The purchase of new vehicles, plant and generators is treated as a capital cost, but as these items do not form part of the network they are classed as being non-operational.

49.10 Vehicles are replaced based on an economic life where the age, condition and amount of use in service is considered against the cost of operating the vehicle. Vehicle replacement also provides the following benefits:

- cost reduction as vehicles with high running costs are replaced with more economic vehicles;
- reduced emissions as engine performance and body design improve;
- improved vehicle reliability;
- greater employee safety from vehicle improvements.

49.11 The options for financing new vehicles are either outright purchase or lease agreements. As mentioned above, vehicles in the East and West Midlands were leased, and as leases expire, replacements will be directly purchased. Our forecasts reflect this transition.

49.12 To ensure that our business approach to new and replacement vehicles remains the most cost effective, we undertake comparisons of purchase and lease costs, and our current analysis shows that outright purchase has a lower overall cost.

Example of monthly vehicle lease/purchase comparison			
Vehicle Type	**Lease cost**	**Purchase**	**% reduction**
Ford Transit 350	£334.93	£200.31	40%
Ford Connect 220	£237.24	£114.72	52%
Defender 110 MEWP	£942.43	£404.92	57%

49.13 Additionally, benefits associated with purchase of vehicles include being able to determine the vehicle life and avoiding punitive excess mileage and condition charges on vehicles that travel great distances.

49.14 As work programmes grow more vehicles are required to enable the work to be carried out. The forecast therefore reflects the changes to the work programme, as well as the migration from leasing.

Additional generation

49.15 Proposed changes to the Guaranteed Standard EGS2 mean that there will be a greater requirement for us to make use of mobile generation to be able to restore supplies in less than 12 hours.

49.16 WPD has been working with generator suppliers to develop new ways of connecting generators to the network. This has led to the availability of larger distribution accessories that can be connected to generators to provide temporary supplies to more customers in a greater number of fault and location specific circumstances.

49.17 Additional mobile generators and accessories will be purchased.

Vehicles non-operational capital expenditure

Vehicles non-operational capital expenditure (£m)					
	West Midlands	East Midlands	South Wales	South West	WPD Total
DPCR5 Annual Average	4.4	3.9	1.2	2.1	11.7
RIIO-ED1 Annual Average	3.8	2.9	1.9	3.3	11.9
RIIO-ED1 Total (8 years)	**30.3**	**23.3**	**15.2**	**26.3**	**95.2**

50 IT & telecoms (IT&T)

Introduction

50.1 WPD's Information Resources (IR) team is responsible for the purchase, development, installation and maintenance of non-operational computer and telecommunications systems and applications. This includes all the operating and maintenance costs of the IT infrastructure (servers, data & telephony networks, PC's and printers) including management and applications software costs. It excludes the IT and communications systems that are used to control the network and collect data from operational sites, which are classified as operational IT&T.

50.2 The IR team aims to deliver a simple 'no frills', highly resilient and available IT&T function, based on a flat and lean structure, without any reliance on contractors or outsourcing.

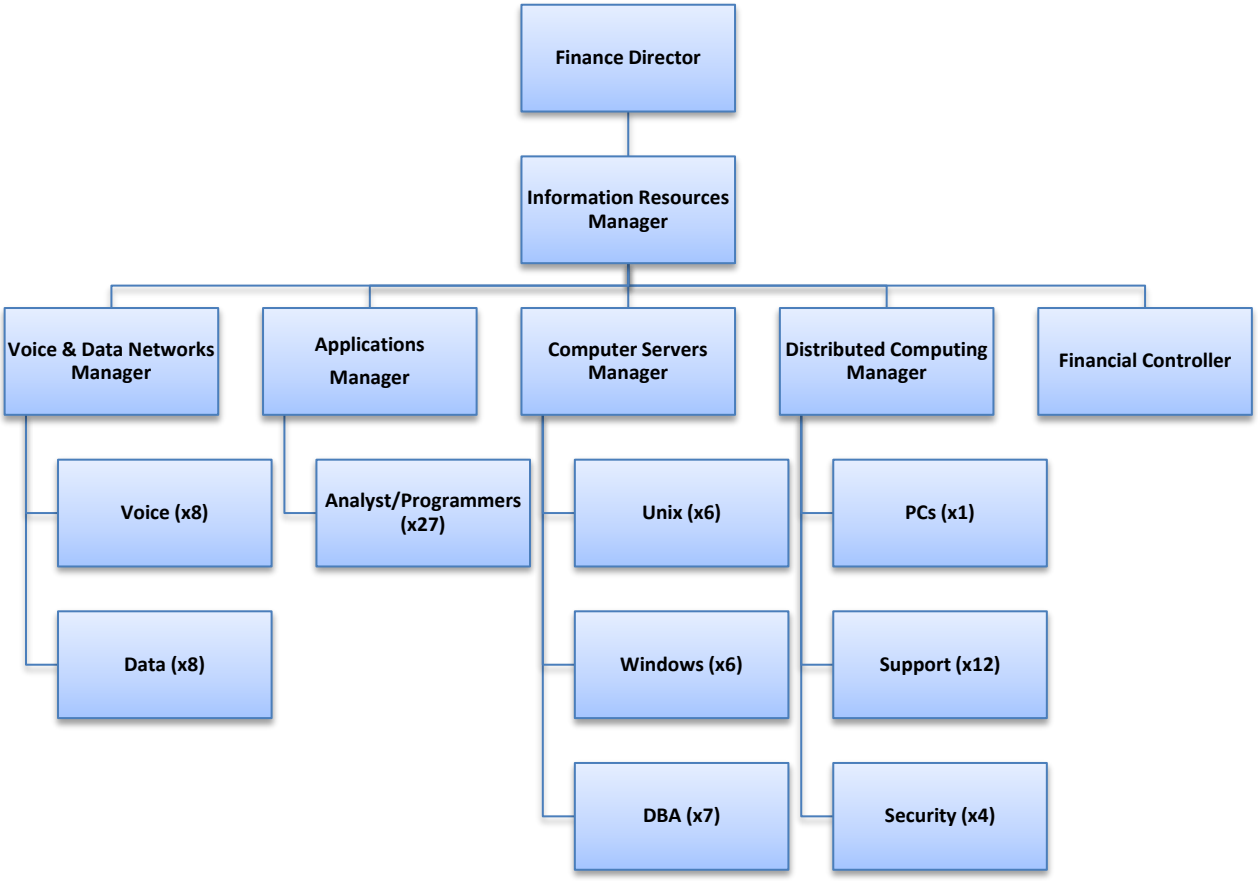
50.3 The IR team is an integral part of the business and not an arms-length service provider. IR shares WPD's goals and delivers IT&T services that are responsive, innovative, reliable and flexible in meeting business requirements.

50.4 The IR team's core principles are:

- **Business led** – IT services should be led by business need. By keeping core IT&T skills in-house enables the IT&T management team to develop close working relationships with the WPD management team and ensure that IT services are properly aligned with WPD business priorities.
- **Self help** –training existing business staff to provide first line support to their colleagues. This has removed the need for a help desk. (It is estimated that this approach saves £2.6m per annum when compared to previous arrangements in place for the two Midlands DNOs prior to acquisition by WPD).
- **Reliability** – achieved by using Tier 1 suppliers - such as IBM, Oracle, Dell, and Microsoft. The performance afforded by adopting proven technologies reduces the risks (and hidden costs) arising from obscure, over-hyped solutions with poor supply chains and inadequate support.
- **Standardisation** – using standard approaches across all hardware and software platforms minimises support costs by limiting the spread of skills needed by internal and external support staff. (It is estimated that this approach saves £1.3m per annum by having fewer support staff).
- **Minimising overheads** – achieved by flattening organisational structures, removing internal service level agreement processes and absorbing the roles of IT strategy, problem and change management, disaster recovery, business account management, project office and security oversight into the management team roles. (It is estimated that this approach saves £0.5m per annum by having fewer project managers and admin staff for these functions)
- **Resilience to Cyber security threats** – WPD has a policy of no direct access to the internet from WPD desk top and laptop computers. The benefits of this innovative policy are significant mitigation of the cyber security risk. (It is estimated that this approach saves at least £450k per annum by avoiding the costs of licences for security software and specialist staff). Furthermore, this policy leads to productivity benefits from the reduction in 'cyberloafing' -non-productive time associated with employees using the internet for personal reasons during working hours.

Organisation

50.5 The IR team headcount is currently 84. It is headed by five functional managers who are responsible for the delivery of all IT&T services to the company who report to the IR Manager who in turn reports to the Finance Director.



50.6 The scale of WPD's IT&T systems has grown significantly since 1999 with 3 major step changes each of which has demonstrated our ability to be both efficient and innovative.

- October 1999 - sale of SWEB supply business to London Electricity to create Western Power Distribution as a stand-alone DNO;
- April 2001 – integration of Infralec (Hyder);
- October 2011 – integration of Central Networks.

WHEN	HEADCOUNT	NOTES	
Oct 1999	45	1 licence	Following sale of SWEB supply business to London Electricity to create Western Power Distribution as a stand-alone DNO
Apr 2001	55	2 licences	+10 following Infralec (Hyder) Integration
Oct 2011	81	4 licences	+26 following Central Networks (Midlands) Integration
Apr 2013	84	4 licences	+3 due to sustained increase in workload since Central Networks (Midlands) Integration

50.7 After the supply business separation in 1999, WPD's strategy was to create a simple, cost effective, efficient and free-standing distribution business. Part of this was the successful creation of a brand new IT&T section.

50.8 The Infralec merger and acquisition activity in 2001 saw a two-thirds increase in business activity but only a marginal increase in staff numbers and IT&T costs. There was no change to the underlying strategy of how IT&T should be run within WPD. The strategy remained the same being based on the principles of keeping IT simple, standard, supported and under the direct control of the business.

50.9 The Central Networks merger and acquisition activity in 2011 exposed us to an example of an alternative way of running IT and reinforced our conviction that adopting the WPD approach is both more effective and less expensive.

50.10 Central Networks was a distribution business consisting of the two licences in East Midlands and West Midlands with the same business purpose as WPD. However, the business and IT were operated far less efficiently than WPD.

50.11 With respect to IT&T all of the IT services required by Central Networks had been outsourced firstly to the parent company E.ON and then on again to T-Systems and Hewlett Packard (HP). The only IT function that remained directly under Central Networks control was the Applications team consisting of some 73 people. The total costs for running IT&T (including Temporary Service Agreements with E.ON and CN IT staff) became the responsibility of WPD on completion of the sale.

50.12 By adopting the WPD approach, a saving of at least £19m per annum was made compared to the way Central Networks ran their IT&T.

50.13 These results have been examined through external benchmarking:

- The 2009 Mouchel Consulting cross DNO benchmark study concluded that "WPD operates a particularly lean IT operation to achieve low unit cost". This was substantiated with WPD ranking first in the majority of measures;
- The 2012 Deloittes' benchmark study concluded that WPD's South West & South Wales DNOs were efficient against the DNO benchmark in 2009/10. Acquiring two less efficient DNOs could have led to weaker productivity. Instead, the KPIs for the post-merger company show that productivity improved further compared to WPD in 2009/10. Most importantly the increase in IT&T costs for WPD from its efficient cost base of South Wales and South West to the larger group is less than would be expected given the availabilities of economies of scale. More details can be found in the Supplementary Annex (SA-08) Business Efficiency.

The task

50.14 Non-operational business activities (together with user numbers, locations and service levels) determine non-operational IT&T activity and costs.

50.15 The non-operational business activities undertaken by the WPD IR team are responsible for delivering outputs that are integral to the overall performance of the business, these include inter alia:

Business activities supported by the WPD IR team		
Corporate Services	**Network Services**	**Logistics**
Accounts Payable Accounts Receivable Data Transfer Network DUoS Billing End User Reporting Finance and Regulation General Ledger Human Resources Legal Management Reporting Meter Point Administration Payroll & Pensions Taxation Treasury	Contact Centres Control Centres Load Analysis Network Asset Management Network Geographical System Mapping Network Policy, Design and Engineering Pole & Site Risk Inspections Stores Barcoding Street Works Time Sheet Recording Vegetation Management	Inventory Management Procurement Property Purchase Management Transport Warehouse Management

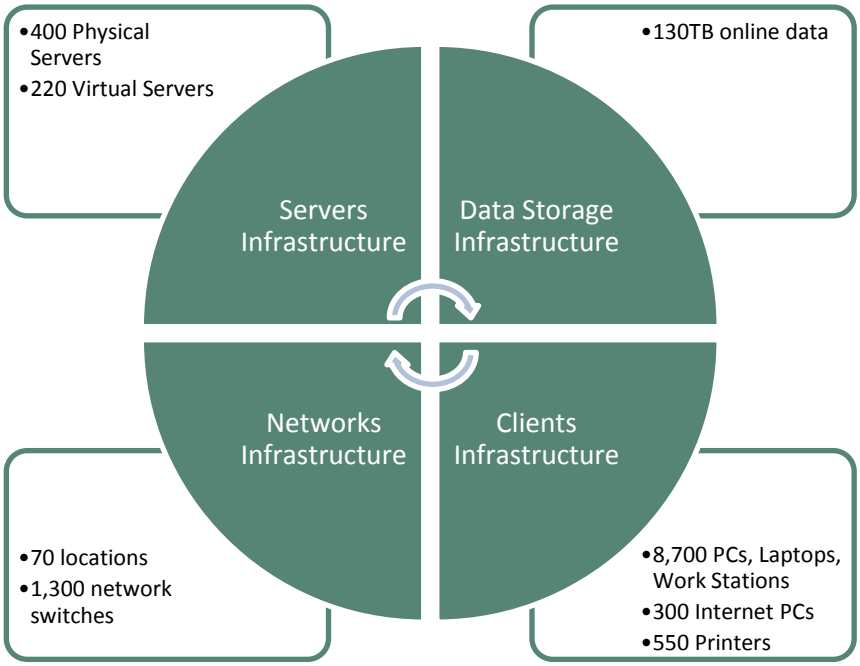
50.16 In support of these business activities IT&T can be separated into two main components:

- Software applications;
- Infrastructure.

50.17 Software applications provide the benefits to the business of reduced clerical staff costs, efficient business processes, better management control, greater productivity, compliance with regulations and improved customer service.

50.18 Software applications are supported by an underlying infrastructure that must be maintained, kept reliable and remain compatible with the software applications in order for the business to realise the benefits.

50.19 The scale of the IT&T required to support WPD's non-operational business is shown below:



50.20 This set of requirements could be supported in a variety of ways with any combination of contractors, outsourcing, in-sourcing, off-shoring, near-shoring and managed service arrangements.

50.21 WPD has chosen to keep direct control and retain a small core in house IT&T team. We do not outsource our service provision and we do not engage IT contractors. This enables WPD to ensure that IT&T support for its business requirements are satisfied as cost effectively, timely and efficiently as possible.

50.22 The choices WPD has made with respective to the efficient and cost effective delivery of Business Support costs and Purchasing of IT&T are described below.

IT&T business support costs

Activity overview

50.23 All daily maintenance and support activities are managed by WPD's IR team directly.

50.24 The IT&T activities ensure that on a daily basis the IT&T that the business relies on is available, reliable and performing as expected.

IT&T activities

50.25 Distributed Computing is responsible for delivery of the client computing infrastructure. This includes the support and services required for desktops, laptops, workstations, mobile devices, printers and the corporate desktop software portfolio. This includes:

- software purchasing, licensing, installation and maintenance;
- hardware purchasing, asset management, installation and maintenance;
- IT problem fixing and support;
- local IT support liaison ("virtual help desk");
- hardware and software technology refresh program;
- user security administration for Windows, mainframe, email, remote access, internet, corporate data share user accounts, starters, leavers and movers requests, password reset requests;
- information security awareness;
- infrastructure change management;
- mobile phones administration;
- disaster recovery testing and contingency planning.

50.26 Computer Services is responsible for the delivery of server computing infrastructure. This includes all server processors, data storage, sub systems and systems infrastructure software such as operating systems, job scheduling, database management systems, electronic mail and firewalls. This includes:

- software purchasing, licensing, installation and maintenance;
- hardware purchasing, asset management, installation and maintenance;
- operating system administration for Windows, Unix and Linux infrastructure;
- database administration for Oracle and SQL Server infrastructure;
- system administration for email infrastructure;
- backup and recovery, system monitoring, alerting, batch scheduling & capacity planning;
- firewall security management and control;
- infrastructure change management;
- hardware and software technology refresh program;
- disaster recovery testing and contingency planning;
- security and controls of Plymouth data centre (including air conditioning, Uninterruptable Power Supply (UPS) protection and intruder, fire, water alarms).

50.27 Communications Services is responsible for delivery of the voice and data network infrastructure and associated Control Rooms and Contact Centre systems. This includes:

- service management of voice and data network connectivity to the wide area network;
- system administration of the Local Area Network;
- system administration of the telephony system;
- system administration of voice mail system;
- system administration of voice recording system;
- system administration of control room telephony system;
- internet and non-internet communications infrastructure security;

- hardware and software technology refresh program;
- infrastructure change management;
- security and controls of out-based IT/Comms equipment rooms (including air conditioning, uninterruptable power supply protection and intruder, fire, water alarms);
- disaster recovery testing and contingency planning;
- third party management for WAN connectivity that connects WPD sites with voice and data networks, telephony, network equipment, mobile phones (service reviews, contracts, upgrades, outages, support).

50.28 Applications are responsible for delivery of the development, implementation, integration, support and enhancement of the application portfolio including the key business systems for corporate, distribution and smart metering. This includes:

- project life cycle management (estimating, planning and control);
- systems analysis (requirements, data);
- systems design (data design, software);
- systems development (programming);
- interfaces design and controls;
- data migration;
- system testing;
- system implementation;
- support and maintenance;
- applications change management;
- code management and version control;
- 3rd party developed systems integration;
- disaster recovery testing and contingency planning.

Cost drivers

50.29 WPD needs a set of core systems to support its (non-operational) business. These systems determine the level of fixed costs required for:

- applications support and maintenance;
- server support;
- database support;
- computer operations;
- network support;
- IT support;
- security administration;
- hardware maintenance;
- software licensing;
- data storage;
- disaster recovery;
- data centre;
- problem management;
- change management;
- cyber security.

50.30 The geographical nature of WPD's business and the operational requirements drive the number of locations (e.g. offices) requiring connectivity that, together with the required reliability and performance determine the level of variable costs for:

- voice and data network circuit (distance, bandwidth and resilience);
- communications/server rooms and support facilities (e.g. UPS, air conditioning, alarms);
- voice/data infrastructure (number of switches/ISDXs);
- local office server infrastructure (number of servers).

50.31 In addition, the user base mix/size determines the level of variable costs for;

- PCs/laptops;
- printers;
- fixed phones/mobile phones;
- voice/data usage costs;
- software licensing costs;
- support calls.

Expenditure forecast

50.32 The forecast has been built up by taking 2012/13 figures as a base and adjusting forecast operating costs with anticipated innovations, known contract changes and new regulatory requirements including:

- removal of mainframe managed services costs due to implementation of a new business system (E5) in 2013 for general ledger, accounts payable, accounts receivable, inventory management and project costing;
- growth in applications support and associated hardware that will be deployed to field staff e.g. electronic timesheets, substation inspections and work orders on tablet type devices;
- increased applications licences and support costs due to regulatory changes requiring new software systems or enhancements e.g. Street Wworks, Meter Point Registration System, geographical mapping of the network, Data Transfer Network for meter data exchange, asset management;
- increased use of management reporting and business intelligence tools (e.g. Webfocus & Hyperion);
- increased use of internet and portal based systems to interact with suppliers and customers e.g. new connections, supply chain management, procurement to pay, stakeholder engagement;
- greater use of image and video as part of normal business processes necessitating the need for new systems to facilitate increasing data storage volumes, management and back up;
- additional and improved ways of providing secure remote access to WPD systems e.g. from home, hotels, mobile;
- changes in software licensing models to match improvements in hardware performance;
- increased use of SMS texting to customers and staff to improve communications;
- Increased use of mobile mail – currently restricted to senior managers but could be pushed further down reporting lines as the need for mobile mail increases;
- New security systems to mitigate risks from cyber threats e.g. intrusion detection, vulnerability analysis, penetration testing;
- Expiry of PPL corporate discount for Oracle licences – the purchase agreement ending in 2017 will increase Oracle support costs;
- Replacement of unsupported technologies (e.g. conversion of ISDX telephony to internet protocol telephony) will incur increased hardware and software maintenance costs;
- Additional communication circuits and bandwidth between WPD offices to improve resilience and availability of voice and data network infrastructure;
- Increased use of internet services requiring improved connectivity and bandwidth.

50.33 Previous forecasts have been shown to have been accurate.

50.34 All revenue spend will be controlled in line with WPD's financial controls & policies.

IT&T business support costs

IT&T business support cost (£m)					
	West Midlands	East Midlands	South Wales	South West	WPD Total
DPCR5 Annual Average	11.2	10.7	5.2	8.2	35.3
RIIO-ED1 Annual Average	9.9	9.9	5.0	8.2	32.9
RIIO-ED1 Total (8 years)	**78.9**	**78.9**	**39.8**	**65.4**	**263.0**

Capital purchase of IT & telecoms

Activity overview

50.35 Non-operational capital expenditure maintains the IT&T asset base to meet existing and future business requirements.

50.36 This activity has two main cost drivers: the refresh of IT&T assets and changing business requirements.

Technology refresh of IT&T assets

50.37 Assets such as PCs, printers, servers, switches and software are replaced/upgraded at periodic intervals in order to:

- take advantage of improvements in hardware performance and reliability;
- reduce 'out of warranty' maintenance costs;
- reduce support & training costs by using common technologies across assset bases;
- experience less diverse faults;
- reduce the risk of any new software being incompatible with existing infrastructure.

50.38 Technology refresh delivers immediate benefits through better performance and reliability.

50.39 Technology refresh also enables the business to take advantage of innovation in IT and to apply it within the distribution business. This is because a modern infrastructure reduces the likelihood that any new software will be incompatible (e.g. today's new software will not be certified to run on the old Windows NT platforms). Secondly, WPD can rapidly adopt new technology in the field (e.g. iPads) without having to re-engineer the IT infrastructure that supports it.

50.40 The technology refresh plan is approved annually and is compiled after reviewing the various IT and communications asset bases in order to assess:

- performance, reliability and life expectancy;
- resources required to undertake the technology refresh;
- hardware, software and operating system compatibilities;
- higher storage capacities that may be required, (business operations may require additional storage that in turn will drive a need for faster processors, more memory, higher motherboard speed, faster network capability. Existing technology may be unable to meet the demands);
- servers need to be upgraded together so that they can work seamlessly;
- the likelihood of an increase in maintenance charges from vendors as warranties expire, components become more difficult to source and fault incidence increases;
- the possibility of skipping a generation of technology (e.g. Windows 2003 to Windows 2008) thereby reducing training and driving more value from original investment;
- whether third party software will reach the end of its life. If this occurs vendors are no longer able to maintain code. (e.g. WPD is replacing its general ledger in 2013 – the existing general ledger has been in service for 20 years but will no longer be supported by the original vendor).

50.41 Technology refresh plans are required due to long lead, migration, testing and implementation times needed to ensure that the impact to the business during the change process is minimised.

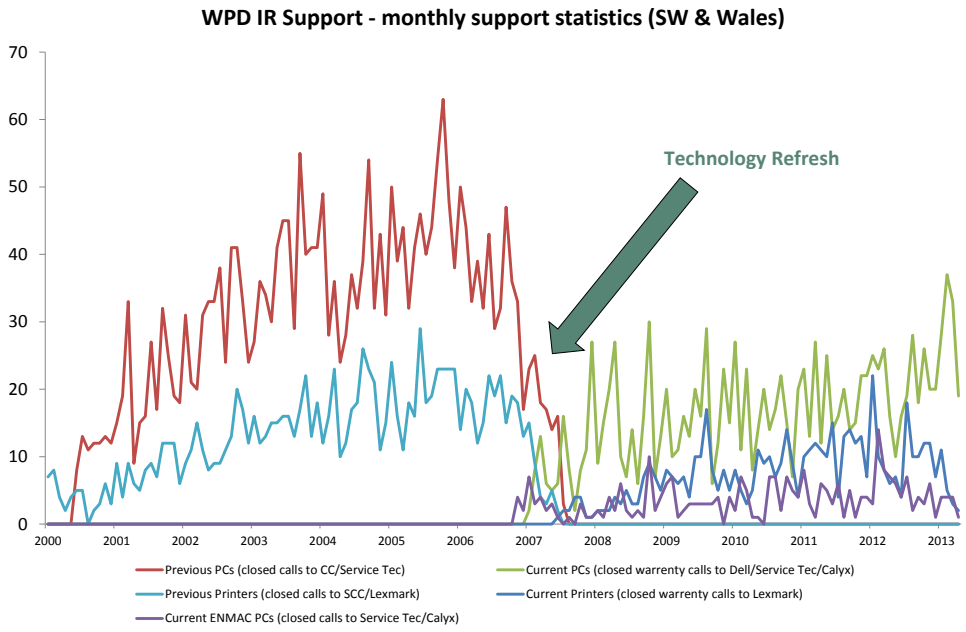
50.42 Assets of similar types (e.g. PCs, servers) are grouped together and refreshed en bloc in order to secure the same technology level across the asset base and obtain favourable bulk

purchase prices. Servers can attract a discount of 15-20% for ad hoc purchases, but we have obtained discounts of up to 60% when purchasing in bulk.

50.43 The table below illustrates some of the PC technology refresh discounts we have recently obtained.

Description	Unit Costs (£)	% Discount given
Dell Optiplex 990 Small Form Factor	480.00	54%
Dell Optiplex 990 Mini Tower	485.00	53%
Dell Latitude 6520 Laptop	838.00	49%
19" TFT	107.00	46%
20" TFT	182.00	47%
24" TFT	315.00	46%
Keyboards (for Laptop Use)	7.00	42%
Wired Mouse (Same as Desktop) (Spares)	3.00	54%
Laptop PSU (Extras)	20.00	54%
Laptop PSU Lead 2m 240v (Extras)	4.50	24%
USB Floppy Disk Kit (Desktop & Laptop)	18.00	14%

50.44 The chart below shows the effect on fault call volumes following the PC technology refresh in 2007.



Changing business requirements

50.45 Evolving markets, changing regulations and business innovation drive longer term work that can involve major changes to existing systems and/or the implementation of new systems. e.g. the acquisition of Central Networks, competition in connections, smart metering, green deal, contact centre performance (HVCT), WPD asset management system (CROWN), field mapping laptops and internet based interfaces (ICP new connections, vegetation management systems).

50.46 Software development projects are normally undertaken in-house although third party companies are involved with the development work if appropriate.

50.47 All such projects are business, not technology, led. Innovation comes from the business driven by the need to improve business efficiency and customer service. IR ensures that the supporting infrastructure required for such projects is available through regular upgrades and periodic technology refreshes.

Drivers of change

Applications software

50.48 The business will continue to innovate and drive the need for non-operational system changes most likely in the areas of:

- field data capture technologies removing the double handling of information;
- field access to corporate office based applications;
- use of internet technology to improve business-to-business processes;
- Contact centre computer telephony integration to improve customer service;
- business intelligence reporting software.

50.49 External influences that will drive functional application changes include:

- smart grids;
- smart metering;
- stakeholder engagement;
- environmental needs;
- regulatory compliance;
- standards of service.

50.50 The implementation of in-house developed systems will only be considered when off the shelf solutions are not available to meet business needs or where there are significant cost efficiencies to doing so. (For example, the HVCT system was built for 10% of the cost quoted by a third-party developer). However, such applications are always developed on supported platforms (e.g. Oracle).

50.51 WPD uses a high number of 3rd party applications. These suppliers will continue to enhance their software in line with industry trends (e.g. Web enabled browsers, Linux Operating Systems). Support for these 3rd party applications, in terms of bug fixing and enhancements, will continue to be provided by the 3rd party vendor.

50.52 Support for the integration of 3rd party systems into WPD's systems and subsequent upgrades/patches is provided by IR subject to ensuring the necessary integration skills are in place.

Computer servers

50.53 The current server asset base is standardised on HP and IBM hardware. This is typically on a 3 to 4 year technology refresh cycle.

50.54 Server hardware will continue to be cheaper, faster and more reliable over time. We will also continue to reduce the number of servers by running more than one application on each server (i.e. using virtual servers), but will do so in a way that does not compromise the resilience of the IT network.

50.55 The three, preferred, operating system environments will continue to be IBM's AIX, Red Hat Linux and Windows Server with the latter two using common Intel hardware to reduce operational costs and reduce the risk of having to translate applications from one operating system to another.

50.56 Storage Area Networks (SANs) are the preferred medium for data storage to optimise performance. A SAN provides large volume data storage that can be shared between multiple application servers through a high capacity fibre network. Various forms of RAID (disk redundancy) are used to provide protection from data loss whilst regular snapshots provide point in time recovery points for critical systems. The SANs are copied to the remote disaster

recovery (DR) site to reduce recovery times. The DR site is already equipped with servers to receive the data.

50.57 Server virtualisation reduces the number of physical servers by allowing applications to share the hardware. The benefit of this is clear however whilst software licences are linked to physical server processor sockets/cores, the deployment of software whether on physical or virtual environments continues to be a complex subject, with vendors pursuing conflicting strategies. Staying on top of licensing models and proving compliance will reinforce the need to keep things simple.

Distributed computing (PCs and printers)

50.58 The current asset base is standardised on Dell and Lexmark hardware. This is typically on a 3 to 4 year technology refresh cycle.

50.59 Client devices are becoming increasingly more commoditised and standard across Tier 1 manufacturers. This in turn makes devices both cheaper and more powerful

50.60 WPD PC clients will still predominately be desktop machines ('Thick Client'), because these suit the applications that are used in the business. However we plan to use more laptop/hand held devices with the introduction of more mobile working throughout the company.

50.61 There will continue to be a requirement for dedicated workgroup printers at each site, but there will be an increase in multi-functional printers to improve on the printer cost per page.

50.62 Improvements will be made in centralised system management of all client devices. Smart technologies and systems will be sought to ease the cost of supporting an enterprise size, national, multi-site organisation.

Data network

50.63 The current data network asset base is standardised on Cisco and Juniper hardware. This is typically on a 4 to 5 year technology refresh cycle.

50.64 The demand for an increasingly resilient, reliable, high bandwidth, low latency network will continue in order to meet business needs for highly available services with increasing amounts of data traffic - driven by smart metering, smart grids, mapping data, scanned images, graphics, pictures and video.

50.65 Wide Area Network (WAN) provision will continue to be provided predominantly by a mix of BT & WPD Telecoms provided circuits. With the acquisition of Central Networks in 2011 the WAN in the Midlands was connected using BT's 21CN network on a 3 year contract. Several South West and South Wales WAN circuits were reinforced to improve resilience and bandwidth requirements. WPD's aim is that WPD Telecoms will develop their network within the Midlands and then migrate circuits away from BT.

50.66 Remote access to corporate systems from WPD laptops has been very successful providing not only greater flexibility for staff but also customer service benefits through the use of home workers for the contact centre. Further improvements will be implemented through the introduction of proven technologies to enable access from home computers to compatible corporate systems e.g. email.

50.67 Changes arising from BT's national network conversion will be closely monitored, however, WPD's strategy is to utilise WPD telecoms network wherever possible.

Telephony network

50.68 The voice network is standardised on Siemens and will continue to be so during the RIIO-ED1 period. This is typically on a 5 year technology refresh cycle.

50.69 The Telephony network in the South Wales and the South West is based on a mature ISDX platform that will be transferred on to an IPT (combined voice and data) platform at the start of ED1. No new ISDX systems were available when we acquired Central Networks in 2011 and so we installed Siemens IPT throughout the West Midlands and East midlands as part of the transition.

50.70 Mobile phones are provided for key business staff and key business functions. Broadly speaking the service providers are Vodafone for South West and South Wales and O2 for the Midlands staff. In addition, key business staff have MTPAS (Mobile Telephone Privilege Access Scheme) enabled mobile phones for Civil Contingencies.

50.71 Smart phones are increasingly popular, with a trend for companies allowing employees to "Bring Your Own Device". Whilst looking to improve WPD mobile mail connectivity, corporately connected smart phones provision will be restricted to approved operating systems and senior staff for cost and security reasons.

Expenditure forecast

50.72 The forecast has been built up by:

- reviewing the base load historical spend, allowing for the recent acquisition of West Midlands and East Midlands and assuming a similar base load will be required for the RIIO-ED1 period;
- identifying the technology refresh cycles of the major IT/Telecoms components assuming refresh costs will remain broadly in line;
- including business driven initiatives to improve functionality and effectiveness.

50.73 Operational IT capital costs covering ENMAC/SCADA, private mobile radio, smart grids and smart metering have not been included. The costs for these are covered by the section on Operational IT&T.

50.74 Technology refresh estimates are provided on the basis that the cost of replacements will be broadly constant although we do expect better performance from the replacement devices.

IT&T Capital expenditure

IT&T non-operational capital expenditure (£m)					
	West Midlands	East Midlands	South Wales	South West	WPD Total
DPCR5 Annual Average	2.8	2.6	1.9	3.1	10.4
RIIO-ED1 Annual Average	4.2	4.2	2.1	3.5	14.1
RIIO-ED1 Total (8 years)	**33.9**	**33.9**	**17.1**	**27.8**	**112.6**

50.75 The well proven track record on the delivery of IT/Comms services that IR has established over previous price review periods will be sustained as we move ahead through RIIO-ED1 by the plan as described above.

Conclusion

50.76 Non-operational IT&T costs are driven by the software applications and infrastructure needed to support the business activities and user base across multiple geographic locations to the required service levels

50.77 WPD's approach of having direct control over IT and its track record demonstrates clear evidence of cost efficiency savings over other approaches of at least £19m per annum.

50.78 The replacement of similar technology types at regular technology refresh intervals ensures that IT&T remains reliable, compatible and through bulk purchasing discounts is cost efficient.

50.79 The investment made by WPD in non-operational IT&T has resulted in WPD maintaining its benchmark performance in terms of customer service, innovation and business efficiency.

51 Property

The property portfolio

51.1 The WPD operational area covers 55,500 km^2, about a quarter of the UK mainland. Operational excellence is achieved by having local teams that can attend to faults quickly and provide a local community based service.

51.2 Offices and depots are required for the 2,500 office-based and 3,600 field staff who serve the 7.8 million customers across the operational area.

51.3 Corporate activities are centralised in a few locations, but there are 59 properties throughout the region for local teams.

51.4 Local depots and reporting centres have office space, an area for parking company vehicles, and a storage area for higher turnover materials.

51.5 We also have two large central stores, from which materials are delivered either to local depots or directly to site.

51.6 Most of the property we occupy is owned by a property company within the group, and the network companies pay a commercial rent to the property company. Property management is run by three people based in Bristol. Specialist work is outsourced to consultants as required.

Environmental policies

51.7 We place a heavy emphasis on minimising our environmental impact, and use the Building Research Establishment Environmental Assessment Method (BREEAM) standards. All new offices and depots have to be BREEAM "excellent", and major refurbishments BREEAM "very good".

Property business support costs

51.8 During the RIIO-ED1 period, the operating costs are expected to remain in line with current levels of expenditure and will cover -the following costs:

- rent;
- security;
- routine maintenance;
- admin;
- cleaning.

Property business support costs expenditure (£m)					
	West Midlands	East Midlands	South Wales	South West	WPD Total
DPCR5 Annual Average	4.8	5.6	2.1	3.4	15.8
RIIO-ED1 Annual Average	4.2	5.6	2.0	3.5	15.3
RIIO-ED1 Total (8 years)	**33.6**	**44.6**	**16.2**	**28.0**	**122.3**

Property non-operational capital expenditure

51.9 We have no plans to buy new properties, but intend to spend almost £2m a year on improvements and refurbishments during the RIIO-ED1 period. This will include the selective installation of low energy lighting, improvements to heating and cooling systems and improved insulation to reduce energy consumption.

Property non-operational capital expenditure (£m)					
	West Midlands	East Midlands	South Wales	South West	WPD Total
DPCR5 Annual Average	0.9	1.2	1.0	1.1	4.3
RIIO-ED1 Annual Average	0.4	0.4	0.3	0.7	1.8
RIIO-ED1 Total (8 years)	**3.4**	**3.3**	**2.3**	**5.4**	**14.3**

52 Small tools, equipment, plant and machinery

52.1 Craft and engineering staff require tools to work on the network assets. These include hand tools for precision work such as electrical fitting and cable jointing, lifting and tensioning tackle for overhead line work, test equipment for commissioning assets and fault location, workshop machinery to enable fitters to refurbish components and plant such as drum trailers and winches used in the erection of overhead conductors.

52.2 Equipment is replaced as items become worn or broken. In addition new staff are provided with the equipment that they require to carry out their duties. Since the rate of usage of equipment and number of new additional staff are related to the volume of work being carried out on the network, the costs have been rolled forward in proportion to the changes in the work programme.

Tools non-operational capital expenditure (£m)					
	West Midlands	East Midlands	South Wales	South West	WPD Total
DPCR5 Annual Average	2.8	3.3	1.7	2.0	9.8
RIIO-ED1 Annual Average	2.9	2.9	1.6	2.4	9.7
RIIO-ED1 Total (8 years)	**22.9**	**22.9**	**12.6**	**19.0**	**77.4**

Non price control costs

53 Non price control costs

53.1 Non price control costs are incurred by carrying out distribution network related activities that operate outside the regulatory price control including the activities where the costs are recharged to third parties. They include:

- excluded services:
  - ES2: Diversion works under an obligation;
  - ES3: Works required by alteration to premises;
  - ES4: Top-up, standby and enhanced system security;
  - ES5: Revenue protection services;
  - ES6: Metering services (other than legacy meter equipment provision);
  - ES7: Miscellaneous.
- legacy metering;
- out of area networks;
- de minimis;
- other (consented) activities.

ES2: Diversions

53.2 Every year there are a number of enquiries for network assets to be moved as a consequence of third party activities. For example, the creation of a new access road onto an existing business estate will remove existing footpaths, lowering ground to road level and reducing depth of cables. This would require the exiting cables to be installed deeper and ducted to provide mechanical protection from the weight of traffic traveling over them. In these circumstances the cost of carrying the work are recovered from the customers and are excluded from price control assessments.

53.3 The majority of these enquiries will be small in scale, with the exception of a very significant and prestigious infrastructure development (High Speed 2 (HS2)) that will impact the East Midlands and West Midlands.

53.4 The forecast for diversions (excluding HS2) are shown in the table below:

Diversions expenditure (excluding HS2) (£m)					
	West Midlands	East Midlands	South Wales	South West	WPD Total
DPCR5 Annual Average	5.6	8.2	2.3	3.6	19.7
RIIO-ED1 Annual Average	8.1	12.0	2.7	4.2	27.0
RIIO-ED1 Total (8 years)	**64.7**	**96.1**	**21.6**	**34.0**	**216.4**

High Speed 2

53.5 In January 2012 the Secretary of State for Transport announced the decision to go ahead with the development of a high speed rail network between London, Birmingham, Leeds and Manchester stating that HS2 is the largest transport infrastructure investment in the UK for a generation.

53.6 HS2 will be built in two phases with the first stage, the link between London and Birmingham, being planned for completion by 2026. The construction of the line will go through the WPD area passing through large parts of Warwickshire, into the North Eastern parts of Birmingham and extending into Staffordshire and consequently there will be the requirement to divert existing overhead line and cables to enable the new railway to be built.

53.7 Detailed analysis of the proposed route has identified that there will be 317 diversion schemes in the RIIO-ED1 period in both the West Midlands and East Midlands. This includes the diversion of overhead lines, underground cables and also some re-siting of substations and plant. Work is due to start in 2017 with completion estimated by 2023.

53.8 There remains uncertainty that HS2 will actually proceed and a change of Government could reverse the decision made in January 2012. For our Business Plan we have assumed that HS2 does proceed. The following information is provided to identify the potential scale of the diversions work should HS2 go ahead.

HS2 project volumes and costs				
	West Midlands		East Midlands	
Voltage	Number of Diversions	Cost (£m)	Number of Diversions	Cost (£m)
132kV	11	24.7	5	6.1
EHV	12	2.3	9	2.0
HV. LV & Communication Circuits	213	23.7	67	6.8
Total	**236**	**50.7**	**81**	**14.9**

ES3: Service alterations

53.9 Every year there are a number of enquiries for network assets to be moved to accommodate an alteration to existing premises. For example, an extension to a property may require the diversion of the existing overhead service. In these circumstances the cost of carrying the work are recovered from the customers and are excluded from price control assessments.

53.10 RIIO-ED1 forecasts are in line with the levels of current (2012/13) expenditure.

Service alteration expenditure (£m)					
	West Midlands	East Midlands	South Wales	South West	WPD Total
DPCR5 Annual Average	3.0	2.4	0.7	1.4	7.5
RIIO-ED1 Annual Average	1.7	1.2	0.6	1.3	4.8
RIIO-ED1 Total (8 years)	**13.5**	**9.7**	**4.9**	**10.2**	**38.3**

ES4: Top-up, stand-by and enhanced systems security

53.11 Top up and standby excluded service income was introduced at the start of privatisation when there was no regulatory distinction between supply business and distribution business revenues within a REC (Regional Electricity Company).

53.12 A customer with their own generation capability required back-up from a REC if their electricity demand exceeded their generation output.

53.13 Whilst a REC was rewarded through the supply tariff if a customer required back-up, there was no reward for a REC if a customer took zero volumes. However, the REC still had to cover the cost of its distribution network assets so the excluded top up and standby service income was created to overcome this issue.

53.14 In subsequent years supply and distribution businesses were separated but top up and standby income continued to be classified as excluded service income by distribution businesses (DNOs).

53.15 In our view it is no longer necessary to have a top up and standby classification because the cost and the volume of the distribution assets relating to top up and standby customers are

included in the RAV; a DNO is rewarded through the price control allowed revenues calculation for RAV and associated operating costs.

53.16 Therefore, for the Business Plan we assume £nil revenues for top up and standby.

ES5: Revenue protection

53.17 Revenue protection services relate to the investigation and prevention of electricity meter interference and other forms of illegal abstraction of electricity.

53.18 This is a service provided to third party suppliers, at their request, with costs recharged to them. Suppliers can make alternate arrangements alternate arrangements for the provision. In South Wales and South West the provision of these services were associated with WPD's domestic metering businesses which were transferred to SSE and EDF respectively. In the West Midlands and East Midlands they remained part of the network operator.

53.19 It is forecast that volumes of activity will remain constant during the RIIO-ED1 period, remaining at 2012/13 levels.

Revenue protection expenditure (£m)					
	West Midlands	East Midlands	South Wales	South West	WPD Total
DPCR5 Annual Average	0.9	0.8	0.0	0.0	1.7
RIIO-ED1 Annual Average	0.7	0.6	0.0	0.0	1.3
RIIO-ED1 Total (8 years)	**5.7**	**4.5**	**0.0**	**0.0**	**10.2**

ES6: Metering services (other than legacy meter equipment provision)

53.20 WPD provides metering services through WPD South West to EDF where meters are purchased and provided primarily to EDF customers under rental agreements. It is anticipated that this service will continue into the RIIO-ED1 period until the roll out of the smart metering programme is completed around 2020. Therefore, we have assumed that the service will wind down to £nil from 2020/21.

Metering services expenditure (£m)					
	West Midlands	East Midlands	South Wales	South West	WPD Total
DPCR5 Annual Average	-	-	-	0.7	0.7
RIIO-ED1 Annual Average	-	-	-	0.2	0.2
RIIO-ED1 Total (8 years)	**-**	**-**	**-**	**1.4**	**1.4**

ES7: Miscellaneous

53.21 WPD does not provide any miscellaneous services

Legacy metering

53.22 Legacy metering activities relate to the provision of meters installed before 31 March 2007. Suppliers pay rentals agreements for the provision of these meters, with small costs of approximately £0.1m across the RIIO-ED1 period being incurred for the administration of the service.

53.23 This activity will continue to be carried out until the roll out of the smart metering programme is completed in 2020, at which point the legacy meters will have been replaced.

Legacy metering income (£m)					
	West Midlands	East Midlands	South Wales	South West	WPD Total
DPCR5 Annual Average	3.0	4.5	1.5	3.4	12.4
RIIO-ED1 Annual Average	0.8	1.3	0.5	1.0	3.6
RIIO-ED1 Total (8 years)	**6.5**	**10.5**	**3.9**	**8.5**	**29.4**

De minimis

53.24 The services included under this heading are:

- property rentals;
- training;
- transport;
- private networks;
- multi-utility (gas/water).

53.25 Actual costs for 2012/13 are shown in the table below. It is expected that volumes of activity will remain constant during the RIIO-ED1 period and so costs will remain at 2012/13 levels.

De-minimis activities - 2012/13 actual gross direct costs (£m)					
	West Midlands	**East Midlands**	**South Wales**	**South West**	**Total**
Transport	-	-	-	0.2	**0.2**
Property	-	-	-	0.5	**0.5**
Training	-	-	-	0.3	**0.3**
Private Networks	0.3	0.4	1.1	1.5	**3.3**
Multi-Utility	0.3	0.8	0.5	0.0	**1.6**
Other	0.4	0.2	0.1	0.2	**0.9**

Out of area networks

53.26 WPD does not provide any service under this heading

Other consented activities

53.27 WPD does not provide any service under this heading

Non activity based costs

54 Non activity based costs

Pass through costs

54.1 Pass through cost in DPCR5 included business rates, transmission exit point charges and Ofgem licence fees. We have assumed in the determining allowed revenues that these items will continue to be treated as pass through costs in RIIO-ED1.

Business rates

54.2 Details about business rates are provided in the Supplementary Annex (SA-07) Financing the Plan. The table below summarises the costs.

Business rates expenditure (£m)					
	West Midlands	East Midlands	South Wales	South West	WPD Total
DPCR5 Annual Average	28.1	35.6	16.3	19.1	99.1
RIIO-ED1 Annual Average	34.5	45.3	18.1	18.3	114.3
RIIO-ED1 Total (8 years)	**276.0**	**362.7**	**144.8**	**146.4**	**929.9**

Transmission exit point charges

54.3 See chapter for Transmission Exit Point charges in this document

Ofgem licence fees

54.4 Licence fees are assumed to continue at the same level as in 2012/13.

Ofgem licence fee **(£m)**					
	West Midlands	East Midlands	South Wales	South West	WPD Total
DPCR5 Annual Average	0.9	1.1	0.5	0.7	3.3
RIIO-ED1 Annual Average	1.2	1.3	0.5	0.8	3.8
RIIO-ED1 Total (8 years)	**9.7**	**10.3**	**4.3**	**6.1**	**30.4**

Smart meter costs

54.5 See chapter for smart meters in the Supplementary Annex (SA-03) Innovation.

Bad debts

54.6 The level of bad debts is difficult to forecast but is typically low in relative terms; we assume £nil in our forecasts.

Sale of scrap

54.7 Scrap is created when poor condition assets are removed from the network or where the construction on new assets leads to short offcuts that cannot be used elsewhere. The disposal of scrap is carried out primarily for environmental reasons where materials such as copper conductor can be recovered and reused. Scrap is sold where materials that have a high commodity value allowing some of the original expenditure to be recovered.

54.8 The current Ofgem RAV policy on the sale of scrap is to fully deduct the income received from RAV on the basis that such assets were probably initially added to RAV, so on sale should be treated as a disposal and therefore deducted from RAV.

54.9 We note that the level of income on sale of scrap is considerably higher in WPD than for other DNOs.

54.10 We have assumed £nil for income from sales of scrap as it is difficult to forecast and we consider that any income should be a reward to a DNO on environmental grounds.

Special considerations

55 Cost allocation methodology

Indirect costs allocation to non-price control activities

55.1 The main activities of WPD are to build, operate, maintain and repair the electricity distribution network. The most significant other business of WPD is the connection of new customers. There are also activities such as diversions of equipment that are treated as excluded services and classed as non price control costs.

55.2 WPD's organisation is set-up on a geographical team structure basis. This means that a team has responsibility for all the main activities, connections and non price control work.

55.3 Direct costs relate to physically working on the network assets. Each team member carrying out direct work completes a timesheet so that the reason for the costs can be separately identified. This also applies to the cost of materials and the cost of using external contractors. Costs can therefore be attributed to the relevant part of WPD.

55.4 Indirect costs represent the cost of engineering management, operations and planning, corporate activities (such as HR, and finance) and non-operational capital for offices and IT systems. As such, these costs are not identified by individual job and therefore a cost allocation methodology is used to allocate indirect costs between business areas.

Allocation methodology

55.5 In general indirect costs are allocated pro rata to the direct costs of main activities, connections and non price control.

55.6 There are two areas of adjustments made before allocation to ensure the costs are reflective of the activities carried out:

- certain indirect costs, which only relate to the main activities, are excluded from the allocation methodology;
- an uplift is applied to connection costs for additional planning work.

Exclusions

55.7 Closely associated indirect costs, business support costs and non-operational capital, are assessed by activity to determine whether the connections business and non price control activities should receive a share of these costs.

55.8 Some categories of costs are excluded from the allocation process (e.g. wayleaves) because there is no association with connections or non price control activities. In certain cases an indirect cost activity is only partially related and thus a portion of that activity's costs is excluded from this process. The exclusions are shown in table below.

Indirect cost allocation - exclusions	
Cost Type	**% excluded**
Wayleaves costs and associated administration costs	100%
IT&T	Partial
Workforce renewal	100%
Insurance premiums, claims and legal fees relating to the network	100%
PR costs including awareness campaign (TV & Leaflets)	100%
ENA membership	100%
EATL fees	100%
Ordnance Survey fees	100%
Fault management and dispatch	100%
Call Centre	Partial

55.9 All exclusions are allocated in full to the main business.

55.10 After exclusions, indirects are allocated pro rata to the direct cost of the main activities, connections and other non price control activities with the exception of Network Design and Engineering.

Uplift for connections design and other non-price control work

55.11 An uplift percentage is applied to connection projects for design work as this is more cost reflective of work done to provide quotations, taking account of the additional planning carried out where customers do not accept connection offers and direct work does not proceed.

Allocation of shared indirect costs between WPD DNOs

55.12 Corporate activities such as finance and IT and other activities, including the control centre and contact centre, are operated as a shared activity in WPD, as this is deemed by management to be the most cost effective way of working.

55.13 Following the acquisition of Central Networks in April 2011 a new operating structure for the Midlands was initiated in the summer of 2011, which followed the WPD working model. The process of assimilation of the Midlands workforce into the new operating structure was partly completed by December 2011 and fully completed by April 2012.

55.14 The year ending March 2012 represented a year of transition so that the cost base did not represent a "normal" year. Whilst costs stabilised to some extent from December 2011, there was still some uncertainty and so shared costs were allocated 50:50 between WW and WEM for just the four months December 2011 to March 2012.

55.15 Commencing April 2012 and to 2022/23 in the BPDT shared costs are allocated:

- 30% East Midlands;
- 30% West Midlands;
- 15% South Wales;
- 25% South West.

55.16 The basis of this allocation is the identification of the key cost drivers which drive shared costs as follows:

Basis for cost allocation of shared indirect costs					
	East Midlands	**West Midlands**	**South Wales**	**South West**	**Total**
MEAV (Modern Equivalent Asset Value)	34%	30%	15%	21%	100%
RAV - per final DPCR5 proposals April 2010	32%	33%	14%	21%	100%
Number of DNOs	25%	25%	25%	25%	100%
WPD Number of distribution managers	28%	28%	16%	28%	100%
Indicative simple average	30%	29%	17%	24%	100%

55.17 These key cost drivers are essentially scale variables with the first two drivers listed (MEAV and RAV) representing a descriptive view of what drive costs, whereas the Number of DNOs and the Number of Distribution Managers (DMS), who cover geographical areas, represent a more deterministic view. For example, the number of DNOs determines how many accounts and RRPs to be produced, whilst the number of DMs is a good indicator of operational workload in the four DNOs.

55.18 The allocation is to an extent judgemental so in our opinion it is appropriate to round the allocation percentage to the nearest five percentage points.

56 Regional adjustments

56.1 WPD distributes electricity to a wide range of different areas including:

- the dense urban sprawl of Birmingham and the West Midlands conurbation;
- large cities including Bristol, Cardiff, Nottingham, Derby, Leicester, Stoke;
- mining towns in the East Midlands;
- sparsely populated rural areas in Lincolnshire, Cornwall and South Wales.

56.2 Travel times can vary significantly, due to availability or absence of direct routes and the effect of traffic congestion.

56.3 Each location has its unique challenges and on balance the mix of issues does not necessitate any specific locational or regional adjustments.

57 Real price effects

57.1 WPD has engaged First Economics to assess real price effects (i.e. above inflation costs) and the findings are shown in the table below:

Real price effects (%)						
	2013/14	**2014/15**	**2015/16**	**2016/17**	**2017/18**	**2018/19 to 2022/23**
Labour – general	(0.6)	0.2	0.7	0.5	0.2	0.9
Labour – specialist	0.7	1.5	2.0	1.8	1.5	2.1
Materials – general/civils	0.7	1.7	1.3	1.0	0.8	1.1
Materials – electrical	0.2	2.2	1.8	1.5	1.3	1.6
Plant and equipment	0.2	1.2	0.8	0.5	0.3	0.6
IT	(2.1)	(2.1)	(2.5)	(2.8)	(3.0)	(2.7)
Property rentals	(0.6)	0.2	0.7	0.5	0.2	0.9

57.2 The forecast has been derived from a number of data sources including the Office for National Statistics and the Office for Budget Responsibility.

57.3 The forecasts costs for specific activities in the Business Plan have not included the effects of these above inflation costs. Their impact is accounted separately and offset, in part, by efficiency savings.

57.4 The First Economics report can be found at http://www.westernpower.co.uk/docs/About-us/Stakeholder-information/Our-future-business-plan/Supporting-Expenditure-information/First-Economics-RPE-forecast.aspx

58 Efficiency assumptions

58.1 We have sought to identify the scope for year on year efficiency improvements. We have considered efficiency improvements into three component parts:

- efficiency catch up, which relates to the opportunity for an inefficient DNO to improve its efficiency to a level consistent with the most efficient DNO;
- merger efficiencies, which relate to the cost saving delivered as a consequence of merger and acquisition activity;
- frontier efficiency shift, which relates to the on-going efficiency improvements that can be delivered by a DNO already operating at the efficiency frontier.

58.2 WPD has been identified as one of the most efficient DNOs. Therefore there is negligible scope associated with catch up efficiency.

58.3 The synergy and efficiency savings that have been delivered following WPD's acquisition of the West and East Midlands DNOs have been identified in this Business Plan. Therefore, there is no further scope for additional merger efficiencies.

58.4 However, our review of available information indicates that there is scope for year on year improvements available to WPD as a frontier performing DNO. Our Business Plan assumes that efficiency savings of 1% per year will be achieved for controllable cost elements of labour, materials and contractor costs.

Business efficiency improvement (%)								
	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
Labour	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Materials	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Contractors	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0

58.5 This 1% per year efficiency saving does not relate to any specific initiatives. However, the generic initiatives that we seek to exploit include:

- improvements to business processes;
- improvements to operational working practices;
- new innovative techniques developed as part of LCNF projects;
- learning from other DNOs, utilities and large asset based organisations;
- reductions in the cost of procured goods and services;
- continued use of in-house resource to undertake core activities; and
- design of the right engineering solutions to network problems (i.e. no 'gold plating').

Appendices

59 Appendix A1 – Transform model

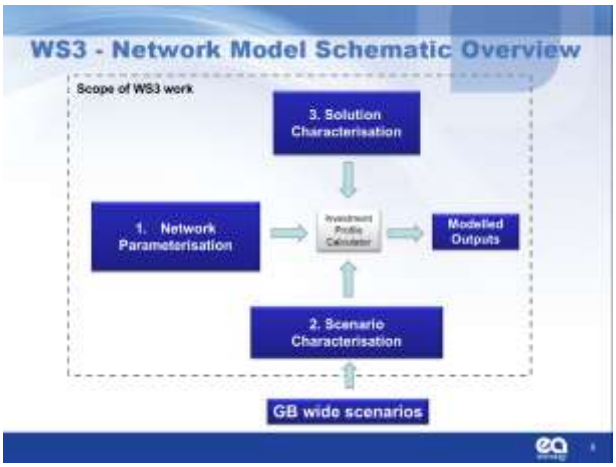
59.1 The Smart Grids Forum (SGF) was established by Ofgem and DECC in early 2011. It brings together key opinion formers, experts and stakeholders involved in the development of smart grids with the aim of providing strategic input to help shape Ofgem's and DECC's thinking and provide leadership in smart grid policy and deployment.

59.2 The SGF has several 'Work Streams' which work on different smart grid issues. Work Stream 3 is led by the DNOs and works to assess the network impacts of LCTs. WPD is a member of the SGF and provides technical expertise for Work Stream projects.

59.3 Work Stream 3 engaged EA Technology to develop an industry model that uses representative networks to assess the impact of load growth forecasts and technology adoption scenarios to determine the mix of traditional and smart interventions required to provide adequate capacity headroom on LV, HV and EHV circuits. EA Technology brands this as the Transform model.

59.4 The main elements of the Transform model are:

- matrix of representative networks with pre-existing loads;
- load growth scenarios including clustering assumptions;
- potential solutions including traditional and smart interventions.
- investment calculation engine;
- modelled outputs/results.



59.5 There are two branches of the Transform model: the GB model and DNO licence model. The Transform GB model considers the whole of Great Britain's distribution networks, and includes additional functionality to generate load profiles (including the impact of supplier led time of use tariffs), represent non-distribution parts of the GB electricity industry, and perform cost-benefit analyses between different investment strategies. The Transform DNO model can be populated to represent an individual DNO licence area.

59.6 Further information about the model can be found in EA Technology's report 'Assessing the Impact of Low Carbon Technologies on Great Britain's Power Distribution Networks', published at http://www.ofgem.gov.uk/Networks/SGF/Publications/Pages/index.aspx.

Matrix of Representative Networks (Network Parameterisation)

59.7 The Transform model considers LV, HV and EHV networks. It uses a small number of generic 'feeders' to represent the wide variety of circuits that exist across Great Britain. To model a particular DNO licence area, each circuit in that licence area must be mapped to the most similar feeder in Transform. The connectivity between circuits at different voltages is also mapped to the connectivity between generic feeders.

59.8 Pre-existing residential and commercial loads connected to each generic feeder form the 'base load' of the modelled distribution network.

59.9 WPD used its asset management database and network management tools to map each of its licence areas into the Transform model.

Separation of EHV modelling

59.10 WPD operates detailed circuit specific models of its EHV system which extends as far as the HV busbars of primary substations. These models provide a more accurate forecast and have been used in place of the EHV components of the Transform model. To avoid double-counting, the EHV components of the Transform model were disabled by setting all EHV headrooms (see section on headroom below) to levels that will not be exceeded.

Load growth scenarios and clustering

59.11 The Transform model comes prepopulated with four LCT and distributed generation (DG) uptake scenarios that represent the four DECC carbon plan scenarios:

- scenario 1 - high abatement in low carbon heat
- scenario 2 - high abatement in transport
- scenario 3 - high electrification of heat and transport
- scenario 4 - credit purchase

59.12 These DECC scenarios are further described in the uncertainty section of this plan.

59.13 DECC's GB-wide LCT uptake forecasts were regionalised to DNO level by Element Energy for use in the Transform DNO model.

59.14 The Transform DNO model can also be populated with a DNO's own view of LCT and DG uptake. As its 'best view' WPD is adopting a scenario based on the Transform model, but also informed by stakeholder feedback and analysis undertaken by the Centre for Sustainable Energy (CSE). The 'best view' scenario is based on the following assumptions.

Growth of LV-connected PV generation

59.15 In each licence area this has been based upon the CSE's analysis for property types suitable for small scale PV, modified by the proportion of GB deployment to date within each licence area from Ofgem feed in tariff data.

Growth of electric vehicles

59.16 In each licence area this has been based upon CSE's analysis of social demographic customer types combined with WPD's view of likely uptake in RIIO-ED1. The mix of electric vehicle types and speed of charging is consistent with SGF Workstream 1 forecasts based on a low uptake of EVs. Charging types are a mixture of slow 3kW, fast 7kW and rapid 50kW.

Growth of domestic heat pumps

59.17 In each licence area this has been based upon CSE's analysis of property types suitable for heat pumps, combined with WPD's view of likely uptake in the RIIO-ED1 period. Significant uptake of domestic heat pumps is assumed to be limited to off-gas areas (at least during this period).

Growth of wind, biomass and large-scale PV generation

59.18 In each licence area this is forecast to be 1/14th of DECC's GB-wide 'High' case.

Customer engagement with Demand Side Response (DSR)

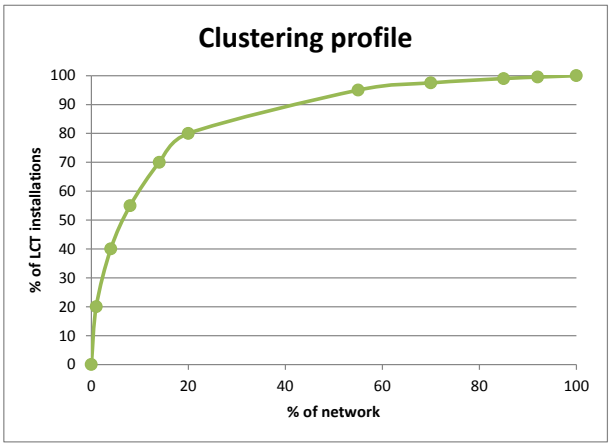
59.19 This is forecast to be in line with EA Technology's 'Low DSR' case included in the Transform model.

Clustering

59.20 The take-up of LCTs is driven by a variety of technical, social and economic factors. An example is that higher levels of solar irradiation in the south of England have driven early adoption of solar panels. Some factors apply to small geographic areas, for instance WPD believes that heat pumps will be more popular in areas without mains gas. This is because a heat pump is currently more economical to run than conventional electric heating, but less economical than gas-fired central heating.

59.21 The model uses clustering to represent the non-uniform network impact of LCT uptake. The same generic feeder with the same pre-existing loads is modelled ten times with different levels of LCT uptake. The illustration below shows high levels of clustering with 80% of all installations appearing on 20% of the network.

Percentage of Network	Percentage of low carbon technology installations
1%	20.0%
4%	40.0%
8%	55.0%
14%	70.0%
20%	80.0%
55%	95.0%
70%	97.5%
85%	99.0%
92%	99.5%
100%	100.0%



59.22 By default the model uses a clustering profile calculated from the uptake of the Feed in Tariff for small-scale generators. For its 'best view', WPD has calculated a clustering profile for each licence area based on the uptake of domestic heat pumps at distribution substation level, forecast using data from CSE.

Winter temperatures and heating load

59.23 A significant proportion of the load applied to the network in the Transform model is electric heating, both conventional (direct or storage) and heat pumps. The magnitude of this load is heavily dependent on winter ambient temperatures.

59.24 Two representative winter days are modelled in Transform. The 'Winter Peak' day is representative of the coldest two-week period of the year. The 'Winter Average' day is representative of the coldest six-month period of the year, excluding the two weeks of the 'Winter Peak'. The temperature at the time of peak demand (which typically occurs at around 6pm) for each representative day can be set in the range -5°C to 5°C. By default, the 'Winter Peak' temperature is set to -3°C and the 'Winter Average' temperature is set to 0°C.

59.25 For its 'best view', WPD has calculated more representative winter temperatures on a regional basis, using hourly temperature data from weather stations in all four licence areas from 2005 to 2013. Following this analysis, the 'Winter Peak' temperature was set to 1°C for the West Midlands and East Midlands licence areas, and 2°C for the South Wales and South West licence areas. This aligns with National Grid guidance for Average Cold Spell conditions for the 'North' and 'South' of GB. The 'Winter Average' temperature was calculated to be approximately 11°C for all licence areas, but was capped at 5°C due to the limited input range. This is unlikely to reduce the accuracy of modelling because most investment for thermal capacity is driven by peak rather than average load.

Solution characterisation

59.26 There is a range of solutions that could be applied to the networks to provide additional headroom. The Transform model characterises these as:

- conventional: representing those options that are currently widely used;
- smart: representing the new technological or commercial solutions being developed.

59.27 Some of the smart solutions require additional investment such as communications infrastructure to allow their use. The Transform model characterises this investment as 'Enablers'.

59.28 We have reviewed the solutions in the Transform model, the year they are forecast to become available, their costs and associated real price effects. We have accepted EA Technology's view on smart solutions and enablers, except for two solutions that we have disabled until 2024 as they are not likely to be implemented during the RIIO-ED1 period. These are 'DSR - DNO to residential' and 'Local smart EV charging infrastructure-Intelligent control devices'. We have used our own costs and views on real price effects for conventional solutions.

Calculation engine

Investment strategy

59.29 The model includes three investment strategy options:

- business as usual – only chooses from conventional solutions to solve network problems;
- smart Incremental – chooses from conventional and smart solutions to solve network problems and 'buys' enablers as they are required for smart solutions;
- top down – chooses from conventional and smart solutions to solve network problems and 'buys' all enablers ahead of need so that infrastructure is in place to support smart solutions.

59.30 WPD has adopted the 'Smart Incremental' strategy for its primary modelling, but also uses the BAU strategy for comparison purposes.

Tipping points

59.31 The Transform model includes 'tipping point' functionality to model changing costs and benefits as some technologies are standardised and benefit from economies of scale.

59.32 This functionality is not fully developed and is targeted at higher levels of deployment of LCTs than we are forecasting as part of our best view. As a result, WPD has left the tipping point functionality of the model disabled, which is the default as provided by EA Technology.

Headroom

59.33 The model uses headroom as the key measure in determining when investment should take place and how much additional capacity is released by an intervention. Headroom is used as a common base to allow comparison of different constraints, including:

- thermal constraints;
- voltage constraints;
- fault level constraints.

59.34 Generic feeders have pre-set starting levels of headroom, while solutions increase (or decrease) headroom by a pre-set percentage when they are applied.

59.35 We have reviewed the pre-set headroom of feeders and made some changes where appropriate to individual licence areas. We have also reviewed the headroom released by solutions and accepted the default settings provided by EA Technology.

Treatment of Transform model output

Real price effects

59.36 Different types of solutions in the Transform model have different real price effects or 'cost curves' setting how their price changes over time. Ofgem's guidance on the Transform model states that the model should be run with real price effects (RPEs) included, but that the RPEs associated with the conventional solutions cost curve (Type 1 – high aluminium, steel, or copper content) should then be stripped out of the model results. This allows the model to take price movements into account in the cost-benefit assessment of solutions, but present costs on a consistent price base.

Re-profiling of results

59.37 The Transform model uses a small number of generic circuits to represent the thousands of unique circuits in a licence area. Therefore when a particular generic circuit reaches a headroom limit, it purchases the appropriate solution as many times as there are real circuits represented by that generic circuit. This results in unrealistically sporadic investment.

59.38 It is WPD's belief that LCT related reinforcement will require more gradual investment as real circuits reach their headrooms. To reflect this in WPD's 'best view' the output of the model has been re-profiled to mirror the forecast ramped uptake of LCTs.

Scaling of results

59.39 It is WPD's view that it is appropriate to scale the resulting expenditure from the Transform model for the following reasons:

- there is significant uncertainty around the future uptake of LCTs, their clustering and hence the impact of LCTs upon distribution networks;
- clustering has a significant impact on the investment needed and whilst our forecasts are based on a detailed analysis of property types and demographic information, other factors such as subsidy or support mechanism designs may result in differing clustering patterns emerging;
- there will be some overlap with asset replacement of HV and LV assets which is difficult to forecast accurately;
- a scaling down of the forecast investment provides a strong incentive on WPD to further innovate and seek the lowest cost solution;
- it is appropriate to share the risk of these uncertainties between WPD and customers.

59.40 As a result, the output from the Transform model for LCT reinforcement in the RIIO-ED1 period has been scaled down by 30% to determine the expenditure requirement in our Business Plan.

60 Appendix A2 – Cost benefit analysis (CBA)

60.1 We have carried out a number of CBAs covering the major areas of expenditure.

60.2 CBAs have been compiled into logical groups in related subject areas. For each group we have established a hyperlink that will access a folder on the WPD website. The folder contains all the CBAs for that group in line with the tables below.

60.3 There is also an index of all the CBAs which can be access by using this link http://www.westernpower.co.uk/docs/About-us/Stakeholder-information/Our-future-business-plan/Cost-Benefit-Analysis/CBA-Index.aspx

Reinforcement

60.4 25 CBAs were completed on a wide range of different types of reinforcement schemes across the four WPD licence areas to test the cost effectiveness of the various reinforcement solutions employed.

60.5 The 25 CBAs covered schemes at 11kV, 33kV 66kV and 132kV with various reinforcement drivers including fault levels, voltage and both 'n-1' and 'n-2' load driven reinforcements.

60.6 A number of generic CBAs were also undertaken to evaluate WPD's proposals to increasingly apply a wide range of smart solutions to address reinforcement needs.

60.7 These support WPD's proposed approach and demonstrate that business as usual (application of conventional reinforcement solutions) only is not a cost effective approach.

60.8 The Reinforcement CBAs are listed in the table below.

CBA Reference	Description	Licence Area
B001_WPD_CBA_ReinforcementSchemes	Feckenham South 66kV Voltage Reinforcement_LR50012	West Midlands
B002_WPD_CBA_ReinforcementSchemes	Ironbridge 33kV Switchgear Replacement_Fault Level_LR80005	West Midlands
B003_WPD_CBA_ReinforcementSchemes	Madeley 33_11kV Substation Reinforcement_LR80003	West Midlands
B004_WPD_CBA_ReinforcementSchemes	Oldbury GSP Reinforcement_LR7017	West Midlands
B005_WPD_CBA_ReinforcementSchemes	Penn 132kV switchgear Replacement_Fault Level_LR7020	West Midlands
B006_WPD_CBA_ReinforcementSchemes	Shrewsbury-Ironbridge 132kV Group Reinforcement_LR80012	West Midlands
B007_WPD_CBA_ReinforcementSchemes	Leicester 132-33kV Substation Reinforcement_LR10135	East Midlands
B008_WPD_CBA_ReinforcementSchemes	Lincoln 132-11kV Substation Reinforcement_LR10018	East Midlands
B009_WPD_CBA_ReinforcementSchemes	Milton Keynes East BSP Reinforcement_LR10060	East Midlands
B010_WPD_CBA_ReinforcementSchemes	Rugby Central 11kV Reinforcement_LR10056	East Midlands
B011_WPD_CBA_ReinforcementSchemes	Staythorpe 132kV Switchgear Replacement_Fault Level_LR10022	East Midlands
B012_WPD_CBA_ReinforcementSchemes	Wigston Magna 132-11kV Substation Reinforcement_LR10136	East Midlands
B013_WPD_CBA_ReinforcementSchemes	Cardiff East-Cardiff North BSP Group Reinforcement_LRSWal25	South Wales
B014_WPD_CBA_ReinforcementSchemes	Mid-Wales 66kV Voltage Reinforcement _LRSWal28	South Wales
B015_WPD_CBA_ReinforcementSchemes	Cardiff South 11kV Switchgear	South

	Replacement_Fault level_LRSWal30	Wales
B016_WPD_CBA_ReinforcementSchemes	East Yelland BSP Reinforcement_LRSWe02	South West
B017_WPD_CBA_ReinforcementSchemes	Exeter City BSP Reinforcement_LRSWe03	South West
B018_WPD_CBA_ReinforcementSchemes	Exeter Main 132kV switchgear Replacement_Fault Level_LRSWe14	South West
B019_WPD_CBA_ReinforcementSmart	Eastern Avenue_FL limiter application_Fault Levels	West Midlands
B020_WPD_CBA_ReinforcementSmart	Leicester_FL limiter application_Fault Levels	East Midlands
B021_WPD_CBA_ReinforcementSmart	132kV OHL Circuit Reinforcement_DLR Application	All 4 Regions
B022_WPD_CBA_ReinforcementTransform	HV Temporary Meshing	All 4 Regions
B023_WPD_CBA_ReinforcementTransform	RTTR Distribution Tx -Defer replacement for 6 years	All 4 Regions
B024_WPD_CBA_ReinforcementTransform	BAU vs Smart Incremental-ED1 only	All 4 Regions
B025_WPD_CBA_ReinforcementTransform	BAU vs Smart Incremental	All 4 Regions

60.9 The results of the reinforcement CBAs demonstrate that WPD has adopted a wide range of solutions across the various types of reinforcement schemes, and in each case adopted the optimum solution after considering the merits of the alternative options.

60.10 Sensitivity analysis has been carried out on the adopted solutions to consider the impact of a cost increase. The increment in costs considered ranges from 10% right up to 30%. An increase of up to 100% has been applied on some of the proposed smart solutions to reflect the higher cost risks that they pose.

60.11 The results of the sensitivity analyses also support WPD's proposed solutions.

60.12 The CBA for reinforcement can be found at http://www.westernpower.co.uk/docs/About-us/Stakeholder-information/Our-future-business-plan/Cost-Benefit-Analysis/Reinforcement.aspx

Asset replacement

60.13 WPD's proposed asset replacement has been underpinned by extensive cost benefit analyses and a cross section of 64 CBAs were originally included as part of our Business Plan submission. The submission included 16 asset replacement CBAs for each of our DNOs. The CBAs that have been selected for submission on the basis of:

- ensuring that the CBAs covered a broad cross section of asset types. CBAs associated with the 32 most significant asset types have been included;
- the degree of significance as determined by the forecast expenditure. The Asset Replacement activities associated with these CBAs account for more than 80% of the forecast Asset Replacement expenditure of each DNO for RIIO-ED1.

60.14 A further 13 CBAs for asset replacement have been provided in response to specific supplementary questions from Ofgem.

60.15 A short commentary is provided with each CBA explaining the selected investment option.

60.16 Sensitivity analyses have been prepared in all instances.

60.17 The Asset Replacement CBAs are listed below and can be found at http://www.westernpower.co.uk/docs/About-us/Stakeholder-information/Our-future-business-plan/Cost-Benefit-Analysis/Asset-Replacement.aspx

Reference	Asset Type	Licence Area
C001_WPD_CBA_AssetReplacement	LV Main (OHL) Conductor	West Midlands
C002_WPD_CBA_AssetReplacement	LV Main (OHL) Conductor	South West
C003_WPD_CBA_AssetReplacement	LV Service (OHL)	South Wales
C004_WPD_CBA_AssetReplacement	LV Service (OHL)	South West
C005_WPD_CBA_AssetReplacement	LV Poles	West Midlands
C006_WPD_CBA_AssetReplacement	LV Poles	East Midlands
C007_WPD_CBA_AssetReplacement	LV Poles	South Wales
C008_WPD_CBA_AssetReplacement	LV Poles	South West
C009_WPD_CBA_AssetReplacement	LV Main (UG)*	West Midlands
C010_WPD_CBA_AssetReplacement	LV Main (UG)*	South West
C011_WPD_CBA_AssetReplacement	LV Service (UG)	East Midlands
C012_WPD_CBA_AssetReplacement	LV SGR at Subs	West Midlands
C013_WPD_CBA_AssetReplacement	LV SGR at Subs	South Wales
C014_WPD_CBA_AssetReplacement	LV UGB & LV Pillars (OD not at Substation)	West Midlands
C015_WPD_CBA_AssetReplacement	LV UGB & LV Pillars (OD not at Substation)	East Midlands
C016_WPD_CBA_AssetReplacement	6.6/11kV OHL (Conventional Conductor)	West Midlands
C017_WPD_CBA_AssetReplacement	6.6/11kV OHL (Conventional Conductor)	South Wales
C018_WPD_CBA_AssetReplacement	6.6/11kV OHL (Conventional Conductor)	South West
C019_WPD_CBA_AssetReplacement	6.6/11kV Poles	West Midlands
C020_WPD_CBA_AssetReplacement	6.6/11kV Poles	East Midlands
C021_WPD_CBA_AssetReplacement	6.6/11kV Poles	South Wales
C022_WPD_CBA_AssetReplacement	6.6/11kV Poles	South West
C023_WPD_CBA_AssetReplacement	6.6/11kV UG Cable	East Midlands
C024_WPD_CBA_AssetReplacement	6.6/11kV UG Cable	South Wales
C025_WPD_CBA_AssetReplacement	6.6/11kV CB (GM) Primary	West Midlands
C026_WPD_CBA_AssetReplacement	6.6/11kV CB (GM) Primary	East Midlands
C027_WPD_CBA_AssetReplacement	6.6/11kV CB (GM) Primary	South West
C028_WPD_CBA_AssetReplacement	HV GM SWGR (secondary) *	West Midlands
C029_WPD_CBA_AssetReplacement	HV GM SWGR (secondary) *	East Midlands
C030_WPD_CBA_AssetReplacement	HV GM SWGR (secondary) *	South Wales
C031_WPD_CBA_AssetReplacement	HV GM SWGR (secondary)	South West
C032_WPD_CBA_AssetReplacement	6.6/11kV Switchgear - Other (PM)	East Midlands
C033_WPD_CBA_AssetReplacement	6.6/11kV Transformer (PM)	South Wales
C034_WPD_CBA_AssetReplacement	6.6/11kV Transformer (PM)	South West
C035_WPD_CBA_AssetReplacement	6.6/11kV Transformer (GM)	West Midlands

C036_WPD_CBA_AssetReplacement	6.6/11kV Transformer (GM)	East Midlands
C037_WPD_CBA_AssetReplacement	6.6/11kV Transformer (GM)	South Wales
C038_WPD_CBA_AssetReplacement	33kV OHL (Pole Line) Conductor	South Wales
C039_WPD_CBA_AssetReplacement	33kV OHL (Pole Line) Conductor	South West
C040_WPD_CBA_AssetReplacement	EHV Poles	West Midlands
C041_WPD_CBA_AssetReplacement	EHV Poles	South Wales
C042_WPD_CBA_AssetReplacement	EHV Poles	South West
C043_WPD_CBA_AssetReplacement	66kV OHL (Pole Line) Conductor	South Wales
C044_WPD_CBA_AssetReplacement	33kV UG Cable (Non Pressurised)	East Midlands
C045_WPD_CBA_AssetReplacement	33kV UG Cable (Non Pressurised)	South Wales
C046_WPD_CBA_AssetReplacement	33kV UG Cable (Oil)	South West
C047_WPD_CBA_AssetReplacement	33kV UG Cable (Gas)	South West
C048_WPD_CBA_AssetReplacement	33kV CB (Air Insulated Busbars)(ID) (GM)	East Midlands
C049_WPD_CBA_AssetReplacement	33kV CB (Air Insulated Busbars)(ID) (GM)	South Wales
C050_WPD_CBA_AssetReplacement	33kV CB (Air Insulated Busbars)(OD) (GM)	South West
C051_WPD_CBA_AssetReplacement	33kV Switchgear - Other	South West
C052_WPD_CBA_AssetReplacement	33kV Transformer (GM)	East Midlands
C053_WPD_CBA_AssetReplacement	33kV Transformer (GM)	South Wales
C054_WPD_CBA_AssetReplacement	33kV Transformer (GM)	South West
C055_WPD_CBA_AssetReplacement	132kV OHL (Tower Line) Conductor	West Midlands
C056_WPD_CBA_AssetReplacement	132kV OHL (Tower Line) Conductor	East Midlands
C057_WPD_CBA_AssetReplacement	132kV Fittings	East Midlands
C058_WPD_CBA_AssetReplacement	132kV UG Cable (Oil)	West Midlands
C059_WPD_CBA_AssetReplacement	132kV UG Cable (Gas)	West Midlands
C060_WPD_CBA_AssetReplacement	132kV CB (Air Insulated Busbars)(OD) (GM)	East Midlands
C061_WPD_CBA_AssetReplacement	132kV Switchgear - Other	West Midlands
C062_WPD_CBA_AssetReplacement	132kV Transformer	West Midlands
C063_WPD_CBA_AssetReplacement	132kV Transformer	East Midlands
C064_WPD_CBA_AssetReplacement	132kV Transformer	South Wales
WPD-RIIOED1-Ph1-131 CBA West Midlands	33kV Overhead Line Fittings	West Midlands
WPD-RIIOED1-Ph1-131 CBA East Midlands	33kV Overhead Line Fittings	East Midlands
WPD-RIIOED1-Ph1-131 CBA South Wales	33kV Overhead Line Fittings	South Wales
WPD-RIIOED1-Ph1-131 CBA South West	33kV Overhead Line Fittings	South West
WPD-RIIOED1-Ph1-132 CBA West Midlands	66kV Overhead Line Fittings	West Midlands
WPD-RIIOED1-Ph1-132 CBA South Wales	66kV Overhead Line Fittings	South Wales
WPD-RIIOED1-Ph1-134 CBA	33kV CB OD (Air Insulated Busbars)	West Midlands
WPD-RIIOED1-Ph1-135 CBA South Wales	33kV Switch (GM)	South Wales
WPD-RIIOED1-Ph1-135 CBA South West	33kV Switch (GM)	South West
WPD-RIIOED1-Ph1-136 CBA West Midlands	33kV Switchgear Other	West Midlands
WPD-RIIOED1-Ph1-136 CBA East Midlands	33kV Switchgear Other	East Midlands
WPD-RIIOED1-Ph1-139 CBA West Midlands	132kV Overhead Line Fittings	West Midlands
WPD-RIIOED1-Ph1-141 CBA	132kV CB OD (Air Insulated Busbars)	West Midlands

* Where the asset installed is a different asset type to the asset removed, CBAS have been prepared on the basis of an aggregation of asset types. For example, three types of LV underground cable are removed but only one type installed.

Diversions and Conversion of Wayleaves to Easements

60.18 In order to confirm the suitability of our overall approach to injurious affection claims, wayleave terminations and requests for diversions, CBAs have been completed on a range of typical schemes, each assessing the different solutions available.

CBA Reference	Description
A001_WPD_CBA_Diversions&Easements A002_ WPD_CBA_Diversions&Easements A003_ WPD_CBA_Diversions&Easements A004_ WPD_CBA_Diversions&Easements	132kV overhead line across a development site
A005_WPD_CBA_Diversions&Easements A006_WPD_CBA_Diversions&Easements A007_WPD_CBA_Diversions&Easements A008_WPD_CBA_Diversions&Easements	132kV overhead line across residential areas
A009_WPD_CBA_Diversions&Easements A010_WPD_CBA_Diversions&Easements	EHV overhead line across a development site
A011_WPD_CBA_Diversions&Easements A012_WPD_CBA_Diversions&Easements	EHV overhead line across residential areas
A013_WPD_CBA_Diversions&Easements A014_WPD_CBA_Diversions&Easements	HV overhead line diversion/injurious affection claim
A015_WPD_CBA_Diversions&Easements A016_WPD_CBA_Diversions&Easements	LV overhead line diversion/injurious affection claim

60.19 The adopted options vary between CBAs, confirming WPD's pragmatic approach where the chosen solution will be dependent upon the situation, considering customer requirements, likely costs and the long term impact.

60.20 The CBAs can be found at http://www.westernpower.co.uk/docs/About-us/Stakeholder-information/Our-future-business-plan/Cost-Benefit-Analysis/Diversion-and-Easements.aspx

Operational IT and Telecoms

60.21 CBA has been completed to assess the suitability of replacement cycles for Primary SCADA trunk communications equipment.

CBA Reference	Description
D001_WPD_CBA_OpsIT&T	Replacement intervals for Primary SCADA communications equipment

60.22 Following the CBA analysis, we have extended the time interval for replacement of Primary SCADA communications equipment from eight years to twelve years.

60.23 The CBA can be found at http://www.westernpower.co.uk/docs/About-us/Stakeholder-information/Our-future-business-plan/Cost-Benefit-Analysis/Operational-IT-T.aspx

BT 21st Century (BT 21CN)

60.24 CBAs were completed to assess options for replacing the protection communications circuits affected by the BT 21CN programme.

CBA Reference	Description
D002_WPD_CBA_BT21CN	Options for replacing BT circuits in WPD West Midlands
D003_WPD_CBA_BT21CN	Options for replacing BT circuits in WPD East Midlands

60.25 The CBAs demonstrate the appropriateness of our approach to replacing the circuits with predominantly a combination of microwave and UHF links, and utilising fibre optic circuits where microwave and UHF links are unsuitable.

60.26 The CBAs can be found at http://www.westernpower.co.uk/docs/About-us/Stakeholder-information/Our-future-business-plan/Cost-Benefit-Analysis/BT21CN.aspx

Quality of Supply

60.27 WPD are proposing to invest in order to reduce number and duration of unplanned supply interruptions to customers. Cost Benefit Analyses has been undertaken in order to demonstrate that the proposed investment is positive.

60.28 The CBAwas undertaken in order to compare the quality of supply experienced by customers with and without investment during ED1 targeted at reducing the number and duration of unplanned supply interruptions to customers.

60.29 These CBAs demonstrate that the proposed investment is justified for all four DNOs as the Net Present Values (NPV) are positive with a study period of 16 years. Sensitivity analyses have revealed that the NPV of the proposed investment in South Wales is essentially zero with a study period of 10 years. However, the effectiveness of the proposed investment is at least 25 years.

60.30 The completed CBAs are identified in the table below and can be found at http://www.westernpower.co.uk/docs/About-us/Stakeholder-information/Our-future-business-plan/Cost-Benefit-Analysis/QoS.aspx

CBA Reference	Description
E001_WPD_CBA_QOS	Reducing number and duration of unplanned supply interruptions to customers in West Midlands
E002_WPD_CBA_QOS	Reducing number and duration of unplanned supply interruptions to customers in East Midlands
E003_WPD_CBA_QOS	Reducing number and duration of unplanned supply interruptions to customers in South Wales
E004_WPD_CBA_QOS	Reducing number and duration of unplanned supply interruptions to customers in South West

Protecting equipment from flooding risk

60.31 CBAs were completed to assess flood protection options at a number of sites.

CBA Reference	Description
F001_WPD_CBA_Flood	Flood Defence Solutions at a 132/11kV Substation
F002_WPD_CBA_Flood	Flood Defence Solutions at a 132/33kV Substation
F003_WPD_CBA_Flood	Flood Defence Solutions at a 33/11kV Substation
F004_WPD_CBA_Flood	Flood Defence Solutions at a 33/11kV Substation

60.32 The CBAs demonstrated that our general policy of protecting substations by utilising specific protection methods to target assets at risk is the most cost effective solution.

60.33 The CBAs can be found at http://www.westernpower.co.uk/docs/About-us/Stakeholder-information/Our-future-business-plan/Cost-Benefit-Analysis/Flood-Defences.aspx

Environment

60.34 CBAs have been completed for a range on environmental investment areas:

CBA Reference	Description
G001_WPD_CBA_PFT	Use of PFT in cables - short cable length
G002_WPD_CBA_PFT	Use of PFT in cables - longer cable length
G003_WPD_CBA_LowLossTx	Installation of lower loss 11kV transformers
G004_WPD_CBA_LowLossCable	Installation of uprated cable to reduce losses
G005_WPD_CBA_LowLossPMT_Mar14	Upsizing pole mounted transformers West Midlands
G006_WPD_CBA_LowLossPMT_Mar14	Upsizing pole mounted transformers East Midlands
G007_WPD_CBA_LowLossPMT_Mar14	Upsizing pole mounted transformers South Wales
G008_WPD_CBA_LowLossPMT_Mar14	Upsizing pole mounted transformers South West
G009_WPD_CBA_LowLossHVCable_Mar14	Upsizing HV cable (185mm to 300mm) West Midlands
G010_WPD_CBA_LowLossHVCable_Mar14	Upsizing HV cable (185mm to 300mm) East Midlands
G011_WPD_CBA_LowLossHVCable_Mar14	Upsizing HV cable (185mm to 300mm) South Wales
G012_WPD_CBA_LowLossHVCable_Mar14	Upsizing HV cable (185mm to 300mm) South West
H001_WPD_CBA_OverSizeTx	Over-sizing of transformers in LCT hot spots
H002_WPD_CBA_OverSizeCable	Over-sizing of cable in LCT hot spots

60.35 The following conclusions can be drawn from the CBAs:

- the addition of PFT can be very cost effective mainly due to the reduced repair costs as a result of easier and quicker fault location;
- the losses saving from introducing lower loss transformer units does not outweigh the incremental cost of these units;
- as for transformers, the reduction in losses alone does not deliver benefits above the additional cost incurred for installing larger cables;
- targeted installation of higher rated assets in low carbon technology 'hot spots' is effective in avoiding future reinforcement costs.

60.36 The CBAs can be found at http://www.westernpower.co.uk/docs/About-us/Stakeholder-information/Our-future-business-plan/Cost-Benefit-Analysis/Environmental.aspx

Black Start

60.37 A CBA has been completed to show the cost effectiveness of establishing Black Start resilience of protection / tripping batteries by installing load disconnection schemes.

CBA Reference	Description
I001_WPD_CBA_BlackStart	Options for establishing Black Start resilience of protection/ tripping batteries

60.38 The CBA can be found at http://www.westernpower.co.uk/docs/About-us/Stakeholder-information/Our-future-business-plan/Cost-Benefit-Analysis/Black-Start.aspx

Inspections and maintenance

60.39 In order to demonstrate the overall cost effectiveness of WPD's approach to inspection and maintenance of network assets strategy, CBAs were completed to evaluate options for two recently revised programmes:

- expanding maintenance of Primary transformers to include oil regeneration;
- maintenance of distribution voltage ring main units – interval and content.

CBA Reference	Description
J001_WPD_CBA_I&M	Oil Regeneration of a 132kV Transformer
J002_WPD_CBA_I&M	Oil Regeneration of a 33kV Transformer
J003_WPD_CBA_I&M	Maintenance intervals for 11kV Ring Main Units
J004_WPD_CBA_I&M	Maintenance intervals for 11kV Ring Main Units
J005_WPD_CBA_I&M	Maintenance content for 11kV Ring Main Units
J006_WPD_CBA_I&M	Maintenance content for 11kV Ring Main Units

60.40 The results of these CBAs support our overall approach towards inspection and maintenance.

60.41 The CBAs can be found at http://www.westernpower.co.uk/docs/About-us/Stakeholder-information/Our-future-business-plan/Cost-Benefit-Analysis/I-M.aspx

Tree Cutting

60.42 CBAs have been completed to evaluate the time interval for routine LV tree clearance.

CBA Reference	Description
K001_WPD_CBA_Trees	LV tree clearance intervals in WPD South West
K002_WPD_CBA_Trees	LV tree clearance intervals in WPD South Wales

60.43 WPD's current policy is to clear trees on a seven year cycle. There are currently additional costs associated with revisits to maintain clearance during this interval. The CBAs demonstrate that shortening the cycle to five years would remove the need for the more expensive revisits and is therefore more cost effective.

60.44 The CBAs can be found at http://www.westernpower.co.uk/docs/About-us/Stakeholder-information/Our-future-business-plan/Cost-Benefit-Analysis/Trees.aspx

Vehicles

60.45 CBAs have been completed to assess the following areas:

- operational vehicles: direct purchase or lease;
- operational vehicles: insourced or outsourced maintenance;
- insourced or outsourced fleet management.

CBA Reference	Description
L001_WPD_CBA_Vehicles	Non-Specialist Operational Vehicles in WPD West Midlands: Purchase or Lease
L002_WPD_CBA_Vehicles	Non-Specialist Operational Vehicles in WPD East Midlands: Purchase or Lease
L003_WPD_CBA_Vehicles	Non-Specialist Operational Vehicles in WPD South Wales: Purchase or Lease
L004_WPD_CBA_Vehicles	Non-Specialist Operational Vehicles in WPD South West: Purchase or Lease
L005_WPD_CBA_Vehicles	Non-Specialist Operational Vehicles in WPD West Midlands: Insourced or Outsourced Maintenance
L006_WPD_CBA_Vehicles	Non-Specialist Operational Vehicles in WPD East Midlands: Insourced or Outsourced Maintenance
L007_WPD_CBA_Vehicles	Non-Specialist Operational Vehicles in WPD South Wales: Insourced or Outsourced Maintenance
L008_WPD_CBA_Vehicles	Non-Specialist Operational Vehicles in WPD South West: Insourced or Outsourced Maintenance
L009_WPD_CBA_Vehicles	Fleet management: Insource or Outsource

60.46 The results of these CBAs demonstrate the overall cost effectiveness of WPD's strategy towards management of operational vehicles:

- direct purchase of vehicles is cheaper than lease;
- insourced maintenance is cost effective for WPD West Midlands, WPD East Midlands and WPD South West. However, due to the availability of suitable contracts in this area only, outsourcing of maintenance is the preferred option for South Wales;
- insourced fleet management is preferable to outsourcing the same activity.

60.47 The CBAs can be found at http://www.westernpower.co.uk/docs/About-us/Stakeholder-information/Our-future-business-plan/Cost-Benefit-Analysis/Vehicles.aspx

Smart meters

60.48 CBAs were completed to assess options for purchase and use of Smart Meter data from the Data Communications Company (DCC).

CBA Reference	Description
M001_WPD_CBA_SmartMeters	Comparison of Smart Meter Data Options in WPD West Midlands
M002_WPD_CBA_SmartMeters	Comparison of Smart Meter Data Options in WPD East Midlands
M003_WPD_CBA_SmartMeters	Comparison of Smart Meter Data Options in WPD South Wales
M004_WPD_CBA_SmartMeters	Comparison of Smart Meter Data Options in WPD South West

60.49 Comparison of the options for purchase of different data quantities demonstrates that WPD's proposals for Smart Meter data provides the most appropriate balance of cost and benefits.

60.50 The CBAs can be found at http://www.westernpower.co.uk/docs/About-us/Stakeholder-information/Our-future-business-plan/Cost-Benefit-Analysis/Smart-Meters.aspx

Non-operational IT and Telecoms

60.51 In order to demonstrate the overall cost effectiveness of WPD's non-operational IT and telecoms strategy, CBAs were completed to evaluate options for a significant element of the IT and telecoms function, namely the routine replacement of PCs and printers.

CBA Reference	Description
N001_WPD_CBA_NonOpIT&T	Routine refresh of IT hardware in WPD West Midlands
N002_WPD_CBA_NonOpIT&T	Routine refresh of IT hardware in WPD East Midlands
N003_WPD_CBA_NonOpIT&T	Routine refresh of IT hardware in WPD South Wales
N004_WPD_CBA_NonOpIT&T	Routine refresh of IT hardware in WPD South West

60.52 WPD replace PCs and printers at four –year intervals. The CBAs for extending this interval demonstrate that any capital expenditure benefit would be more than outweighed by the additional operational support required to maintain levels of service.

60.53 The CBAs can be found at http://www.westernpower.co.uk/docs/About-us/Stakeholder-information/Our-future-business-plan/Cost-Benefit-Analysis/Non-Op-IT-T.aspx

Non-operational capital expenditure - property

60.54 Buro Happold are a leading international professional services firm that provides engineering consultancy, design, planning, project management and consulting services for all aspect of buildings, infrastructure and the environment. WPD engaged Buro Happold to evaluate WPD's property portfolio in order to assess investment requirements to ensure that the properties remain in good condition. In addition, Buro Happold specifically investigated the scope for replacing heating and cooling systems and lighting systems with low energy variants when the existing systems have reached the end of their useful lives.

60.55 Cost Benefit Analysis (CBA) has been undertaken in order to compare:

- The cost of replacing either the heating and cooling and lighting system or lighting system on a "like for like" basis;
- The cost of replacing either the heating and cooling and lighting system or lighting system with a low energy variant and the consequential energy savings.

60.56 These CBAs have demonstrated that it is not cost effective to replace either Heating and Cooling systems or lighting systems with low energy variants when the existing systems have reached the end of their useful lives. The Net Present Values of the CBAs are not positive during the lifetime of the systems.

60.57 The completed CBAs are identified in the table below and can be found at http://www.westernpower.co.uk/docs/About-us/Stakeholder-information/Our-future-business-plan/Cost-Benefit-Analysis/Non-Op-Property.aspx

CBA Reference	Description
P001_WPD_CBA_NonOpProperty	Replacement of Lighting Systems With Low Energy Variants
P002_WPD_CBA_NonOpProperty	Replacement of Heating and Cooling Systems With Low Energy Variants

61 Appendix A3 – Summary core cost tables including pensions

WPD Total

WPD Total - Core costs funded through DUoS including pensions											
Costs excluding RPEs & pensions, including efficiency (£m at 2012/13 prices)	**Average per year in DPCR5**	**Average per year in RIIO-ED1**	**Spend profile in RIIO ED1**								**Total RIIO-ED1**
			2015/16	**2016/17**	**2017/18**	**2018/19**	**2019/20**	**2020/21**	**2021/22**	**2022/23**	
Customer Related Reinforcement	-6.2	6.7	6.1	6.0	6.5	6.7	7.1	6.9	7.0	7.3	53.6
General Network Reinforcement	54.8	46.4	73.0	67.7	38.9	49.4	39.9	34.9	38.7	28.5	371.0
Reinforcement for Low Carbon Technologies	0.0	25.1	4.7	4.7	9.6	18.6	27.6	36.5	45.3	53.9	200.8
TOTAL - Reinforcement of the Network	**48.6**	**78.2**	**83.8**	**78.4**	**55.0**	**74.7**	**74.6**	**78.3**	**91.0**	**89.7**	**625.4**
Asset Replacement	197.8	209.2	210.9	211.6	209.4	210.2	209.2	208.5	207.9	206.2	1673.9
Diversions	26.2	39.9	54.4	52.8	38.0	38.3	29.2	33.7	34.1	39.0	319.5
Quality of Supply (reducing power cuts)	13.0	3.8	5.2	5.1	5.1	5.0	5.0	4.9	0.0	0.0	30.3
Improving service for remote ("worst served") customers	0.3	0.4	0.0	1.6	1.6	0.0	0.0	0.0	0.0	0.0	3.2
Real Time Control Systems and Telecommunications	14.4	12.3	19.4	11.6	24.4	12.9	6.6	8.8	3.7	10.8	98.2
Protecting equipment from flooding risk	4.2	1.9	5.1	4.0	2.3	0.4	0.7	1.3	0.5	0.7	15.0
Enhancing site security, ESQCR and other legal requirements	19.3	12.4	16.6	15.8	15.6	10.4	10.4	10.1	10.0	9.9	98.8
Reducing oil and gas leaks from equipment	4.9	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	13.6
Undergrounding in National Parks and AONBs	1.1	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	8.0
Other Network Investment	10.0	3.9	8.4	9.5	3.2	3.5	2.6	1.5	1.5	0.8	31.0
TOTAL - Non-Load Network Investment	**291.2**	**286.4**	**322.7**	**314.7**	**302.3**	**283.4**	**266.4**	**271.5**	**260.4**	**270.1**	**2291.5**
Inspection, maintenance and routine tree cutting	79.0	51.4	53.2	52.5	52.1	51.5	50.8	50.9	50.2	49.8	411.0
Tree clearance to improve network resilience to severe weather	3.8	7.6	7.8	7.7	7.7	7.7	7.4	7.4	7.4	7.4	60.5
Responding to and repairing faults	97.5	94.4	99.7	98.1	96.6	95.0	93.3	92.0	90.9	89.8	755.4
Other network operating costs	8.1	8.4	8.7	8.6	8.4	8.4	8.4	8.2	8.1	8.1	66.9
TOTAL - Network Operating Costs	**188.4**	**161.7**	**169.4**	**166.9**	**164.8**	**162.6**	**159.9**	**158.5**	**156.6**	**155.1**	**1293.8**
Engineering management	**148.5**	**132.4**	**136.2**	**135.4**	**133.5**	**132.3**	**131.3**	**131.0**	**130.0**	**129.1**	**1058.8**
Corporate activities	**77.9**	**39.8**	**41.6**	**41.3**	**40.5**	**39.9**	**39.4**	**39.2**	**38.6**	**38.2**	**318.7**
Workforce renewal	**21.1**	**23.2**	**22.5**	**23.0**	**23.4**	**23.3**	**23.3**	**23.3**	**23.3**	**23.3**	**185.4**
Vehicles, IT, Property & Engineering Equipment	**110.6**	**101.0**	**107.0**	**108.3**	**91.8**	**102.3**	**101.7**	**102.0**	**102.4**	**92.4**	**807.9**
TOTAL CORE COSTS	**886.3**	**822.7**	**883.2**	**868.0**	**811.3**	**818.5**	**796.6**	**803.8**	**802.3**	**797.9**	**6581.5**

West Midlands

West Midlands - Core costs funded through DUoS including pensions											
Costs excluding RPEs & pensions, including efficiency (£m at 2012/13 prices)	**Average per year in DPCR5**	**Average per year in RIIO-ED1**	**Spend profile in RIIO ED1**								**Total RIIO-ED1**
			2015/16	**2016/17**	**2017/18**	**2018/19**	**2019/20**	**2020/21**	**2021/22**	**2022/23**	
Customer Related Reinforcement	-2.2	2.3	2.1	2.1	2.3	2.4	2.4	2.4	2.4	2.5	18.6
General Network Reinforcement	26.7	16.7	19.7	20.3	17.5	18.6	18.0	12.4	13.1	13.9	133.5
Reinforcement for Low Carbon Technologies	0.0	7.0	1.3	1.3	2.7	5.2	7.7	10.1	12.6	15.0	55.7
TOTAL - Reinforcement of the Network	**24.5**	**26.0**	**23.1**	**23.7**	**22.5**	**26.2**	**28.1**	**24.9**	**28.1**	**31.4**	**207.8**
Asset Replacement	64.1	63.9	64.7	65.3	64.1	64.3	63.8	63.4	63.1	62.4	511.1
Diversions	9.6	11.0	9.7	9.0	8.7	9.4	9.7	14.2	13.5	13.5	87.7
Quality of Supply (reducing power cuts)	3.8	2.0	2.7	2.6	2.6	2.6	2.6	2.5	0.0	0.0	15.6
Improving service for remote ("worst served") customers	0.0	0.1	0.0	0.5	0.5	0.0	0.0	0.0	0.0	0.0	1.0
Real Time Control Systems and Telecommunications	5.0	3.1	5.7	3.9	6.8	1.2	1.7	1.9	0.8	2.5	24.5
Protecting equipment from flooding risk	0.6	0.2	0.0	0.1	0.2	0.1	0.2	0.4	0.1	0.1	1.2
Enhancing site security, ESQCR and other legal requirements	5.2	3.1	3.3	3.2	3.2	3.2	3.1	3.1	3.0	3.0	25.1
Reducing oil and gas leaks from equipment	1.3	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	4.0
Undergrounding in National Parks and AONBs	0.4	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	2.4
Other Network Investment	1.1	1.2	3.2	3.4	0.7	0.8	0.6	0.3	0.3	0.2	9.5
TOTAL - Non-Load Network Investment	**91.1**	**85.3**	**90.1**	**88.8**	**87.6**	**82.4**	**82.50**	**86.6**	**81.6**	**82.5**	**682.1**
Inspection, maintenance and routine tree cutting	27.0	14.5	15.0	14.8	14.7	14.5	14.4	14.4	14.2	14.1	116.1
Tree clearance to improve network resilience to severe weather	1.3	2.0	2.0	2.0	2.0	2.0	1.9	1.9	1.9	1.9	15.6
Responding to and repairing faults	30.0	27.5	29.1	28.6	28.2	27.7	27.2	26.8	26.4	26.1	220.1
Other network operating costs	**2.4**	2.5	2.6	2.6	2.5	2.5	2.5	2.4	2.4	2.4	19.9
TOTAL - Network Operating Costs	**60.7**	**46.5**	**48.7**	**48.0**	**47.4**	**46.7**	**46.0**	**45.5**	**44.9**	**44.5**	**371.7**
Engineering management	**48.7**	**39.6**	**40.8**	**40.5**	**39.9**	**39.5**	**39.40**	**39.2**	**38.9**	**38.7**	**316.9**
Corporate activities	**32.1**	**11.6**	**12.1**	**12.0**	**11.8**	**11.6**	**11.50**	**11.4**	**11.2**	**11.1**	**92.7**
Workforce renewal	**4.8**	**6.3**	**6.1**	**6.2**	**6.3**	**6.3**	**6.30**	**6.3**	**6.3**	**6.3**	**50.1**
Vehicles, IT, Property & Engineering Equipment	**35.5**	**30.0**	**32.4**	**31.7**	**25.4**	**28.3**	**31.0**	**32.7**	**31.7**	**27.1**	**240.3**
TOTAL CORE COSTS	**297.4**	**245.2**	**253.3**	**250.9**	**240.9**	**241.0**	**244.8**	**246.6**	**242.7**	**241.6**	**1961.7**

East Midlands

East Midlands - Core costs funded through DUoS including pensions											
Costs excluding RPEs & pensions, including efficiency (£m at 2012/13 prices)	**Average per year in DPCR5**	**Average per year in RIIO-ED1**	**Spend profile in RIIO ED1**								**Total RIIO-ED1**
			2015/16	**2016/17**	**2017/18**	**2018/19**	**2019/20**	**2020/21**	**2021/22**	**2022/23**	
Customer Related Reinforcement	-3.0	2.2	2.0	2.0	2.1	2.2	2.2	2.4	2.3	2.3	17.5
General Network Reinforcement	20.3	21.4	47.2	40.5	13.8	15.6	9.6	12.8	20.8	11.1	171.4
Reinforcement for Low Carbon Technologies	0.0	11.0	2.1	2.1	4.2	8.2	12.1	16.0	19.9	23.7	88.3
TOTAL - Reinforcement of the Network	**17.3**	**34.6**	**51.3**	**44.6**	**20.1**	**26.0**	**23.9**	**31.2**	**43.0**	**37.1**	**277.2**
Asset Replacement	54.8	53.6	54.1	53.9	53.6	53.5	53.2	53.8	53.6	53.4	429.1
Diversions	9.1	10.7	13.5	13.1	12.8	12.6	8.4	8.3	8.4	8.4	85.5
Quality of Supply (reducing power cuts)	3.8	1.1	1.5	1.5	1.5	1.4	1.4	1.4	0.0	0.0	8.7
Improving service for remote ("worst served") customers	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.2
Real Time Control Systems and Telecommunications	5.8	3.2	6.0	4.0	6.9	1.3	1.9	2.0	0.8	2.6	25.5
Protecting equipment from flooding risk	1.5	0.6	1.3	1.7	0.9	0.1	0.2	0.4	0.2	0.2	5.0
Enhancing site security, ESQCR and other legal requirements	4.0	3.3	3.4	3.4	3.3	3.3	3.3	3.2	3.2	3.1	26.2
Reducing oil and gas leaks from equipment	1.7	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	4.8
Undergrounding in National Parks and AONBs	0.4	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.8
Other Network Investment	7.8	2.0	4.9	5.3	1.4	1.5	1.1	0.6	0.6	0.3	15.7
TOTAL - Non-Load Network Investment	**88.9**	**75.2**	**85.4**	**83.7**	**81.2**	**74.4**	**70.2**	**70.4**	**67.5**	**68.7**	**601.5**
Inspection, maintenance and routine tree cutting	22.0	12.2	12.6	12.4	12.3	12.2	12.0	12.1	11.9	11.8	97.3
Tree clearance to improve network resilience to severe weather	0.7	1.8	1.8	1.8	1.8	1.8	1.7	1.7	1.7	1.7	14.0
Responding to and repairing faults	31.7	31.5	33.1	32.6	32.2	31.7	31.2	30.8	30.5	30.1	252.2
Other network operating costs	**2.8**	3.0	3.1	3.0	3.0	3.0	3.0	2.9	2.9	2.9	23.8
TOTAL - Network Operating Costs	**57.2**	**48.4**	**50.6**	**49.8**	**49.3**	**48.7**	**47.9**	**47.5**	**47.0**	**46.5**	**387.3**
Engineering management	**48.8**	**40.3**	**41.8**	**41.4**	**40.7**	**40.2**	**40.0**	**39.6**	**39.5**	**39.1**	**322.3**
Corporate activities	**27.5**	**11.1**	**11.7**	**11.6**	**11.3**	**11.1**	**11.0**	**10.9**	**10.8**	**10.6**	**89.0**
Workforce renewal	**5.1**	**6.3**	**6.1**	**6.2**	**6.3**	**6.3**	**6.3**	**6.3**	**6.3**	**6.3**	**50.1**
Vehicles, IT, Property & Engineering Equipment	**35.7**	**29.6**	**30.2**	**30.2**	**26.5**	**29.2**	**30.6**	**30.6**	**32.1**	**27.6**	**237.0**
TOTAL CORE COSTS	**280.5**	**245.5**	**277.1**	**267.5**	**235.4**	**235.9**	**229.9**	**236.5**	**246.2**	**235.9**	**1964.3**

South Wales

South Wales - Core costs funded through DUoS including pensions											
Costs excluding RPEs & pensions, including efficiency (£m at 2012/13 prices)	**Average per year in DPCR5**	**Average per year in RIIO-ED1**	**Spend profile in RIIO ED1**								**Total RIIO-ED1**
			2015/16	**2016/17**	**2017/18**	**2018/19**	**2019/20**	**2020/21**	**2021/22**	**2022/23**	
Customer Related Reinforcement	-0.3	1.1	1.0	0.9	1.1	1.0	1.3	1.1	1.1	1.3	8.8
General Network Reinforcement	3.8	3.9	2.6	2.7	3.0	7.6	6.1	5.5	2.2	1.5	31.2
Reinforcement for Low Carbon Technologies	0.0	1.4	0.3	0.3	0.5	1.0	1.5	2.1	2.6	3.0	11.3
TOTAL - Reinforcement of the Network	**3.5**	**6.4**	**3.9**	**3.9**	**4.6**	**9.6**	**8.9**	**8.7**	**5.9**	**5.8**	**51.3**
Asset Replacement	32.1	36.3	35.6	36.4	36.0	37.2	36.8	36.1	36.5	36.1	290.7
Diversions	3.1	8.4	17.6	17.3	8.9	8.8	3.6	3.6	3.7	3.8	67.3
Quality of Supply (reducing power cuts)	2.5	0.4	0.5	0.5	0.5	0.5	0.5	0.5	0.0	0.0	3.0
Improving service for remote ("worst served") customers	0.2	0.1	0.0	0.5	0.5	0.0	0.0	0.0	0.0	0.0	1.0
Real Time Control Systems and Telecommunications	1.3	3.0	3.8	2.0	5.7	5.2	1.3	2.2	0.9	2.7	23.8
Protecting equipment from flooding risk	1.3	1.0	3.7	2.1	1.1	0.1	0.2	0.1	0.1	0.3	7.7
Enhancing site security, ESQCR and other legal requirements	3.4	1.4	1.5	1.4	1.4	1.3	1.4	1.3	1.3	1.3	10.9
Reducing oil and gas leaks from equipment	0.4	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	2.4
Undergrounding in National Parks and AONBs	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	1.6
Other Network Investment	0.9	0.3	0.1	0.3	0.40	0.4	0.3	0.2	0.2	0.1	2.0
TOTAL - Non-Load Network Investment	**45.3**	**51.3**	**63.3**	**61.0**	**55.0**	**54.0**	**44.6**	**44.5**	**43.2**	**44.8**	**410.4**
Inspection, maintenance and routine tree cutting	13.2	10.3	10.7	10.6	10.5	10.4	10.2	10.2	10.1	10.0	82.7
Tree clearance to improve network resilience to severe weather	1.0	1.6	1.7	1.6	1.6	1.6	1.6	1.6	1.6	1.6	12.9
Responding to and repairing faults	12.5	12.6	13.4	13.2	12.9	12.7	12.4	12.2	12.1	12.0	100.9
Other network operating costs	**1.1**	1.1	1.2	1.2	1.1	1.1	1.1	1.1	1.1	1.1	9.0
TOTAL - Network Operating Costs	**27.8**	**25.7**	**27.0**	**26.6**	**26.1**	**25.8**	**25.3**	**25.1**	**24.9**	**24.7**	**205.5**
Engineering management	**21.5**	**21.3**	**22.0**	**22.0**	**21.5**	**21.5**	**21.1**	**21.1**	**20.9**	**20.6**	**170.7**
Corporate activities	**7.3**	**6.8**	**7.1**	**7.1**	**6.9**	**6.9**	**6.7**	**6.7**	**6.6**	**6.5**	**54.5**
Workforce renewal	**4.6**	**4.6**	**4.4**	**4.6**	**4.7**	**4.6**	**4.6**	**4.6**	**4.6**	**4.6**	**36.7**
Vehicles, IT, Property & Engineering Equipment	**15.5**	**15.5**	**15.8**	**17.0**	**15.0**	**17.7**	**15.5**	**14.8**	**14.2**	**13.9**	**123.9**
TOTAL CORE COSTS	**125.5**	**131.6**	**143.5**	**142.2**	**133.8**	**140.1**	**126.7**	**125.5**	**120.3**	**120.9**	**1053.0**

South West

South West - Core costs funded through DUoS including pensions											
Costs excluding RPEs & pensions, including efficiency (£m at 2012/13 prices)	**Average per year in DPCR5**	**Average per year in RIIO-ED1**	**Spend profile in RIIO ED1**								**Total RIIO-ED1**
			2015/16	**2016/17**	**2017/18**	**2018/19**	**2019/20**	**2020/21**	**2021/22**	**2022/23**	
Customer Related Reinforcement	-0.7	1.1	1.0	1.0	1.0	1.1	1.2	1.0	1.2	1.2	8.7
General Network Reinforcement	4.0	4.4	3.5	4.2	4.6	7.6	6.2	4.2	2.6	2.0	34.9
Reinforcement for Low Carbon Technologies	0.0	5.7	1.1	1.1	2.2	4.2	6.3	8.3	10.2	12.2	45.5
TOTAL - Reinforcement of the Network	**3.3**	**11.1**	**5.6**	**6.3**	**7.8**	**12.9**	**13.7**	**13.5**	**14.0**	**15.4**	**89.1**
Asset Replacement	46.8	55.4	56.5	56.0	55.7	55.2	55.4	55.2	54.7	54.3	443.0
Diversions	4.4	9.9	13.6	13.4	7.6	7.5	7.5	7.6	8.5	13.3	79.0
Quality of Supply (reducing power cuts)	2.9	0.4	0.5	0.5	0.5	0.5	0.5	0.5	0.0	0.0	3.0
Improving service for remote ("worst served") customers	0.1	0.1	0.0	0.5	0.5	0.0	0.0	0.0	0.0	0.0	1.0
Real Time Control Systems and Telecommunications	2.3	3.1	3.9	1.7	5.0	5.2	1.7	2.7	1.2	3.0	24.4
Protecting equipment from flooding risk	0.8	0.1	0.1	0.1	0.1	0.1	0.1	0.4	0.1	0.1	1.1
Enhancing site security, ESQCR and other legal requirements	6.7	4.6	8.4	7.8	7.7	2.6	2.6	2.5	2.5	2.5	36.6
Reducing oil and gas leaks from equipment	1.5	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	2.4
Undergrounding in National Parks and AONBs	0.2	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	3.2
Other Network Investment	0.2	0.5	0.2	0.5	0.7	0.8	0.6	0.4	0.4	0.2	3.8
TOTAL - Non-Load Network Investment	**65.9**	**74.7**	**83.9**	**81.2**	**78.5**	**72.6**	**69.1**	**70.0**	**68.1**	**74.1**	**597.5**
Inspection, maintenance and routine tree cutting	16.8	14.4	14.9	14.7	14.6	14.4	14.2	14.2	14.0	13.9	114.9
Tree clearance to improve network resilience to severe weather	0.8	2.3	2.3	2.3	2.3	2.3	2.2	2.2	2.2	2.2	18.0
Responding to and repairing faults	23.3	22.8	24.1	23.7	23.3	22.9	22.5	22.2	21.9	21.6	182.2
Other network operating costs	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.7	1.7	14.2
TOTAL - Network Operating Costs	**42.7**	**41.2**	**43.1**	**42.5**	**42.0**	**41.4**	**40.7**	**40.4**	**39.8**	**39.4**	**329.3**
Engineering management	**29.5**	**31.1**	**31.6**	**31.5**	**31.4**	**31.1**	**30.8**	**31.1**	**30.7**	**30.7**	**248.9**
Corporate activities	**11.0**	**10.3**	**10.7**	**10.6**	**10.5**	**10.3**	**10.2**	**10.2**	**10.0**	**10.0**	**82.5**
Workforce renewal	**6.6**	**6.1**	**5.9**	**6.0**	**6.1**	**6.1**	**6.1**	**6.1**	**6.1**	**6.1**	**48.5**
Vehicles, IT, Property & Engineering Equipment	**23.9**	**25.8**	**28.6**	**29.4**	**24.9**	**27.1**	**24.6**	**23.9**	**24.4**	**23.8**	**206.7**
TOTAL CORE COSTS	**182.9**	**200.3**	**209.4**	**207.5**	**201.2**	**201.5**	**195.2**	**195.2**	**193.1**	**199.5**	**1602.5**

2015-2023

RIIO-ED1 **BUSINESS PLAN**

SA-06 Supplementary Annex – Uncertainty

June 2013 (Updated April 2014)

WESTERN POWER DISTRIBUTION

Serving the Midlands, South West and Wales

SA-06 Uncertainty
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1 Introduction

1.1 This document is a supplementary annex to the Western Power Distribution (WPD) Business Plan for the eight year period from 1st April 2015 to 31st March 2023.

1.2 It sets out the main uncertainties that exist during the period and the mechanisms that are required to protect WPD and customers from outcomes that are materially different to forecast. The uncertainty mechanisms apply equally to the four WPD distribution licences of West Midlands, East Midlands, South Wales and South West.

1.3 The eight year period aligns with the next regulatory price control review period, known as RIIO-ED1; the first for electricity distribution to be determined using Ofgem's Revenue = Incentives, Innovation and Outputs framework. The Business Plan, supplementary annexes, detailed cost tables and financial models form the submission under RIIO-ED1 to the regulator Ofgem (Office for Gas and Electricity Markets), who will use the information to determine allowed revenues.

Structure of this document

1.4 We appreciate that the readers of the WPD Business Plan suite of documents will range from regulatory experts and well informed stakeholders through to new customers who may have had little previous knowledge of WPD.

1.5 This document is aimed at readers who require a more detailed understanding of the uncertainties faced by WPD. A less detailed description of the uncertainties can be found in the main Business Plan Overview document.

1.6 This document is subdivided into the following sections:

Chapter	Title	Content
2	**Overview of uncertainty**	A brief description of what type of uncertainty can lead to the need for an uncertainty mechanism.
3	**Regulatory framework**	An overview of the uncertainty mechanisms being proposed for RIIO-ED1 by Ofgem.
4-16	**Descriptions of each proposed uncertainty mechanism**	Individual descriptions of the type of uncertainty, the specific mechanism being proposed by Ofgem and WPD's position.
17	**Other uncertainties where WPD will manage the risk**	Description of the areas of uncertainty which could have an impact on WPD but where no mechanism is required because WPD will bear the risk.
Appendix A1	**Potential uncertainty mechanisms defined in the Ofgem RIIO Handbook**	An extract from the RIIO handbook on the different types of mechanism that can be applied.

2 Overview of uncertainty

2.1 The price control review process sets the allowances that an efficient DNO requires to deliver its outputs for a full price control period. These allowances are based upon best knowledge at the time of submitting plans to Ofgem, which are two years before the start of that price control. For RIIO-ED1 this means that DNOs are forecasting ten years into the future.

2.2 Whilst the majority of forecasts are based upon well-established models and a good understanding of costs, there are some elements that are either beyond the control of DNOs (e.g. the rate of inflation) or there is uncertainty about what a future outcome will be (e.g. the scale of the uptake of low carbon technology (LCT)).

2.3 The circumstances beyond the control of DNOs may lead to a requirement for adjustments to a particular allowance. It is an uncertainty mechanism that structures what triggers a change, how that change is implemented and the amount of change allowed during the price control period.

2.4 This document identifies the areas where there is a requirement for uncertainty mechanisms.

2.5 We do not propose any alternative mechanisms to those proposed by Ofgem, but we do describe why the mechanisms are appropriate to apply to WPD.

Assessing the need for an uncertainty mechanism

2.6 The proposals in this Business Plan have been derived by using the most up-to-date information that is available and therefore represents WPD's best view. Whilst we are best placed to manage the risk of delivery of our plan, there are some areas of uncertainty which need additional mechanisms due to the external nature of the uncertainty and its potential impact.

2.7 In assessing the need for uncertainty mechanisms we consider:

- the reason for introducing each one;
- the appropriate mechanism;
- the value and impact on customers and other stakeholders;
- whether the proposed mechanism works with other aspects of the plan.

2.8 We also consider whether there are any drawbacks in terms of :

- undermining efficient delivery;
- creating pricing volatility;
- other unintended consequences;
- overall complexity;
- the cost to actually implement the mechanism (both ours and Ofgem's).

3 Regulatory framework

3.1 Ofgem has identified a range of uncertainty mechanisms that will apply during RIIO-ED1. Some uncertainty mechanisms are 'Mechanistic' and adjust allowances each year in response to external measures or as a result of externally defined costs. Others are 'Assessed' mechanisms that provide DNOs the opportunity to submit evidence that justifies the need for adjustments to their revenue. These assessments are carried out at predefined points in time, known as re-opener windows.

3.2 The different types of uncertainty mechanism that are possible under the RIIO framework are described in the Appendix A1 - 'Potential uncertainty mechanisms'.

3.3 The following table is extracted from Ofgem's 'Uncertainty mechanism' supplementary annex to the 'Strategy decision' document published in March 2013. It shows which mechanisms are to be used for different areas of uncertainty.

Type	Area covered	Frequency
Mechanistic		
Indexation	RPI Indexation of allowed revenues Cost of debt	Annual
Pass through	Business rates Ofgem licence fees DCC fixed costs Transmission connection point charges	Annual
Volume driver	Smart meter rollout costs	Annual (above a defined threshold)
Assessed		
Reopener	Street works Enhanced physical site security High-value projects	2019
	Load related expenditure	2017, 2020
	Innovation rollout mechanism	2017, 2019
	Pension deficit repair mechanism	2016, 2019, 2022
Trigger	Tax	At any time

3.4 We discuss each mechanism in the following chapters.

3.5 In addition, within the load related expenditure section we describe the range of potential outcomes that could arise as a consequence of different low carbon technology scenarios.

4 Load related expenditure

Uncertainty

4.1 The external drivers of investment due to changes in the demand on our network are:

- General economic conditions which has a significant influence on new connections;
- Customer behaviour in terms of energy efficiency and their usage in response to overall prices and tariffs introduced by suppliers;
- The rate of adoption of LCTs;
- The connection of Distributed Generation (DG) which is heavily influenced by support mechanisms (incentives) and planning policy.

4.2 The UK targets for reducing carbon dioxide emissions require a reduction of 80% by 2050. This target will be met through the decarbonisation of heating and transport, improvements in energy efficiency and producing electricity from renewable sources. A number of low carbon technologies such as electric vehicles, solar panels, wind farms and heat pumps place new requirements on the network.

4.3 There is considerable uncertainty about the level and shape of future electricity demand as the UK moves towards a low carbon economy. Whilst we do not know exactly how and when these changes will affect us, the use of scenarios gives us realistic ranges that we need to plan to be able to deliver. A flexible and rapid response to change is essential whilst continuing to provide market leading performance in the day to day management of our network.

4.4 The Government has set out its approach to energy and climate change in its document "The Carbon Plan: Delivering our low carbon future", published in December 2011. This sets out potential pathways (scenarios) to put the UK on track to halve greenhouse gas emissions, on 1990 levels, by the mid-2020s and a path towards an 80% reduction by 2050.

4.5 The Government Department of Energy and Climate Change (DECC) has, via the Smart Grid Forum (work stream 1) created scenarios for heat pumps, electric vehicles and photo-voltaic (PV) generation that are consistent with The Carbon Plan and include assumptions about the take up of demand side response (DSR) and the impact of energy efficiency improvements. A further group of the Smart Grid Forum (work stream 3) has taken these DECC scenarios and added further data to produce a report and model (called Transform) to show the impact of these energy scenarios on the GB distribution network.

4.6 DECC has set out four illustrative scenarios all of which would meet the Government's carbon targets. These national scenarios, all of which require a significant adoption of LCTs, have been summarised by DECC as follows:

Scenario 1	High emissions abatement in low carbon heat
• Medium levels of fuel efficiency • High levels of low carbon heat • High levels of solid wall insulation	High level of emissions reductions from uptake of low carbon heat in buildings and industry (8 million installations) with significant emission reductions from transport (60g CO_2/km) and significant thermal insulation of buildings (5 million solid wall insulation).
Scenario 2	**High emissions abatement in transport**
• High levels of fuel efficiency • Medium levels of low carbon heat • High levels of solid wall insulation	High level of emissions reductions from transport (50g CO_2/km), with comparatively lower reductions from low carbon heat (7 million installations) and significant thermal insulation of buildings (5 million solid wall insulation).
Scenario 3	**High electrification of heat and transport**
• High levels of fuel efficiency • High levels of low carbon heat • Low levels of solid wall insulation	This reflects a future where there is high electrification in heat and transport, with significant uptake of Electric Vehicles (EVs) and heat pumps (as in scenario 1 and scenario 2) and lower comparative levels of insulation (2.5 million).
Scenario 4	**Credit purchase**
• Low levels of fuel efficiency • Low levels of low carbon heat • Medium levels of solid wall insulation	Reflects a future where more than one key technology under-delivers and carbon credits are purchased. It assumes 1.6 million low carbon heat installations, medium levels of insulation (4.5 million) and fuel efficiency of 70g CO_2/km.

4.7 Whilst DECC has produced a number of scenarios for meeting the emissions target, there is considerable uncertainty about the uptake of low carbon technology, how installations will cluster (be installed within the same geographical area) and the resultant impact on the network.

4.8 The rate of growth will be dependent on many factors such as the development of these technologies by manufacturers, the rate of production and sales prices, the relative cost of different fuels, the availability of subsidies, changes to building regulations and the general attitude of consumers.

4.9 Our expenditure forecasts are based upon pragmatic assumptions informed by data provided by the Centre for Sustainable Energy (CSE). We have proposed to use information from more advanced monitoring of the network and data from smart meters to identify where LCT hotspots are emerging so that reinforcement work can be targeted at the parts of the network where it is required. Tracking expenditure against forecasts will determine whether there is significant variance.

4.10 The Transform model has been used to assess the impact of both our 'Best View' and the four DECC Carbon Plan scenarios. The model produces forecasts of expenditure on the basis of using smart incremental techniques (e.g. active network management, demand side response) and continuing to reinforce the network using conventional techniques (e.g. more/larger transformers, cables). Decisions on reinforcement during the RIIO-ED1 period need to consider the potential investment needs during the RIIO-ED2 and RIIO-ED3 periods.

4.11 Since there is uncertainty about the LCT uptake, analysis of the DECC scenarios gives plausible ranges of the reinforcement that may be required in the future. There is also uncertainty about the viability, benefits and costs of smart solutions, which means that conventional reinforcement may also be required.

4.12 The following tables compare the costs of the different scenarios; the first showing WPD's Best View and the range of costs using smart incremental solutions and the second comparing WPD's Best View to the range of costs using conventional techniques. Ofgem has requested data on a reference case as part of the Business Plan Data Templates. This is the DECC scenario 1 smart incremental case in the following tables.

LV & HV LCT related reinforcement expenditure 2015/16 to 2022/23 – Comparison of WPD Best View and DECC scenarios using smart incremental techniques (£m)					
	WPD 'Best View' forecast	**Scenario 1 – high emissions abatement in heat provision**	**Scenario 2 – high emission abatement in transport**	**Scenario 3 – high electrification of heat and transport provision**	**Scenario 4 – International Carbon Credit purchases needed to meet targets**
West Midlands	55.1	68.7	63.1	75.1	4.7
East Midlands	87.7	186.2	113.3	140.3	5.8
South Wales	11.3	91.2	92.5	90.0	13.5
South West	44.9	34.0	40.3	44.4	2.0
Total	199.0	380.0	309.1	349.8	26.0

(Note: the DECC forecasts are based on the clustering pattern currently seen from the uptake of small scale PV whereas the WPD Best View is based on a more clustered approach following the work undertaken by CSE. If the DECC forecast were to use the higher CSE clustering then the investment levels would be much higher)

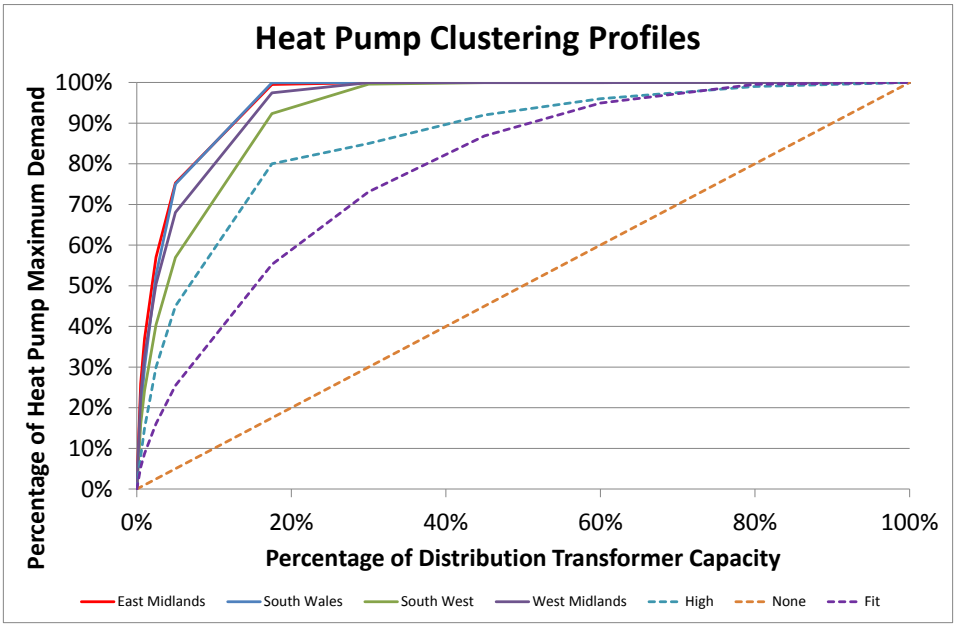
LV & HV LCT related reinforcement expenditure 2015/16 to 2022/23 – Comparison of WPD Best View and DECC scenarios using conventional techniques (£m)					
	WPD 'Best View' forecast	**Scenario 1 – high emissions abatement in heat provision**	**Scenario 2 – high emission abatement in transport**	**Scenario 3 – high electrification of heat and transport provision**	**Scenario 4 – International Carbon Credit purchases needed to meet targets**
West Midlands	55.1	105.4	125.4	124.1	9.8
East Midlands	87.7	240.2	185.6	241.8	9.2
South Wales	11.3	132.2	151.1	165.9	26.6
South West	44.9	49.9	83.0	92.7	6.3
Total	199.0	527.7	545.1	624.5	52.0

(Note: the DECC forecasts are based on the clustering pattern currently seen from the uptake of small scale PV whereas the WPD Best View is based on a more clustered approach following the work undertaken by CSE. If the DECC forecast were to use the higher CSE clustering then the investment levels would be much higher)

4.13 A further factor of uncertainty in the potential reinforcement required as a result of LCTs is in the degree of clustering of the uptake of the technologies. The Transform model has a default clustering assumption (called FIT clustering) that assumes that all technologies will cluster in a similar way to that seen with small scale PV to date based on the uptake of feed in tariffs.

4.14 The Transform model has two standard clustering assumptions built into it, a FIT clustering and a high clustering case. Comparison of these assumptions and the results from the detailed analysis by the CSE is shown in the graph below:

4.15 The outputs from the Transform model are very sensitive to the clustering assumption used and this resulted in us undertaking work with the Centre for Sustainable Energy (CSE) to gain a better understanding of clustering by assessing how property size and type may affect the uptake of heat pumps and PV generation and how socio-demographic groupings will affect the uptake of electric vehicles. This research indicated that clustering maybe even higher than both the Transform assumptions. CSE researched impacts in WPD licence areas is shown in the graph below.



4.16 The sensitivity of the reinforcement forecasts to the varying clustering assumptions are shown in the resulting investment needs in the following table. Raw output from the Transform model has been used to demonstrate the effect of clustering in this table. Our 'Best View' is derived from the CSE research. Our 'best view' figures that are actually utilised for our Business Plan cost forecasts are lower than the CSE clustering based figures because other factors are taken into account, which are detailed in the Supplementary Annex (SA-05) on Expenditure.

LV & HV LCT related reinforcement expenditure 2015/16 to 2022/23 (£m) Comparison of forecast using differing clustering assumptions			
	Using CSE data	**Using 'FIT' clustering**	**Using 'High' Clustering**
West Midlands	93.1	11.7	45.7
East Midlands	149.4	7.6	50.9
South Wales	19.7	.4	6.8
South West	77.3	17.2	57.6
TOTAL	**339.6**	**36.9**	**160.9**

4.17 The need for network reinforcement, in addition to that needed for the growth in LCTs, is dependent on widespread changes in demand driven by general economic conditions and the specific location of the development of new load or generation connections.

4.18 Assumptions about the amount of load growth are used to forecast which parts of the network will require reinforcement, but actual load growth can differ.

4.19 There is also uncertainty about the level of large scale generation that will seek connection to the network. Whilst this has an impact on the resources needed, a significant part of the cost associated with these connections is recovered directly from the Generators. Details of the forecast costs for large scale generation are in connections sections of the Supplementary Annex (SA-05) on Expenditure.

Regulatory framework

4.20 Ofgem recognises that there is significant uncertainty over the investment required to accommodate new and changing patterns of energy use.

4.21 The load-related reopener mechanism introduced for DPCR5 will continue into RIIO-ED1, but with an expanded scope that also includes fault level reinforcement and secondary network connections.

4.22 The re-opener will operate around a 20% dead band, where efficient costs incurred above the dead band can be funded through additional allowances. DNOs will fund a proportion of the expenditure that is below the dead band threshold but above allowances. The proportion will be derived from their efficiency incentive rate (70% for companies that are fast tracked).

4.23 There will be two windows in 2017 and 2020 where DNOs have the opportunity to demonstrate that incurred efficient costs are more than 20% higher than the combined allowances for load related work. At the end of RIIO-ED1 there will not be an opportunity to recover additional costs, even if they exceed the threshold at that point. DNOs will make use of the reopener windows if costs are forecast to exceed the reopener thresholds.

WPD position

4.24 There will be many factors that will determine the overall costs of load related reinforcement. This will include general reinforcement of the network, reinforcement associated with specific connections, LCT influenced reinforcement and fault level reinforcement.

4.25 DNOs are best placed to manage the variety of requirements to develop the network for new loads and ensure that loading risk outputs are met.

4.26 The reopener dead-band drives DNOs to seek innovative low cost solutions to minimise the financial impact of additional reinforcement. This is because additional costs up to the reopener threshold have to be funded by the DNOs (subject to the efficiency incentive).

4.27 The ability to recover costs above the threshold provides a safety net for companies where load growth is significantly higher than forecast.

4.28 The elements of the reopener balance protection for DNOs with drivers for efficiency. WPD does not require any additional mechanisms.

Resource requirements

4.29 Whilst the above can address the financial effects of uncertainty, there is still the need to be able to resource the activity. Resource availability is addressed in the Operational Training section of Supplementary Annex on Expenditure but there is a time lag between identifying the need for additional resources and them being available. For this reason, the following indicators will be monitored to act as triggers for the provision of extra resources associated with the move towards a low carbon economy:

- number of heat pumps connected – notification processes are currently being established via the Electricity Networks Association (ENA);
- number of notifications of PV connections –Numbers installed can be obtained from the Ofgem FIT register which has data available at post code level;
- number of notifications of EV charging points – notification processes are currently being established via the ENA;
- new or changed subsidies – both changes to the values of subsidies and to conditions that apply e.g. insulation standards that are a precondition of a subsidy;
- legislative or standards changes that impact on equipment used e.g. changes to building regulations;
- payback periods on LCTs;
- changes in relative cost of gas (mains and LPG), heating oil and electricity.

5 High-value projects

5.1 Projects with costs exceeding £25m are classed as high-value projects. Unforeseen load growth patterns or new connection activity can lead to problems on the network that can only be resolved by carrying out extensive work.

5.2 The move to an eight year price control period increases the chances of unidentified high-value projects arising once allowances have been determined.

5.3 Whilst it is right for DNOs to manage the risks associated with variations in small projects, some protection is required from the financial impact of high-value projects.

Regulatory framework

5.4 Ofgem recognises that DNOs may not be aware of some projects at the start of RIIO-ED1, but state that DNOs should become aware of them through effective stakeholder engagement.

5.5 One reopener window will be available in 2019. DNOs will need to clearly define the outputs that will be delivered to enable Ofgem to carry out a project by project assessment. Any additional costs, above ex-ante allowances, will need to exceed a materiality threshold.

WPD position

5.6 We do not expect to have many projects falling within this category and the availability of a reopener adequately covers any future requirements that may arise.

6 Transmission connection point charges

6.1 The WPD network is connected to the National Grid at Transmission Connection Points (also referred to as Transmission Exit Points). National Grid provides infrastructure at these exit points to allow power to flow between the transmission system and distribution network.

6.2 National Grid recovers the cost of providing these exit points through annual charges. The charges cover the costs for new assets when additional capacity is requested by WPD and the costs of replacing existing assets determined by National Grid's replacement programme. In most cases the costs of work are recovered by charges over a forty year period.

6.3 Even though National Grid provides a quotation for the proposed work, the eventual charges are determined by the actual costs of the work. This means that if additional costs are incurred they are included in the charges levied on WPD. There is little opportunity to influence the costs once projects are under way.

6.4 This means that whilst forecasts for future costs can be made the actual costs vary depending upon the work programme and costs incurred by National Grid.

Regulatory framework

6.5 Ofgem proposes to treat part of transmission connection charges as pass through costs.

6.6 This will apply to assets installed prior to 2015 and any new work resulting from National Grid's assets replacement programme.

6.7 It will not cover the costs of additional or upgraded connection points requested by WPD.

6.8 An ex-ante allowance will be provided to cover the costs of work requested by WPD since the scope and overall requirements are under the control of WPD.

WPD position

6.9 Since the National Grid work programme is beyond the control of DNOs there is a need for a pass through mechanism for transmission connection points.

6.10 The proposed regulatory framework provides a balanced approach to managing cost uncertainty and, by excluding DNO instigated work, places a responsibility on DNOs to identify the most efficient mechanism for providing the additional capacity required at transmission connection points. WPD does not require any additional mechanisms.

7 Street works

7.1 Legislation requires WPD to inform Highways Authorities about work that will affect public roads. Most Highways Authorities currently operate a Notice process which does not incur fees, but the Department for Transport is encouraging them to implement Permit schemes for traffic sensitive strategic roads that will introduce new charges. In addition Highways Authorities have the option of implementing Lane Rental schemes where utilities pay a daily charge for working in the road.

7.2 Current costs are relatively low, but these could increase significantly, especially where Lane Rental schemes are introduced.

7.3 There are no mandated timescales and each Highway Authority is free to choose which approach it prefers.

7.4 We have assumed that Highway Authorities will adopt Permits schemes, but only apply these to traffic sensitive roads. This will introduce an additional cost of £1m per annum across WPD. This approach balances the additional costs where Highways Authorities choose to apply Permit fees to all roads against situations where Notice schemes remain in place.

7.5 The main uncertainty relates to the adoption of Lane Rental schemes, which could introduce substantial additional costs.

Lane Rental

7.6 The New Roads and Street Works Act (NRSWA) as amended by the Transport Act 2000 and the Traffic Management Act 2004 contains provision for Highway Authorities to operate Lane Rental schemes that involve charging Works Promoters for the time their works occupy the highway.

7.7 Lane Rental schemes can only be implemented by a Highways Authority that has operated a Permit Scheme for 2 years. It is unlikely that all Permit Scheme operators will seek to implement full Lane Rental schemes applicable to all roads. It is more likely that Highways Authorities will apply Lane Rental to traffic sensitive routes only.

7.8 At the point of developing this Business Plan no Highway Authorities in any of the WPD licence areas have indicated they are planning to operate Lane Rental in the near future. But, it is conceivable that during RIIO-ED1, many Lane Rental schemes could be introduced, leading to high additional costs for works in the highway.

7.9 An indication of the costs if all authorities introduce Lane Rental on traffic sensitive routes only is shown in the table below. This is derived by considering:

- different notice types of work - Major, Standard, Minor and Immediate - since the number of notices and average duration of works varies for each type;
- the current annual number of notices;
- the average duration of works;
- daily rates to be charged.

West Midlands – Estimated annual Lane Rental charges for all work on traffic sensitive routes					
Parameter	**Major**	**Standard**	**Minor**	**Immediate**	**Total**
Volume of notices (number per annum)	75	402	100	423	
Average duration of works (days)	35.3	6.7	2.3	6.4	
Daily Permit Fee (£)	2,500	2,500	2,500	2,500	
Total Annual Cost (£m)	6.6	6.7	0.6	6.8	20.7

East Midlands – Estimated annual Lane Rental charges for all work on traffic sensitive routes					
Parameter	**Major**	**Standard**	**Minor**	**Immediate**	**Total**
Volume of notices (number per annum)	70	458	196	527	
Average duration of works (days)	35.3	6.7	2.3	6.4	
Daily Permit Fee (£)	2,500	2,500	2,500	2,500	
Total Annual Cost (£m)	6.2	7.7	1.1	8.4	23.4

South Wales – Estimated annual Lane Rental charges for all work on traffic sensitive routes					
Parameter	**Major**	**Standard**	**Minor**	**Immediate**	**Total**
Volume of notices (number per annum)	13	136	63	78	
Average duration of works (days)	9.3	6.5	2.4	5.9	
Daily Permit Fee (£)	2,500	2,500	2,500	2,500	
Total Annual Cost (£m)	0.3	2.2	0.4	1.2	4.1

South West – Estimated annual Lane Rental charges for all work on traffic sensitive routes					
Parameter	**Major**	**Standard**	**Minor**	**Immediate**	**Total**
Volume of notices (number per annum)	12	175	177	165	
Average duration of works (days)	7.6	6.5	1.4	6.9	
Daily Permit Fee (£)	2,500	2,500	2,500	2,500	
Total Annual Cost (£m)	0.2	2.8	0.6	2.8	6.4

7.10 The potential annual cost for Lane Rentals on sensitive roads is approximately £55m.

7.11 Since local authorities are not planning any such schemes in the short term, no Lane Rental costs have been included in the Business Plan.

Regulatory framework

7.12 Ofgem proposes to have one reopener window in 2019 where additional costs for the full period will be considered. It will cover additional costs associated with Permit Schemes and Lane Rentals, including system set up costs, but these will need to exceed a materiality threshold for the reopener to apply.

WPD position

7.13 WPD actively engages with over 60 local authorities to keep informed of changes to requirements across the company. Since local authorities apply to the Department for Transport to introduce schemes, there is sufficient time to understand the impact of changes. This means that one reopener at the mid-point of RIIO-ED1 will be adequate.

8 Smart meter rollout and DCC fixed costs

Smart meter rollout

8.1 The rollout of smart meters to domestic customers has cost uncertainty as a result of three main factors:

- the volume of remedial work required at the metering position;
- the charges to be made by the Data and Communications Company (DCC) for the provision of data from smart meters;
- the development of in-house systems for the receipt and storage of data, proactive load management and transfer of the Change of Supplier Registration Service to the DCC.

8.2 The volume and costs of the remedial work included within the Business Plan assumes that 2% of installations will require action to allow the meter operator to install a smart meter. The National Skills Academy has provided forecasts that suggest 4% of installations will require a visit to enable a smart meter to be connected and therefore costs could double. Due to the uncertainty of the actual volumes of remedial work it is proposed that a volume driver is required to adjust allowances once the work is completed.

8.3 We have identified that an additional 60 staff will be required to deal with the service position defects. There is sufficient scope for expansion of training facilities should more staff need to be trained to deal with higher volumes of defects. This is covered in more detail in the Operational Training section of the Expenditure Supplementary Annex.

8.4 Provisional charges for DCC services, published by DECC in January 2013, suggested that costs for WPD would be approximately £100m over the RIIO-ED1 period. These charges have been reviewed by DECC and figures shared in April 2013 suggest that the costs will be reduced to around £29m. These costs may change again once DECC completes the procurement process to establish the DCC provider.

8.5 The in-house data systems for communication with the DCC and for the storage of smart meter data are planned to be completed by the end of 2015, however the design requirements for these systems is yet to be defined. In addition, systems may also be required to enable the DCC to carry out the Change of Supplier Registration Service which is a process currently carried out within DNO systems.

8.6 Once the rollout of smart meters nears completion, there will be a need for the IT systems to be able to instigate load management (e.g. reducing demand at peak times). The exact nature of these systems and the interaction with suppliers and customers is undefined and therefore there is uncertainty about the costs.

Regulatory framework

8.7 The proposed regulatory framework has two mechanisms; a volume driver for the volume of remedial work required and a pass through for the DCC and system costs.

8.8 Ofgem will provide an allowance for remedial action based on 2% of the installations visited requiring work. There will be an annual adjustment for actual volumes undertaken and there will not be a dead band. The volume driver will adjust allowances, up or down, to align with the actual volume of activity. Ofgem will also apply a tapering mechanism should the proportion of properties requiring remedial action exceed 10%. This tapering mechanism will reduce the allowance per installation as the proportion increases.

8.9 DCC fixed costs and the costs for the development of DNO IT systems will be treated as pass through costs up until the end of the March 2020. Beyond this Ofgem expects the costs to be covered by the benefits being derived from the use of data from smart meters. Variable data costs will not be included and there will not be any allowances to cover the costs of smart meter data.

WPD position

8.10 Suppliers will be installing smart meters at around four times the rate of routine meter changes. This will identify higher volumes than normal for remedial actions required at service positions. The exact impact is uncertain and the use of a volume driver to adjust allowances is appropriate.

8.11 DECC has determined that full fixed costs for the DNOs will be levied from the start of the smart meter rollout. Costs will be incurred at a time when there will be insufficient coverage to gain benefits. During the rollout programme, allowances are required for these costs and the use of a pass through approach is appropriate.

8.12 Since the specification of the IT and communication systems that DNOs will require to make use of the data are not fully defined the costs are uncertain. Since the specifications will be determined by DECC and the DCC the requirement is outside of the control of DNOs and a pass through mechanism for the costs is appropriate.

8.13 At present Ofgem has determined the cut-off point for pass through costs at being March 2020. This point was based on the previous DECC timescales for the completion of the smart meter rollout. Since Ofgem's Strategy Document, DECC has delayed the rollout by a year resulting in a mismatch of the dates. The cut-off point for allowing pass through costs needs to reflect the timescales specified by DECC and should also be adjusted for any future changes to the rollout programme.

9 Enhanced physical site security

9.1 The Department of Energy and Climate Change (DECC) are responsible for assessing the items of our network which are a part of the Critical National Infrastructure (CNI). The assessment undertaken considers the number of customers connected to a specific site, its criticality to the network in general or its role in supporting key installations or customers. When a site is defined as being part of this list, additional security works are undertaken to increase the protection of the site.

9.2 The Centre for the Protection of National Infrastructure (CPNI) works with the industry to identify where additional security measures are required. These depend on Government intelligence of future security risks and therefore the locations and scale are uncertain. DECC and CPNI will evaluate and approve our proposals before any works commence and require a completion report to ensure the works are effectively deployed.

Regulatory framework

9.3 Ofgem proposes that additional costs can be recovered where DNOs have delivered projects efficiently, can produce a technical report that shows the proposed works meet security requirements and have an audit that confirms the work has been completed to the right standard.

9.4 Where additional costs exceed a materiality threshold, DNOs can apply for a reopener in 2019. Costs below the threshold can be logged up and Ofgem will consider them as part of RIIO-ED2 allowances.

WPD position

9.5 The uncertainty about what security enhancements will be required requires a mechanism that allows DNOs to recover costs. The mechanism should only be applicable to security enhancements proposed by the CNPI as other security measures are within the control of DNOs.

9.6 The proposals made by Ofgem provide recovery of all efficiently incurred costs. WPD does not require any additional mechanisms.

10 Innovation rollout

10.1 WPD is carrying out the highest number of Low Carbon Network Fund projects of all DNOs. We expect to develop a number of solutions that can be applied to the network that will lead to lower costs or more effective management of the network in facilitating a move to a low carbon economy.

10.2 The implementation of some of these solutions may set the foundations for future benefits. However, this may require investment ahead of the benefits being delivered. Without additional funding these projects may not be economic over the price control period.

Regulatory framework

10.3 Ofgem has proposed an innovation rollout mechanism that can be used for costs associated with the implementation of proven low carbon or environmental innovations.

10.4 It cannot be used if the rollout will lead to commercial benefits being obtained during RIIO-ED1.

10.5 Where the benefits will materialise in the long term, an application can be made for additional funding should the cost of the rollout exceed a materiality threshold. Costs below the threshold will not be funded, but will be subject to the efficiency incentive.

10.6 There will be two windows, in 2017 and 2019, where DNOs can apply for additional funding and application can be made ahead of expenditure being incurred.

WPD position

10.7 There is a need to provide DNOs with an opportunity to obtain additional funding for the rollout of innovative techniques that will provide longer term benefits valued by stakeholders.

10.8 The proposals made by Ofgem provide two opportunities to request additional funding. WPD does not require any additional mechanisms.

11 RPI indexation

11.1 Costs forecasts in this Business Plan are presented in 2012/13 prices. The allowances that Ofgem provide will also be presented in 2012/13 prices.

11.2 Real costs during the price control will change and therefore the allowances need to be indexed to take account of inflation or, if it occurs, deflation.

Regulatory framework

11.3 Ofgem proposes to use the Retail Prices Index (RPI) to adjust allowances for economy-wide inflation/deflation.

11.4 This principle is established within regulatory mechanisms and is acceptable to WPD.

12 Cost of debt

12.1 Prior to using the RIIO framework for price controls, the cost of debt was determined at the start of a price control and fixed for the whole period. The move to longer price control periods, under RIIO, has led Ofgem to implement a methodology that varies the costs of debt in line with a published index.

Regulatory framework

12.2 Ofgem proposes to set the real cost of debt using the a 10 year simple trailing average of the iBoxx GBP Non-Financials indices of 10+ years maturity, with credit ratings of broad A and broad BBB, less the implied 10 year gilt inflation break evens published by the Bank of England. The costs of debt will be updated each year.

WPD position

12.3 The proposals made by Ofgem provide a good mechanism for calculating a real cost of debt. WPD does not require any additional mechanisms.

13 Business rates

13.1 Business rates are periodically revalued and the next revaluation is due in 2017. It is anticipated that they will increase significantly, but the actual amounts will be determined by the Valuation Office, an executive agency of the Inland Revenue.

13.2 When revaluations take place, WPD engages with the Valuation Office to ensure that rate charges are minimised.

Regulatory framework

13.3 Ofgem proposes to allow business rates to be pass through provided that DNOs can demonstrate they have made efforts to minimise the valuations.

WPD position

13.4 WPD will seek to minimise the degree of any increases through negotiation with appropriate valuation officials.

13.5 Charges are mostly outside of the influence of WPD and it is appropriate for them to be treated as pass through costs.

14 Corporation tax

14.1 The Government sets corporation tax in response to economic conditions and other financial objectives. The changes are outside of the control of WPD and can occur at any time.

Regulatory framework

14.2 Ofgem proposes to have annual adjustment mechanism where revenues are adjusted if the impact of a tax change exceeds a materiality threshold. This introduces a dead band where revenues are not altered if the impact of the tax change does not breach the threshold. Within the dead band DNOs benefit from tax reduction and incur additional costs when taxes increase. Adjustments can increase or decrease revenues and the use of the dead-band shares the impact of tax changes between DNOs and customers.

WPD position

14.3 Changes to tax legislation are clearly outside the control of DNOs. There is a need to adjust tax allowances to cater for change and since this can happen at any point in time an annual window is required. Adjustments are required to provide benefits to customers where tax obligations reduce (by lowering revenues) and protect DNOs where taxes increase.

14.4 Ofgem's proposals cater for any changes. WPD does not require any additional mechanisms.

15 Established pension deficit repair

15.1 Final salary pension schemes need to be funded on the basis of estimates of the value of investments held by the scheme (the assets) and the projected pension costs (the liabilities). Both the assets and liabilities vary over time and full valuations are carried out every three years. If the assets are worth more than the estimate of the liabilities, there is a surplus. If the assets are worth less than the liabilities, there is a deficit.

15.2 When there is a deficit, companies have a legal obligation to pay in enough money over time to ensure that the deficit is eliminated.

15.3 In their restated pension principles, Ofgem have undertaken to give companies an allowance to pay the regulated 'Distribution' portion of the deficits at 31 March 2010. No specific allowance is available for any deficit that is created after 31 March 2010 although the costs of any such incremental deficit relating to regulated activities will be allowed as part of overall employment costs.

15.4 The deficits at 31 March 2010 are known as established pension deficits. When these are revalued the scale of deficit changes. Pension allowances need to reflect the revised deficits in order to ensure that the costs are fairly spread across current and future customers.

Regulatory framework

15.5 Ofgem proposes to have three re-opener windows (in 2016, 2019 and 2022) that coincide with triennial actuarial revaluations. These will be used to assess costs and adjust allowances to reflect economic and efficiently incurred deficit.

WPD position

15.6 The three reopener windows provide opportunity for the revision of allowances to cater for changes in pension deficit. WPD does not require any additional mechanisms.

16 Ofgem licence fees

16.1 Ofgem funds its activities by charging licence fees. These charges are dependent upon the costs incurred by Ofgem and are outside the control of DNOs. Whilst there is significant development and change in energy provision, there is uncertainty about the scale of Ofgem's activities and it is difficult to determine an appropriate ex-ante allowance.

Regulatory framework

16.2 Ofgem proposes to allow Ofgem licence fees to be treated as pass through.

WPD position

16.3 It is appropriate that Ofgem licence fees to be treated as pass through.

17 Risk managed by WPD

17.1 The development of expenditure forecasts for an eight-year price control requires the use of currently available information to predict future requirements. Changes to legislation, the impact of a catastrophic incident and Government decisions on the development of national infrastructure can result in different requirements to those that were used within forecasting assumptions.

17.2 Where DNOs have an element of control over the costs of such changes, uncertainty mechanisms ensure that the financial risk is shared between customers and DNOs.

17.3 There are a number of uncertainties where there is no need for an uncertainty mechanism because the scale of the impact is small or the risks can be limited through actions by WPD.

17.4 New obligations may arise at any time and could introduce costs that cannot be avoided. During RIIO-ED1, Ofgem will be carrying out a mid-period review to assess whether new outputs are required as a consequence of changes to Government policy. As part of this process WPD will identify where outputs will need to be adjusted.

Risk being managed by WPD for uncertainty mechanisms proposed by Ofgem.

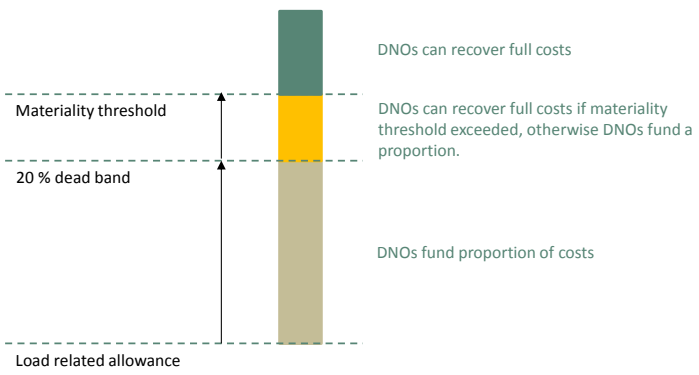
17.5 The efficiency incentive rate ensures that any additional expenditure incurred by a DNO exposes the DNO to a proportion of the costs. This proportion is 70% for fast tracked companies.

17.6 The majority of the re-opener uncertainty mechanisms can only be triggered when materiality thresholds are exceeded. Any additional expenditure incurred by DNOs below the thresholds is subject to the efficiency incentive rate.

17.7 The most significant area of risk for WPD under these mechanisms is the approach used for load related expenditure. This uses a 20% dead band around the total costs of load related work (including customer specific reinforcement, load reinforcement and fault level reinforcement).

17.8 Any additional costs within the dead band are subject to the efficiency incentive rate. Costs above the dead band can only be recovered if the excess above the dead band exceeds a further materiality threshold. This means that costs for load related expenditure need to exceed both the 20% dead band plus the materiality threshold to trigger the re-opener that only allows costs above the dead band to be fully recovered. This is illustrated in the diagram below.

Load related dead band and materiality threshold



17.9 The value of load related expenditure is relatively high and therefore the 20% dead band equates to a significant value of expenditure that is subject to the efficiency incentive rate. This is illustrated in the table below which uses load expenditure from WPD's best view case.

Load related re-opener dead band (£m)				
	West Midlands	East Midlands	South Wales	South West
Total load related expenditure	205.5	271.4	49.3	85.3
Dead band	41.1	54.3	9.9	17.1
Amount funded by WPD (at 70%)	28.8	38.0	6.9	11.9

Note this illustration does not include the additional costs of the materiality threshold

17.10 This financial risk will drive the development of lower cost solutions for load related work and the resultant efficiencies will provide benefits for customers into the future.

17.11 WPD is in a strong position to manage the risks. Our innovation programme has a wide range of projects developing new techniques that will lead to smarter lower cost investments.

Other known risks that will be managed by WPD

Railway electrification

17.12 Network Rail is proposing electrification of a number of railway lines. Firm plans are already being developed for 'announced routes', such as the Paddington to Swansea railway line and Midland Mainline. The electrification work requires a number of overhead lines and cables to be diverted.

17.13 WPD and Network Rail have a Master Wayleave Agreement (MWA) covering rights for WPD overhead lines and cables to be situated on railway property. This agreement dates from 1961 and is in effect a terminable licence (like any other wayleave).

17.14 Network Rail has informed WPD that it requires that these diversions be at WPD's cost. The diversion costs for these known schemes have been included in the Business Plan.

17.15 There are a large number of further options in England and Wales that are being considered including routes between Birmingham, Bristol and Plymouth. At this stage there is no clear indication from Network Rail when such additional schemes will go ahead, but some will arise during RIIO-ED1. The Business Plan therefore includes an estimate for an additional line based upon the forecast costs of the known schemes.

17.16 WPD will manage the risk that further railway lines will be electrified prior to 2023. The risk is relatively low as the mobilisation of such works can take several years, which means that future requirements for diversions for electrification of railways is likely to rollover into RIIO-ED2.

High Speed 2 (HS2)

17.17 In January 2012 the Secretary of State for Transport announced the decision to go ahead with the development of a high speed rail network between London, Birmingham, Leeds and Manchester stating that HS2 is the largest transport infrastructure investment in the UK for a generation.

17.18 HS2 will be built in two phases with the first stage, the link between London and Birmingham, being planned for completion by 2026. The construction of this first phase will cut through the WPD area passing through large parts of Warwickshire, into the North Eastern parts of Birmingham and extending into Staffordshire and consequently there will be the requirement to divert existing overhead line and cables to enable the new railway to be built.

17.19 Analysis of the proposed route has identified that there will over 300 diversion schemes in both the West and East Midlands across all voltages.

17.20 Unlike the railway electrification of existing lines, the costs for diverting electricity distribution assets will be funded by HS2 which means that the work will be treated as an excluded service (i.e. not funded through DUoS).

17.21 There remains uncertainty that HS2 will actually proceed; there is concern about the business case and a change of government could reverse the decision made in January 2012. For our Business Plan we have assumed that HS2 does proceed.

17.22 There is limited financial risk because expenditure will be funded by HS2.

Changes to EU legislation

Biocidal Products Directive

17.23 The Biocidal Products Directive is leading to a review of the use of creosote as a wood preserver and whilst the electricity industry is currently allowed to use creosote impregnated poles up to 2018, their use could be banned during the RIIO-ED1 period. An alternative could be a hybrid pole being developed in Sweden made from a fibreglass inner and UV protective polyethylene outer layer, but this is still under development and not ready for the UK market.

17.24 The alternative poles are more expensive than wooden poles with the hybrid pole estimated to be two to three times the cost of wooden pole and concrete poles being five times the cost.

17.25 The scale and timing of the changes are uncertain. Whilst there is a risk of higher costs, these will not impact until later in RIIO-ED1 and there should be a much clearer position for the mid period review of outputs. No additional costs have been included in the Business Plan and WPD will bear the risk of these costs arising.

Ecodesign of electrical equipment

17.26 The EU is considering a regulation to implement Directive 2009/125/EC regarding the ecodesign of electrical equipment and if introduced this would lead to a requirement to use more efficient transformers. The additional cost of these units is considerable and, at larger distribution substation level, can lead to a doubling of the cost of a transformer.

17.27 Whilst this may become a requirement of EU law as soon as 2014, there is uncertainty about when the regulations would come into force and any run down period allowed for manufacturers to move to the new designs.

17.28 No additional costs have been included in the Business Plan and WPD will bear the risk of these costs arising.

18 Appendix A1 – Potential uncertainty mechanisms

18.1 The price control review process sets the allowances that an efficient DNO requires to deliver its outputs for a full price control period. Circumstances beyond the control of DNOs may lead to a requirement for different allowances. Uncertainty mechanisms allow changes to the revenue allowances during the period and the mechanisms vary depending on the outputs companies are expected to deliver.

18.2 The Ofgem handbook for implementing the RIIO model describes the potential uncertainty mechanisms to address the financial issues as:

Category of uncertainty mechanism	Description of types of uncertainty mechanism tool	Summary of provision in price control licence
Mechanisms fully calibrated at price control review	Indexation	Provision that adjusts the revenue the company is allowed to collect from customers according to changes in a specified price index (e.g. the RPI or a published input price index).
	Volume driver calibrated at price control review	Provision allowing revenue to vary as a function of a volume measure (e.g. number of new connections).
	Revenue trigger calibrated at price control review	Provision allowing revenue to increase/decrease by a specified amount (or in a specified way) if and when certain trigger events occur during the price control period.
	Use it or lose it mechanism	If revenue set aside for a specified activity or purpose is not used as intended, revenue can be adjusted to remove this allowance.
Forward looking revenue adjustment determined during price control	Revenue adjustment based on updated cost assessment if trigger event occurs (e.g. specific re-opener)	Provision allowing for a specific part of the company's revenue allowance to be reviewed and potentially adjusted by Ofgem during the price control period, on a forward-looking basis, if and when specified conditions are met (e.g. if a measure of customer demand exceeds specified thresholds).
Revenue allowance determined after company incurs relevant expenditure	Pass-through items	Provides that the company will be fully or partially compensated for costs incurred in specified areas or on specified items (e.g. Ofgem licence fees).
	Logging up of actual expenditure subject to ex post efficiency review	Provides that a company will be fully compensated for actual expenditure on a certain activity, through the revenue allowance set at the next price control review, at least insofar as Ofgem determines the relevant expenditure was efficiently incurred.
	Backward-looking revenue adjustment based on benchmarking analysis of outturn costs	A company will receive an amount of revenue, in respect of a particular activity or output, which Ofgem will determine based on benchmarking analysis of other companies' actual expenditure on that activity or output. This mechanism may be considered where the activity or output is new and there is no historical expenditure data to use for benchmarking at the time the price control is set.

2015-2023

RIIO-ED1 **BUSINESS PLAN**

SA-07 Supplementary Annex – Financing the plan

June 2013 (Updated April 2014)

WESTERN POWER DISTRIBUTION

Serving the Midlands, South West and Wales

SA-07 Financing the plan
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1 Introduction

1.1 This document is a Supplementary Annex to the Western Power Distribution (WPD) Business Plan for the eight year period from 1st April 2015 to 31st March 2023.

1.2 It describes the how the plan will be financed and the financial parameters required by WPD.

1.3 It relates to the financing for all four WPD distribution licences of West Midlands, East Midlands, South Wales and South West.

1.4 The eight year period aligns with the next regulatory price control review period, known as RIIO-ED1; the first for electricity distribution to be determined using Ofgem's Revenue = Incentives, Innovation and Outputs framework. The Business Plan, Supplementary Annexes, detailed cost tables and financial models form the submission under RIIO-ED1 to the regulator Ofgem (Office for Gas and Electricity Markets), who will use the information to determine allowed revenues.

Structure of this document

1.5 We appreciate that the readers of the WPD Business Plan suite of documents will range from regulatory experts and well informed stakeholders through to new customers who may have had little previous knowledge of WPD.

1.6 This document is aimed at readers who require a more detailed understanding of how the Business Plan will be financed during RIIO-ED1. A less detailed description can be found in the main Business Plan Overview document.

1.7 This document is subdivided into the following sections:

Chapter	Title	Content
2	Business Plan financial assumptions	A summary of the key financial assumptions used within the Business Plan
3	Sources and uses of cash	A summary of where the cash will come from to deliver the Business Plan
4	Business financing objectives	A description of the key financial objectives we intend to achieve to meet our financing requirements
5	Credit ratio limits	A description of both the target key credit ratios and a year on year forecast of the key credit ratios for each of the four licences.
6	Existing financial commitments	A view of the current debt commitments of WPD as at 31 March 2013.
7	Availability of capital	A review of the different debt markets available to WPD.
8	Cash flow risk and volatility	An overview of the risk assessment made of the cash flow profile of WPD through the RIIO-ED1 period
9	Allowed returns (cost of capital)	A review of the cost of capital components, including cost of debt, cost of equity and gearing.
10	Evolution of the regulatory asset value	The approach taken for additions to the RAV including capitalisation and depreciation.
11	Related party costs	A summary of the inter group banking facility agreement
12	Taxation	A summary of the tax modelling undertaken within the Business Plan.
13	Business rates	A summary of the business rate forecast used within the Business Plan.
14	Pensions	A summary of the WPD pension schemes and modelling undertaken for the Business Plan.
15	Impact on customers' bills	A summary the impact on customers' bills and the impact on suppliers.
16	Revenue request for RIIO-ED1	An overview of how our revenue request for each year of the RIIO-ED1 period has been calculated.
17	Appendices	A number of appendices with additional information or containing links to supporting reports

2 Summary of Business Plan financial assumptions

2.1 The key assumptions used in the Business Plan are discussed within the document and are shown in the table below, together with the comparative values as used for DPCR5:

Key financial assumptions	RIIO-ED1	DPCR5
WACC (real):		
Cost of debt (pre-tax)	2.6%	3.6%
Cost of equity	6.4%	6.7%
Gearing (leverage)	65%	65%
WACC: Vanilla	3.9%	4.7%
Regulatory Slow / Fast Pot Capitalisation Ratio	80% / 20%	85% / 15%
Capital Recovery Period	Transition to 45 years by end of RIIO-ED1	20 years
IQI Incentive Ratio	70%	50%

3 Funding required: Sources and uses of cash

3.1 The Business Plan incorporates our best view of our future expenditure. Our work and investment in the network during the RIIO-ED1 period will require funding. This funding will largely come from revenues but will also require new capital to be raised. The following table shows the sources and uses of cash during RIIO-ED1 for our four DNOs (assuming inflation of 2.8%):

Sources and Uses of Cash in RIIO-ED1 (nominal £m)									
	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	Total
Sources of Funds									
Revenues	1,480.7	1,544.8	1,532.3	1,587.2	1,643.8	1,703.4	1,767.2	1,834.1	13,093.4
New debt	205.0	201.7	178.7	190.0	196.7	214.3	269.0	284.2	1,739.5
Debt refinancing	0.0	0.0	0.0	0.0	0.0	150.0	0.0	700.0	850.0
Reinvested equity return	108.5	85.4	136.4	160.7	159.8	168.5	128.1	134.5	1,082.0
Total Sources of Funds	**1,794.2**	**1,831.9**	**1,847.4**	**1,938.0**	**2,000.2**	**2,236.1**	**2,164.2**	**2,952.8**	**16,764.9**
Uses of Funds									
Pass through costs	-144.8	-149.2	-169.5	-191.6	-218.2	-225.4	-232.7	-240.9	-1,572.3
Operating costs	-268.7	-285.0	-293.4	-305.2	-314.1	-325.0	-327.0	-341.1	-2,459.4
Capex	-717.9	-731.3	-694.5	-736.6	-743.7	-787.0	-822.3	-855.2	-6,088.5
Tax	-85.4	-66.5	-63.0	-53.5	-51.5	-51.5	-54.0	-56.2	-481.5
Pensions	-218.1	-223.0	-227.9	-232.9	-238.3	-244.2	-249.6	-255.2	-1,889.2
Interest	-211.5	-220.4	-234.5	-244.7	-252.3	-261.1	-275.4	-288.8	-1,988.7
Equity return	-147.8	-156.6	-164.7	-173.4	-182.3	-191.8	-203.3	-215.4	-1,435.4
Maturing debt	0.0	0.0	0.0	0.0	0.0	-150.0	0.0	-700.0	-850.0
Total Uses of Funds	**-1,794.2**	**-1,831.9**	**-1,847.4**	**-1,938.0**	**-2,000.2**	**-2,236.1**	**-2,164.2**	**-2,952.8**	**-16,764.9**

3.2 To fund the core expenditure costs detailed in the Expenditure chapter and to be able to pay our tax, pension and interest costs we have to raise over £1.7bn of new debt during RIIO-ED1. This is after taking into account the revenues we are requesting and our intended dividend payments. We also have to refinance £850m of existing debt.

3.3 A further £1,082m will be invested by our shareholder reinvesting the equity return allowed by Ofgem.

4 Business financing objectives

4.1 This section sets out how we intend to provide funding for our plan, what the cost of that funding will be and what the risks associated with the financing are. In order to do so we:

- explain the credit ratio limits we are required to meet in order to have access to debt capital;
- set out our existing financial commitments;
- consider the general availability of capital;
- set out our view of the costs of both debt and equity capital;
- consider the risks associated with our cashflows and how that might affect the financeability of our plan.

4.2 The key factors that we use to measure the financeability of the plan are the credit ratio limits that we must meet and the Return on Regulatory Equity (RORE).

4.3 As part of the process of assessing the financeability of our plan we have consulted our core banking group and also some of our key investors. The questionnaires sent to both groups and a summary of their responses, set out on an anonymous basis, can be found in appendices 1 to 4.

5 Credit ratio limits

5.1 WPD's financial strategy is to maintain good investment grade credit ratings, i.e. ratings of at least BBB (Standard and Poor's (S&P) and Fitch) and Baa2 (Moody's).

5.2 The ratings assigned by the credit rating agencies to WPD depend partly on our key financial credit ratios but also the credit ratios of our ultimate owners, PPL Corporation. More details concerning PPL Corporation can be found at www.pplweb.com. Our credit ratio limits have therefore been selected from the generic ratios used by credit rating agencies for DNOs to maintain at least BBB/Baa2 ratings. Each rating agency uses a slightly different methodology to rate companies (see Appendix 5). However, the fundamental key financial ratios used will be common to all the rating agencies. The Moody's methodology is the most explicit in terms of ratios (although this only accounts for 40% of the weighting of their rating). We therefore aim for credit ratios at all four DNOs, in the long run, that are as least as good as those in the Baa values as set out in the table below (based on the Moody's key credit metrics):

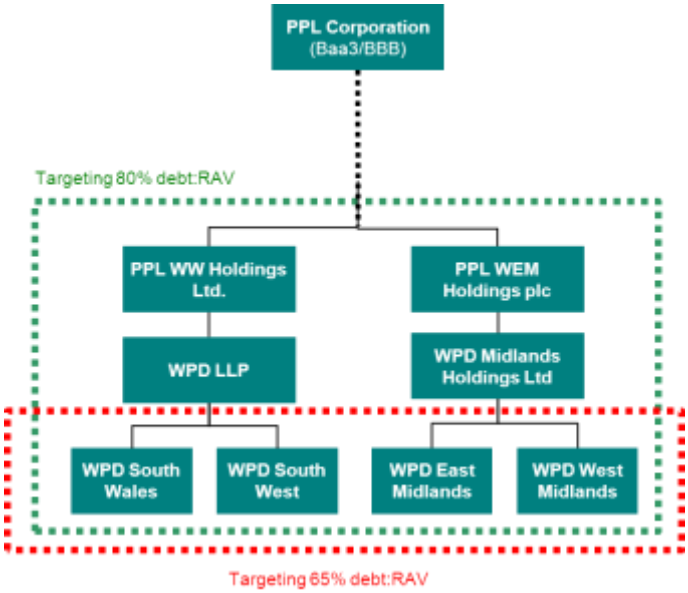
Financial Ratio	A	Baa
Funds from operations (FFO) to Interest	≥3.5x – 5.0x	≥2.5x – 3.5x
FFO/Net debt	≥12% – 20%	≥8% – 12%
Post maintenance interest cover ratio (PMICR)	≥2.0x – 4.0x	≥1.4x – 2.0x
Retained cash flow (RCF)/Capex	≥1.5x – 2.5x	≥1.0x – 1.5x
Net debt/Regulated asset value (RAV) (excluding pension deficits)	≤60%	65%

5.3 In addition to these metrics we also consider other ratios that are important in managing the financial structure of the business. These include regulatory ratios and those required under different bond and bank facilities.

- Earnings before interest, tax, depreciation and amortisation (EBITDA)/Interest cover;
- Regulatory Equity/EBITDA;
- Regulatory Equity/Regulatory earnings (Profit After Tax).

5.4 The overall leverage of the WPD UK Group is targeted at no more than 80% Debt/RAV with the DNO leverage limited to 65% (as illustrated below). The holding companies do not invest in the network and they carry out no operational business. Therefore, as investment is made in the network and the regulatory asset base increases, the DNO debt will rise while the holding company debt will remain relatively constant. It is therefore possible that the levels of debt between holding companies and DNOs may need to be reset from time to time to keep within the targets we have adopted. This is because the holding company debt will remain the same until a new issuance of debt at one of the holdings companies occurs.

5.5 In order to remain within the overall credit ratios targets as shown above, dividends will be reinvested or foregone to ensure that new equity does not need to be raised, i.e. we do not expect there to be any need for market issues of equity because any additional equity will be added by the shareholder reinvesting or not receiving their return on equity.



5.6 The forecast credit ratios for each of our DNOs for RIIO-ED1 are set out below. (These take into account the assumptions and conclusions reached later in this section; particularly those in relation to asset lives.):

West Midlands (y/e March)	2016	2017	2018	2019	2020	2021	2022	2023
FFO/Interest Cover	3.4 x	3.5 x	3.3 x	3.3 x	3.2 x	3.2 x	3.2 x	3.1 x
FFO/Net Debt	13.5%	13.8%	12.1%	12.0%	11.6%	11.6%	11.4%	11.2%
PMICR	1.0 x	1.1 x	0.8 x	0.8 x	0.7 x	0.7 x	1.0 x	1.0 x
RCF/Capex	69%	70%	71%	71%	70%	69%	64%	63%
Net Debt/RAV (excluding pension deficits)	65%	65%	65%	65%	65%	65%	65%	65%
EBITDA/Interest Cover	3.8 x	3.9 x	3.6 x	3.5 x	3.5 x	3.5 x	3.4 x	3.3 x
Regulatory Equity/EBITDA	2.5 x	2.5 x	2.8 x	2.9 x	3.0 x	3.0 x	3.0 x	3.0 x
Regulatory Equity/Regulatory Earnings	6.2 x	6.3 x	7.9 x	8.2 x	8.7 x	8.7 x	8.8 x	9.2 x

East Midlands (y/e March)	2016	2017	2018	2019	2020	2021	2022	2023
FFO/Interest Cover	4.4 x	4.2 x	3.5 x	3.4 x	3.3 x	3.3 x	3.4 x	3.3 x
FFO/Net Debt	15.8%	15.7%	12.9%	12.4%	11.9%	11.9%	11.9%	11.6%
PMICR	1.5 x	1.5 x	0.9 x	0.8 x	0.7 x	0.8 x	1.1 x	1.1 x
RCF/Capex	66%	68%	72%	72%	72%	70%	63%	63%
Net Debt/RAV (excluding pension deficits)	65%	65%	65%	65%	65%	65%	65%	65%
EBITDA/Interest Cover	4.9 x	4.7 x	3.9 x	3.6 x	3.6 x	3.6 x	3.6 x	3.6 x
Regulatory Equity/EBITDA	2.5 x	2.5 x	2.8 x	2.9 x	3.0 x	3.1 x	3.1 x	3.1 x
Regulatory Equity/Regulatory Earnings	5.8 x	6.0 x	8.2 x	8.8 x	9.4 x	9.4 x	9.3 x	9.7 x

South Wales (y/e March)	2016	2017	2018	2019	2020	2021	2022	2023
FFO/Interest Cover	2.7 x	3.0 x	2.8 x	2.8 x	2.8 x	3.0 x	3.2 x	3.1 x
FFO/Net Debt	10.4%	11.4%	10.2%	10.0%	9.9%	10.0%	10.2%	9.9%
PMICR	0.2 x	0.4 x	0.5 x	0.6 x	0.6 x	0.7 x	0.8 x	0.9 x
RCF/Capex	66%	66%	63%	60%	61%	59%	59%	58%
Net Debt/RAV (excluding pension deficits)	65%	65%	65%	65%	65%	65%	65%	65%
EBITDA/Interest Cover	3.3 x	3.4 x	3.0 x	3.0 x	3.0 x	3.2 x	3.4 x	3.4 x
Regulatory Equity/EBITDA	2.7 x	2.8 x	3.1 x	3.2 x	3.2 x	3.3 x	3.3 x	3.4 x
Regulatory Equity/Regulatory Earnings	8.1 x	8.7 x	11.7 x	12.7 x	13.3 x	12.6 x	11.4 x	11.5 x

South West (y/e March)	2016	2017	2018	2019	2020	2021	2022	2023
FFO/Interest Cover	4.4 x	4.6 x	4.1 x	4.0 x	3.9 x	3.6 x	3.4 x	3.4 x
FFO/Net Debt	13.1%	13.5%	12.3%	11.9%	11.6%	11.1%	10.9%	10.6%
PMICR	0.9 x	1.0 x	0.8 x	0.8 x	0.7 x	0.7 x	1.1 x	1.1 x
RCF/Capex	89%	90%	92%	95%	93%	93%	86%	85%
Net Debt/RAV (excluding pension deficits)	65%	65%	65%	65%	65%	65%	65%	65%
EBITDA/Interest Cover	5.2 x	5.1 x	4.5 x	4.4 x	4.3 x	4.0 x	3.8 x	3.7 x
Regulatory Equity/EBITDA	2.7 x	2.8 x	3.0 x	3.1 x	3.1 x	3.2 x	3.2 x	3.3 x
Regulatory Equity/Regulatory Earnings	7.0 x	7.5 x	8.7 x	9.3 x	9.9 x	10.6 x	10.7 x	11.0 x

5.7 It is notable that for most ratios each of the DNOs passes the threshold for Baa rating, albeit that the amount of headroom has reduced from DPCR5. In certain years in all four DNOs the PMICR ratio is below the level that is stated above by Moody's as being within the Baa range. However by adjusting the asset lives and maintaining the capitalisation at DPCR5 levels as detailed below, the ratios do start to recover towards the end of the period.

6 Existing financial commitments

6.1 The existing fixed rate debt and nominal weighted average cost of debt (coupons) as at 31 March 2013 are set out below:

Amount	Maturity	Coupon
WPD West Midlands plc		
£250 million	2025	6.00%
£800 million	2032	5.75%
WPD East Midlands Plc		
£250 million	2040	6.25%
£106 million*	2043	2.671% + RPI
£700 million	2023	5.25%
WPD South Wales plc		
£150 million	2020	9.25%
£225 million	2037	4.80436%
£200 million	2040	5.75%
WPD South West plc		
£250 million	2027	5.875%
£129 million*	2053	1.541% + RPI
£147 million*	2056	1.541% + RPI
£200 million	2040	5.75%

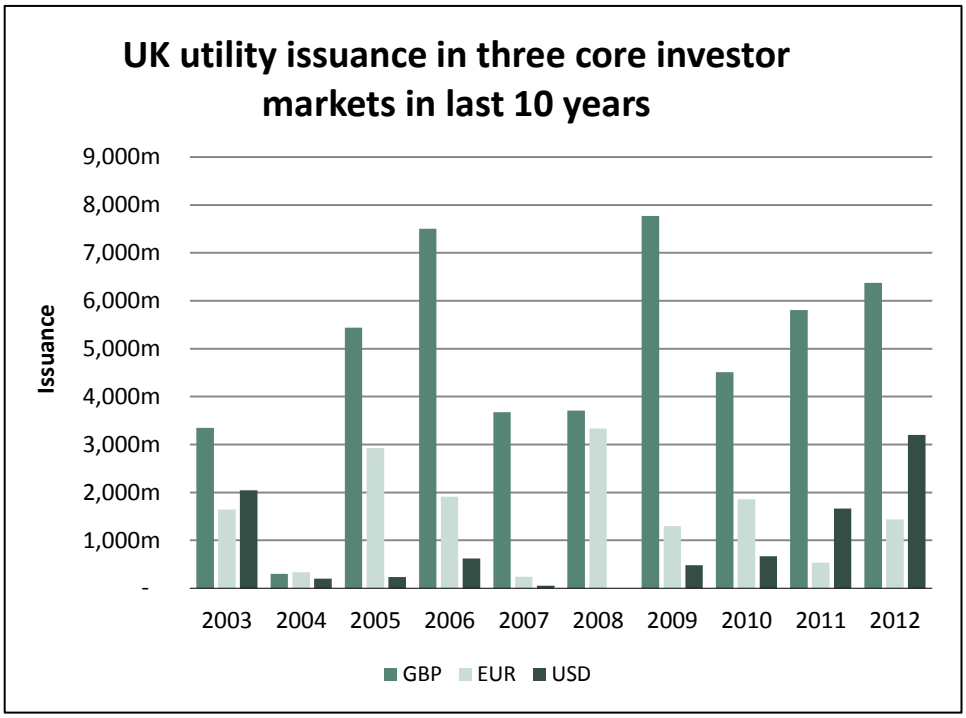
(*Index linked to RPI - RPI assumed at 2.8%)

6.2 In addition as at 31 March 2013 there was £34m of debt at floating rates in the capital structure of the DNOs.

6.3 As at the same date the total debt within the four DNOs was £3,441m. The nominal weighted average cost of this existing debt, assuming inflation at 2.8% is therefore 5.68%, with the average weighted maturity being 2033 (20 years). Based upon this inflation rate the real cost of the existing debt is 2.88%.

7 Availability of capital

7.1 The total amount of capital to be raised by the WPD DNOs during RIIO-ED1 is £2.6bn. Significant capital markets however exist in the UK, the United States and in Europe that ensure that relative to the size of the markets, the capital to be raised is modest and financeable. To illustrate this, the chart below shows the amounts of debt raised by utilities in the three principal markets over the last 10 years. In 2012 alone over £10bn of funding was provided to UK utilities.



Source: RBS

7.2 In comparison in 2012 the total corporate issuance in these three markets, including the above utility issuances, totalled some £1.6 trillion, with the average over the last five years also being over £1 trillion.

7.3 The WPD group has the UK's largest electricity distribution network and we need to raise approximately £325m per annum over the RIIO-ED1 period. This represents just over 0.03% of all corporate issuance in the three core markets per annum and only 0.45%, 0.06% and 0.09% of the annual Sterling, US and Euro markets each year of the price control period (based upon the average corporate issuance over the last five years in each market).

7.4 The WPD DNOs also maintain committed bank facilities through a syndicate of banks. These facilities give WPD access to over £800m of immediately available funding. This funding is used to help finance the company between debt issuances and is also a source of finance if significant immediate expenditure was required, such as repairing the network after widespread catastrophic damage caused by a storm. Once WPD has utilised approximately 50% of these funds we would look to re-establish the quantum of facility by undertaking a bond issuance.

7.5 WPD will look to continue to maintain committed facilities of approximately 10% of its RAV.

7.6 Included within the questionnaires sent to our core banks and bond investors were questions that related to the availability of capital. The general consensus was that funding of this magnitude would be available to WPD unless there was some period of general market inaccessibility due to severe widespread market reluctance to purchase debt (which would generally be temporary and short in duration). Appendices 3 and 4 show a summary the responses received from the banks and bond investors.

8 Cash flow risk/volatility

Cash flow timing issues

8.1 Based upon the current Ofgem assumptions for the RIIO-ED1 period the cash flow profile of the WPD DNOs shows significant deterioration unless some compensating adjustments are made.

8.2 This deterioration is a result of delays in cashflow caused primarily by:

- the adoption of 45 year lives for assets acquired after 1st April 2015;
- the inclusion of non-operational capital expenditure (capex) and business support costs in the core expenditure (totex) pot that were previously treated as 100% fast money in DPCR5 i.e. incurred and recovered within the same regulatory period.

8.3 In order to stabilise the credit ratios over time we have assumed a constant gearing percentage of 65%. Using this gearing ratio, the anticipated cost of the debt to be issued during RIIO-ED1 and the cost of existing debt, we have calculated the risk of not meeting the minimum requirements of investment grade over the RIIO-ED1 period. The analysis shows that some adjustment will be required to improve cashflow.

8.4 The adjusting actions considered were to either reduce asset lives from 45 years to a phased transition approach over the RIIO-ED1 price control period, and/or to reduce the capitalisation percentage from 80% (the percentage equivalent to the DPCR5 amount capitalised given the changes in the definition of totex for RIIO-ED1); either of these possible actions have the effect of stabilising the credit ratios.

8.5 We engaged NERA Economic Consulting to conduct risk assessments and risk modelling of our cashflows on our behalf (see appendices 6 and 7 for more information). NERA's work has led us to conclude that phasing-in the introduction of a 45 year asset life during RIIO-ED1 is sufficient to stabilise credit ratios. This appears an appropriate course of action because it is a transitional measure to deal with a potential problem that is itself transitional. Changing the capitalisation ratio from the proportion of costs capitalised in DPCR5 is unnecessary. The application of a transitional approach for asset lives from the current life of 20 years to the intended life of 45 years is also consistent with the approach taken for the majority of the businesses in the RIIO-GD1 and RIIO-TD1 price control reviews.

Cash flow risk

8.6 The primary aim of the work undertaken by NERA was to develop a risk modeling framework that is applicable throughout the RIIO-ED1 price control period that could be amended as more information became known. The key tool used was a "Monte Carlo" simulation model. Taking the existing WPD financial model as a starting point, the NERA model was built on by randomising key inputs, assuming that they followed particular statistical distributions. These randomised input assumptions were then fed into the WPD financial model to calculate the key ratios and measures of financial performance. The model allowed the calculations to be repeated over several thousand iterations to derive statistical distributions around these key financial parameters. By examining these distributions we have been able to address some of the issues that the changes in RIIO-ED1 have created and identify what may need to be changed in order to achieve the financial ratios consistent with Ofgem's assumed credit ratings. See appendix 8 for more information on the method adopted.

8.7 The results of NERA's work are set out in appendix 6 and based on their conclusion we are confident that we will be able to maintain our current credit ratings throughout RIIO-ED1 if the proposed increase in assets lives is phased in over the eight year period.

9 RIIO-ED1 allowed returns (cost of capital)

Cost of debt

9.1 There are two separate costs of debt to be considered in the Business Plan – the actual cost of debt to WPD and the Ofgem allowed cost of debt.

9.2 In order to determine the financeability of the plan we need to estimate the nominal cost of our future debt issuance. The cost of the future issuance together with the cost of the existing debt portfolio is used to determine the interest costs when we calculate the projected financial ratios for RIIO-ED1.

9.3 The cost of debt is also part of the Weighted Average Cost of Capital (WACC) that is used to set allowances. (The WACC is the combined cost rate of funding calculated using a pre-tax cost of debt and post-tax cost of equity weighted by notional gearing.)

9.4 Ofgem will determine the allowed cost of debt, used in setting allowances, based on a 10 year trailing average bond selection (the iBoxx) less the implied 10 year gilt inflation break evens published by the Bank of England.

9.5 In setting allowances for RIIO-ED1, Ofgem will initially use a 10 year trailing average of iBoxx, with an assumed cost of debt for RIIO-ED1 of 2.6%. Actual allowances will be based on the 10 year trailing average of the iBoxx values calculated as at the 31st October each year. The method of calculation is discussed further below.

9.6 Further details as to the composition of the index, the methodology being adopted, the risks relating to debt issuance and the approach WPD plan to take are given in appendix 9.

Overview of approach to estimating the nominal cost of future WPD debt issued

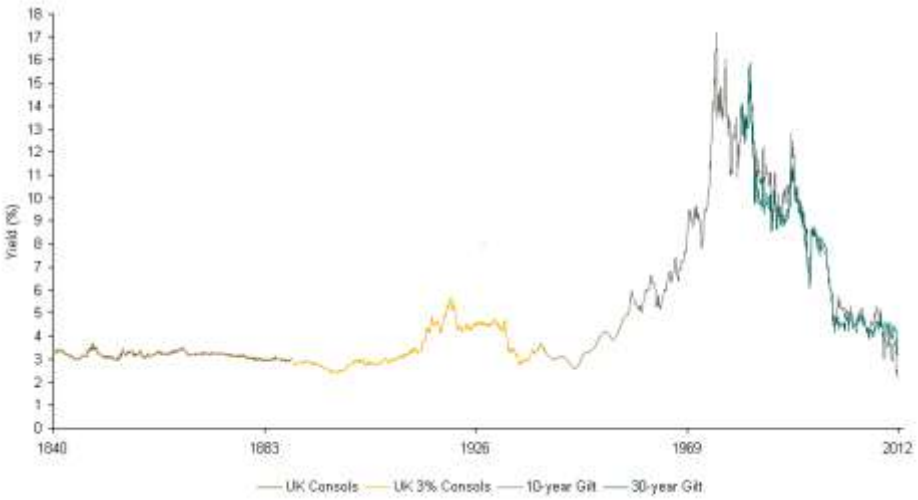
9.7 In order to determine what the cost of the debt will be for the new debt that we will issue we have used the current 20 year gilt yield and have then added a credit spread. This is the process by which new debt is priced when issued and is therefore the best approach to take to calculating a nominal cost of debt. This nominal cost of debt is then adjusted by an implied inflation rate to create a real cost of debt.

9.8 Below are the steps we have taken to calculate the cost of the debt we plan to issue.

Cost of debt to be issued – gilt yields

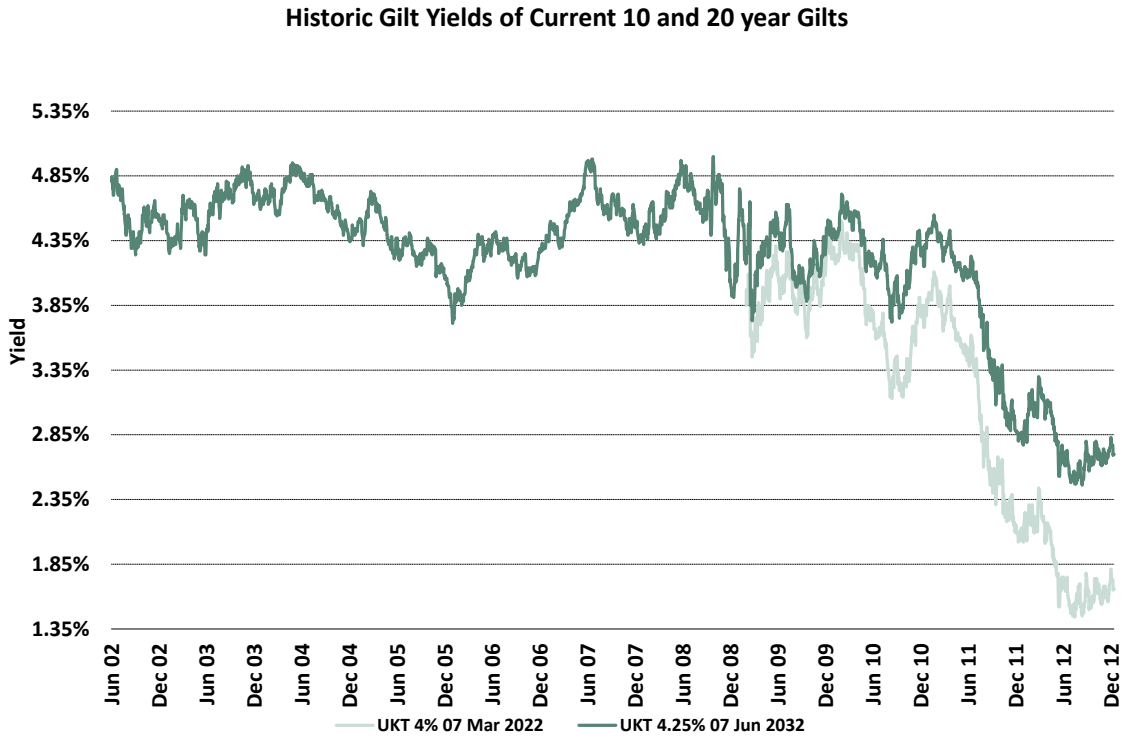
9.9 In setting the cost of debt we use the 20 year gilt yield because although Ofgem's RIIO-ED1 cost of debt is based on a 10 year trailing average of the iBoxx indices we believe using a 20 year maturity better balances refinancing risk and yield i.e. asset lives from 2015 will be increasing towards 45 years for regulatory purposes. Financing assets on a 10 year basis would mean refinancing each asset approximately 3 times during its life rather than once on a 20 year basis. Also the average maturity of the debt used within the current iBoxx indices is 22 years for the A rated debt and 17 years for the BBB. Therefore an overall average of 20 years aligns with these maturities.

9.10 It should be noted that gilt yields are currently at near all-time lows as the chart below, demonstrates.



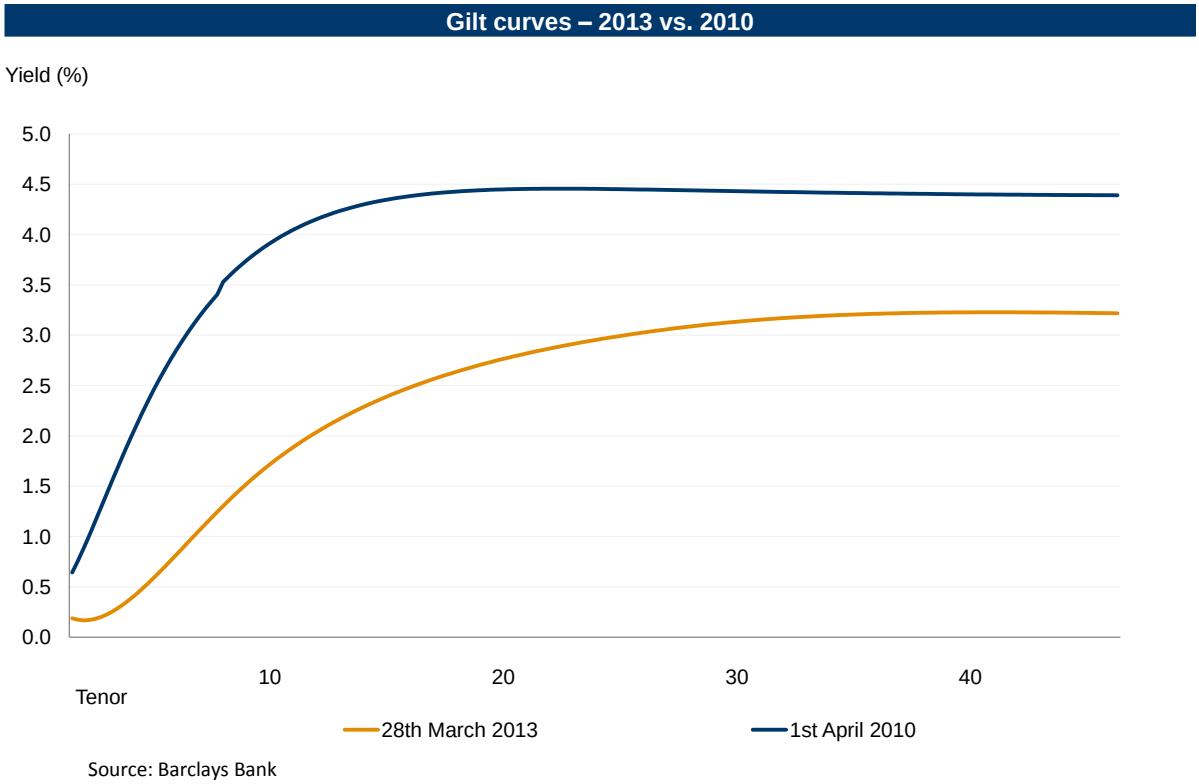
Source: England Yield of Consols, NBER Macrohistory Mar-1888 to Dec-1938, British Historical Statistics by B.R. Mitchell; Primark Datastream, RBS Gilts 1987 to current

9.11 A more detailed view of the last ten years is shown below:



Source: RBS

9.12 Below are the yields that were applicable for different gilt maturities as at 28th March 2013 and those at the start of the DPCR5 price control period.



9.13 The 20 year gilt yield (officially known as UKT 4.25% 07 June 2032) on which our cost of debt is largely based was 2.7345% on 28 March 2013. This is 132 basis points (1.32%) more than the 10 year gilt yield (UKT 4.0% 07 March 2022) and 37 basis points (0.37%) less than the 30 year gilt yield.

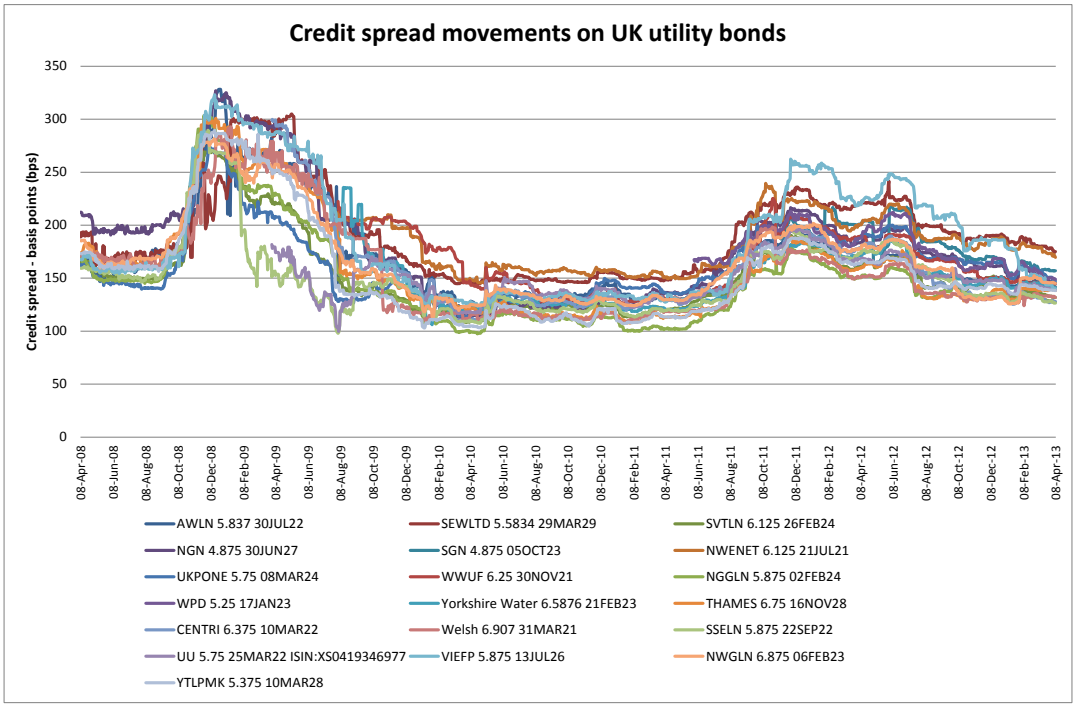
9.14 The respective yields at the start of the DPCR5 price review were 3.918%, 4.445% and 4.479% for the 10, 20 and 30 year gilts. A downward movement of between 140 and 230 basis points (depending upon which tenor you look at) has therefore occurred since that point in April 2010.

9.15 If gilt yields rise during RIIO-ED1 then, to the extent that credit spreads are not lowered to offset the rise, the cost of the debt we will issue will also rise.

9.16 Given that gilt yields are at historically low levels it is more likely that they will rise rather than fall over the course of RIIO-ED1. There is therefore a risk that DNOs will need to fund any shortfall in the allowed cost of debt for a considerable period of time. NERA have calculated this shortfall having an NPV of less than £17million over the RIIO-ED1 period, with a maximum loss limited to £65million (at 95% probability). See appendix 10 for more detail on the cost of debt modelling.

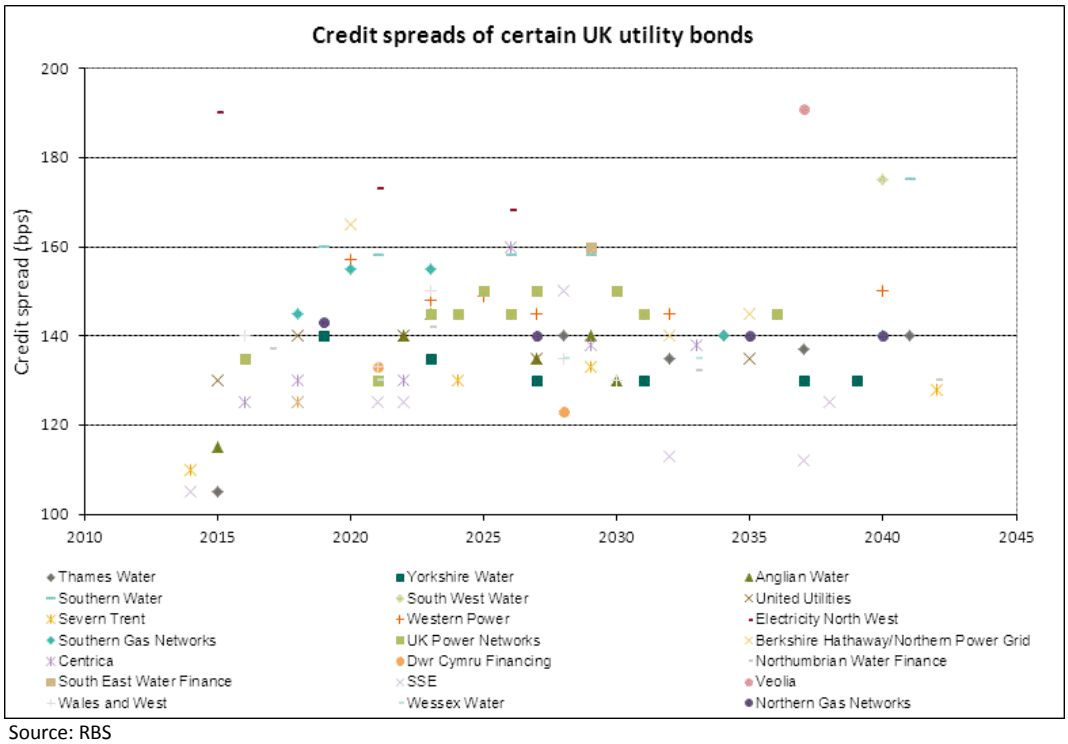
Cost of debt – credit spread

9.17 The credit spread is the amount of yield investors require, over and above the benchmark gilt, in order to buy a bond. Over the past few years credit spreads have been volatile as is demonstrated below:



Source: RBS

9.18 Credit spreads also vary between companies and individual bonds, sometimes between bonds issued by the same company or between companies in the same group, and as well as between sectors and by rating, as the chart shows below.



Source: RBS

9.19 This is because the credit spread is a direct reflection of the desirability of a bond at a point in time given market conditions as well the demands of individual investors' portfolios. In general unless there is a lack of supply investors will only enter the market if the bond yield is above a certain level, therefore when gilt yields are low credit spreads tend to increase.

Calculating the nominal cost of debt

9.20 In setting a nominal cost of debt for the Business Plan we have assumed a credit spread of 160 basis points (bps). This is the same spread as the existing WPD 2032 bond but with a new issuance premium of 10 basis points added. This spread would be representative for the same market in which we have chosen the corresponding gilt (20 years), and is therefore consistent in producing a cost of debt.

9.21 In determining the financeability of the plan we have therefore assumed a cost of debt of 5.5% nominal based on the average yield level observed for the 20 year gilt over the last 5 years (3.80%) plus the credit spread of 170 (160 +10) basis points as stated above.

9.22 The existing WPD DNO debt totals some £3.4bn and has an average maturity of 20 years, with an average interest rate payable of 5.68%. £850m of this existing debt matures within the RIIO-ED1 period and will need to be replaced with new debt. However an additional £1.74bn will need to be raised giving a total debt portfolio of £5.2bn at the end of the price control period. At that point in 2023 the average nominal cost of debt will be approximately 5.54%, with the average over the 8 year period being 5.60%.

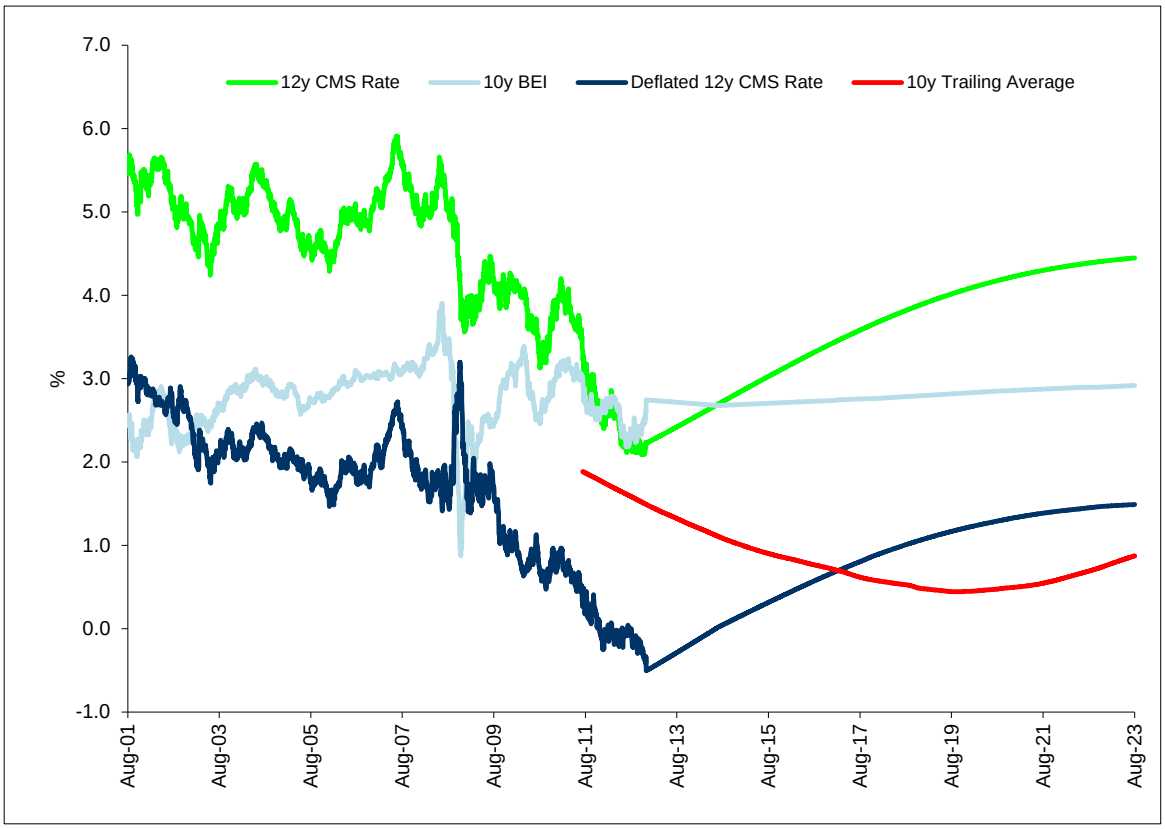
Calculating the real cost of debt used to set allowances

9.23 Under the RIIO framework, the cost of debt component of the WACC is adjusted annually to be the daily average of the last 10 years' yields on a selection of corporate bonds with maturities of greater than 10 years with the iBoxx bond index. The results are then adjusted for inflation, by deducting the implied 10-year gilt inflation break evens published daily on the Bank of England website, to produce the real cost of debt within the WACC.

9.24 The future iBoxx index levels are difficult to forecast because there is no forward curve for the iBoxx indices. Therefore, in order to calculate WPD's DNOs revenues for the RIIO-ED1 period we have asked two banks, The Royal Bank of Scotland (RBS) and Lloyds, to estimate what the iBoxx rates would show for the RIIO-ED1 period and to adjust the results for inflation.

9.25 RBS have used swap rates as a proxy of the iBoxx inputs and believe the 12 year constant maturity swap (CMS) represents a closely correlated alternative based on the implied forward swap curve. Below is a chart showing the forward projections using this calculation. Swap rates will be lower than iBoxx rates because they incorporate less of a credit risk than the corporate bonds included in the iBoxx calculation. RBS estimate that the credit spread required to reflect a 10 year maturity is approximately 140bps. If it is assumed that this was maintained at a constant level then the notional cost of debt would be the CMS plus the credit spread, i.e. CMS plus 1.4%.

9.26 The CMS forecast rates from RBS are shown below, where the deflated 12 year CMS rate is calculated as the 12 year CMS rate less break-even inflation. These deflated rates are then used together with historic information to produce the forecast RIIO-ED1 10 year trailing average before the addition of the 140bps credit spread.



Source: RBS

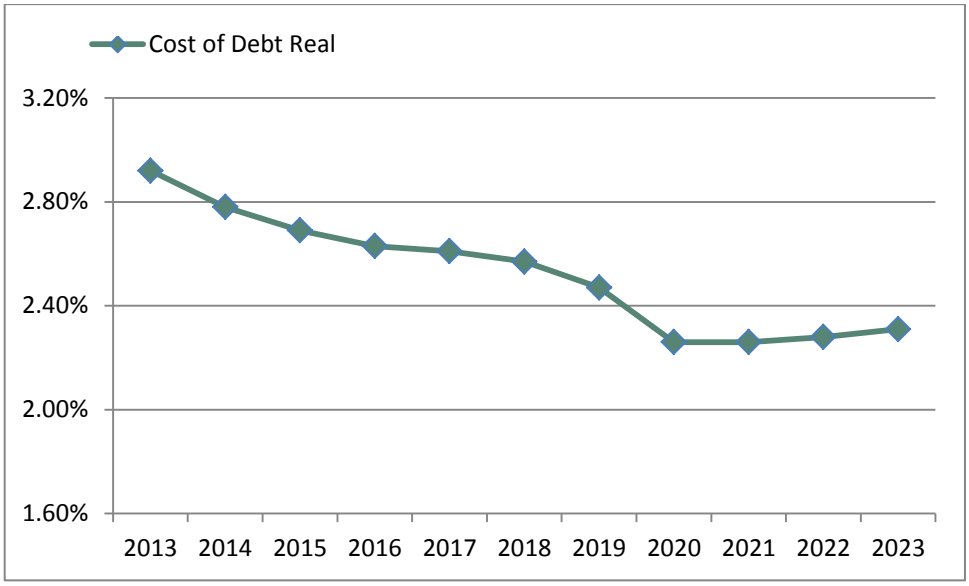
9.27 Lloyds similarly consider that constructing a forward curve for the Real Cost of Debt is cumbersome due to the complexities in modelling a forward iBoxx and Government liability curve. However, by applying a number of simplifying assumptions Lloyds use the 20 year swap rate as a proxy for the iBoxx, and both swap markets and index linked gilts to convert the nominal curves to real. In outline the method is to:

9.28 Assume benchmark maturity is 20 years i.e. the 20 year swap rate is modelled forward to form the nominal interest rate benchmark. This is based on the average duration of the iBoxx indices being approximately 22 and 17 years for the A and BBB rated indices respectively.

9.29 To this is added a credit spread to give a 'proxy' iBoxx yield. For the purposes of this representation a spread of 183bps has been assumed which is the average iBoxx A and BBB yields minus the 20 year nominal swap rate in 2012.

9.30 The nominal iBoxx settings can be determined on any given day; however for ease of presentation the below shows the 20 year swap rate at the beginning and the end of each calendar year and simply takes the average and then adds the credit spread to give an annual iBoxx setting.

9.31 Finally the forward implied inflation rate must be determined that would 'make real' the index setting. This is calculated again by taking the implied inflation rate at the beginning and end of each calendar year and taking the simple average of the two. A further adjustment to this rate is necessary as the inflation rate as implied by the gilts and the swap markets tend to be different. For 2012 the differential between the 10 year implied gilt inflation and the nominal swap inflation was 38bps and this is the implied level used below:



Source Lloyds Bank

9.32 Following the work performed by RBS and Lloyds we have used the results to calculate an estimated average annual cost of debt by taking the midpoint between the two forecasts as shown below (including credit spread). These values have been used in our financeability studies to assess the financeability of our Business Plan.

Bank Cost of Debt Forecast	2015	2016	2017	2018	2019	2020	2021	2022	2023
RBS	2.33	2.19	2.04	1.93	1.86	1.87	1.93	2.07	2.25
Lloyds	2.69	2.63	2.61	2.57	2.47	2.26	2.26	2.28	2.31
Average	**2.51**	**2.41**	**2.33**	**2.25**	**2.17**	**2.07**	**2.10**	**2.18**	**2.28**

These annual points have been calculated by taking the average of the data at the start and end of each of the respective years.

9.33 The above calculations and forecasts include numerous assumptions. Therefore to enable comparability between DNOs Business Plans we have used the most recent valid data point that has been calculated for the cost of debt, namely 2.6%. We have utilised this figure within each year of the RIIO-ED1 finance plan to produce the forecast figures.

RIIO-ED1 Cost of Debt Forecast	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
Rate used in Financing Plan	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6

9.34 NERA have also looked at whether WPD would benefit from moving towards a more "weighted" debt indexation mechanism, based on actual/expected CAPEX / RAV, rather than a straight trailing average. However, they have found that the effect would be extremely small and that a ten year trailing average is considered a good index to use. (See appendix 11 for more detail).

Auxiliary costs of purchasing debt

9.35 Ofgem state that since DNOs have traditionally been able to outperform the cost of debt then there is sufficient differential to cover any auxiliary costs. These auxiliary costs could include:

- debt Issuance costs;
- liquidity management fees;
- embedded debt costs – previously efficient debt costs being higher than the iBoxx rate (if interest rates continue at low levels);
- inflation risk premium;
- EMIR regulations;
- Impact of Basel III regulations;
- Impact of Solvency II regulations;
- Procyclicity of returns.

9.36 NERA Economic consulting have looked at the so called 'Halo effect', where it is considered that utility companies benefit from a market bias, or 'halo', that allows them to issue debt more cheaply than the other similarly rated corporates and therefore justifies not allowing for issuance costs to be included in the cost of debt calculation. Their conclusion is that such an effect does not exist for DNOs and debt issuance occurs at the same price level as other corporates. (See appendix 12).

9.37 As many of these costs are derived from interacting with bank counterparties we have been in discussion with many of our relationship banks regarding this issue. We consider that we have always incurred certain auxiliary costs relating to debt issuance and do not believe that this will change in the future. There are however certain European regulations that have recently been adopted by the UK that have the potential to increase cost in particular areas. We consider that banks will pick up some of this additional cost and any cost that is subsequently passed on will not be significant.

9.38 No additional funding is required to cover these auxiliary costs.

Cost of equity

9.39 The recent history of regulatory determinations on the cost of equity is set out in the table below:

Component	DPCR5	RIIO-GD1	NGG	NGEG
Gearing	65%	65%	62.5%	60%
Risk-free rate	2.0%	2.0%	2.0%	2.0%
Equity risk premium	5.25%	5.25%	5.25%	5.25%
Equity beta	0.90	0.90	0.91	0.95
Cost of Equity	**6.7%**	**6.7%**	**6.8%**	**7.0%**

9.40 The question to determine for the Business Plan is whether there is any compelling reason to suppose that any of the estimates used to calculate the components of the Cost of Equity should be different for WPD either because market facts have changed or because there are risk factors we face that companies covered by earlier determinations do not.

9.41 Taking each of these components in turn:

Gearing – 65%

9.42 Reducing the gearing from 65% would increase costs for customers because the WACC would rise as a greater part of the business would be financed by expensive equity (compared to debt financing). However, the gearing assumption would need to be reduced if there were pressure from either Credit Rating Agencies to reduce gearing below 65% in the licenced entities in order to maintain ratings or if shareholders were being forced to inject capital or forego dividends in order to reduce the gearing below 65% because debt financing was not available.

9.43 There is currently no pressure from credit rating agencies to reduce gearing in order to maintain investment grade credit ratings for DNOs and through enquiry with the banks and debt investors (as can be seen in appendices 3 and 4), there does not appear to be a shortage of debt financing over the foreseeable period.

9.44 The work undertaken by NERA for WPD concludes that, if all else remains equal, there is insufficient volatility in the cashflows for RIIO-ED1 to justify a reduction in the gearing level for RIIO-ED1.

9.45 WPD does not have access to the decisions of other companies or investors. However, there is no evidence to suggest that there is pressure to reduce gearing at licenced entities. There is no publicly available evidence of very recent transaction in the sector, but investors in pure distribution groups i.e. WPD, NPG, UKPN and ENW may also have additional holding company debt, which is supported by the DNO. The additional debt in some cases has needed additional credit support in the form of for example parent company guarantees, credit wraps (effectively a guarantee from an insurance company), or additional debt covenants (effectively mortgaging the shares in the DNOs).

9.46 There is no evidence to suggest that the gearing level should be lowered from 65%.

9.47 We consider that raising the level above 65% could have a negative impact on DNO's ratings or ability to raise debt at a reasonable cost without special conditions.

9.48 We therefore use a 65% gearing level within our Business Plan, consistent with RIIO-GD1/T1 and DPCR5.

Risk-free rate – 2.0%

9.49 The risk-free rate is the theoretical rate of return of an investment with no risk. The risk-free rate represents the interest that an investor would expect from an absolute risk free investment over a specified period of time. The return on Government bonds is normally taken as a good proxy for the risk free rate because the likelihood of default by the Government in meeting its obligation is considered incredibly low.

9.50 Ofgem's calculation methodology in their March 2013 Strategy decision document uses an approach that is in line with WPD's rationale. The 10 and 20 year gilts (as shown above) demonstrate the movement in the nominal gilts yields. Similar to the Ofgem method if inflation over this period of 2.8% is deducted from these figures then the 20 year gilt gives an average of 1.5% and the 10 year gilt 0.4%. (The average yield of the 10 year gilt of 0.4% is based upon only 4 years of data as it is referenced to the current 10 year gilt that was issued in February 2009. The Ofgem calculated rate for 10 year gilt incorporates the former Government 10 year debt instrument that existed prior to that date and had a higher yield. If this past data is taken into account then the figures would more closely align with Ofgem's.)

9.51 Work undertaken by NERA has shown that they believe the risk free rate is within a range of 1.2% to 2.1% (See appendix 13).

9.52 On this basis WPD agree with the Ofgem risk free rate. Based upon the recent Transmission and Gas Distribution Review and also on the level as used in DPCR5 a level of 2.0% is appropriate.

Equity risk premium – 5.25%

9.53 The equity risk premium is the additional return than an investor would expect over and above the risk free rate. The excess return compensated the investor for taking a higher risk than the risk free rate will provide and this acts as an incentive (and compensation) for an investor to buy into equity.

9.54 Calculating this premium, especially at time of financial uncertainty, is difficult. The approach that Ofgem has taken in its strategy document is practical and the range of 4.75% to 5.50% is reasonable.

9.55 NERA have undertaken some analysis of this area and consider that a range of 5.0% to 5.5% is appropriate (see appendix 13).

9.56 Based upon the above, the RIIO-T1 and RIIO- GD1 final proposals, and the value used in DPCR5, a level of 5.25% is the right equity risk premium.

Equity beta – 0.90

9.57 The equity beta is a measure of an equity share's volatility in relation to the equity market. The market is given a beta of 1.0 and individual shares are ranked according to how much they deviate from the market. Shares with a beta higher than 1.0 are considered more risky than the market as a whole and those with a beta of less than 1.0 are less risky than the market as a whole.

9.58 As no pure UK DNO groups or companies shares are traded on any equity market the equity beta has to be estimated by econometricians or by looking at the next closest comparators i.e. the listed shares of water companies and large electric utilities such as National Grid or SSE.

9.59 Equity betas are difficult to use as a prediction of the future as they are largely based upon past performance of a company's shares and does not readily incorporate new corporate information.

9.60 NERA have looked at the asset beta of the DNOs that can be turned into as equity beta (see appendix 13 for the NERA paper and appendix 14 for the calculation). Their predicted range of equity betas is 0.95 to 1.10.

9.61 For DPRC5 and RIIO-GD1 the equity beta used was 0.90.

9.62 On the basis of the above the Ofgem range of 0.90 to 0.95 is reasonable. For the Business Plan we have adopted the lower end of the range of 0.90.

Cost of equity – 6.4%

9.63 Several studies undertaken by econometric consultants, including those First Economics, Oxera and NERA, show how the cost of equity components can be provided (see Appendix 13 for NERA report). The studies produce ranges of values for each component which are tabulated below as calculated by NERA:

Component	Low	High
Risk-free rate	1.2%	2.1%
Equity risk premium	5.00%	5.50%
Equity beta	0.95	1.10

9.64 Ofgem have suggested the ranges set out below:

Component	Low	High
Risk-free rate	1.7%	2.0%
Equity risk premium	4.75%	5.50%
Equity beta	0.90	0.95

9.65 Taking the lowest and highest from each line the total ranges produced are these:

Component	Low	High
Risk-free rate	1.2%	2.1%
Equity risk premium	4.75%	5.50%
Equity beta	0.90	1.10

9.66 The DPCR5 result and the RIIO-ED1 proposals both fall comfortably within these ranges. We do not believe there are any specific factors to distinguish WPD or any other DNO in a way that would require the studies to be reworked.

9.67 It could be argued that the mid-point of each range should be taken. However, if the range is acceptable then each point on the range should also be acceptable and consistency with both DPCR5 and RIIO-ED1 is more important in assuring investors that the regulatory environment is stable.

9.68 We initially used a cost of equity in our Business Plan for RIIO-ED1 of 6.7%, which is the same as used in both DPCR5 and RIIO-GD1; this updated plan assumes a 6.4% cost of equity in line with Ofgem's decision to fast track Western Power Distribution document dated 28th February 2014.

Equity injections

9.69 WPD do not propose to have any equity injections during the RIIO-ED1 period.

9.70 Since WPD will not be issuing any equity, there will not be a need for any ex-ante allowance to cover the cost of issuing equity.

9.71 In order to remain within the overall credit ratios targets, dividends will be reinvested or foregone to ensure that new equity from our ultimate parent does not need to be raised, i.e. we do not expect there to be a need for any market issued equity because any additional equity will be added by the shareholder not receiving their return on equity.

Weighted average cost of capital

9.72 The Weighted average cost of capital or WACC is the return that a company is required to earn on its asset base in order meet the financing obligations of those assets e.g. bond interest payments, shareholder dividends, bank interest, etc.

9.73 In this document we have used the assumptions in Ofgem's decision to fast track Western Power Distribution document. This gives a real WACC as shown below:

	RIIO-ED1 WACC
Cost of debt (Pre-tax)	2.6%
Cost of equity (Post-tax)	6.4%
Gearing (leverage)	65%
WACC (Vanilla)	3.9%

Credit rating scenarios/sensitivities

9.74 We have used NERA Economic Consulting to test the Business Plan to ensure that we can achieve credit ratios that are consistent with a 'comfortable investment grade' credit rating (i.e. in the BBB to A range). The plan has been tested under a range of reasonable scenarios with differing assumptions being applied within numerous Monte-Carlo simulations. We have tested that the Business Plan is consistent with achieving a range of returns on regulatory equity ("RORE") with the lowest RORE value being the equivalent to the cost of debt and the highest value being in the low double digits (both figures are in real post-tax terms).

9.75 The results of this work can be seen in appendix 6. This demonstrates that WPD remain within the range of investment grade but without achieving ratios that could be considered excessively strong at customers' expense.

9.76 We have also asked the credit rating agencies to review our Business Plan and they have informally indicated they consider WPD to be able to maintain its level of credit rating.

Stakeholder evaluations

9.77 In order to assess the impact of the changes in RIIO-ED1 on WPD we have undertaken a round of meetings with banks and debt investors, along with accompanying questionnaires (see appendices 1 and 2). The purpose of these meetings and the questionnaires was to better understand the external risks that WPD may face e.g. market risk, pricing risk, liquidity risk, tenor risk.

9.78 The results of the questionnaire are summarised in appendices 3 and 4.

10 Evolution of the regulatory asset value (RAV)

10.1 This section sets out the approach we have taken in the Business Plan for additions to the regulatory asset value (RAV). The main factors discussed below are:

- Capitalisation ;
- Depreciation (including transitional arrangements).

Capitalisation

10.2 Under the RIIO framework, a fixed proportion of core expenditure costs (totex) are added (capitalised) to RAV in order to ensure all DNOs face equal incentives in choosing between operating and capital solutions. The percentage of core expenditure costs capitalised reflects the expected share of each DNO's capital expenditure in total costs, to ensure that current and future consumers bear a fair share of costs.

10.3 In DPCR5 all core expenditure costs, with the exception of business support costs and non-operational capital expenditure, are capitalised at a rate of 85% (known as "slow pot") and 15% funded in the year they are incurred (known as "fast pot"). Business support costs and non-operational capital expenditure are treated entirely as fast pot.

10.4 For RIIO-ED1 any outstanding boundary issues have been removed and now all core expenditure costs, including business support costs and non-operational capital expenditure, are included in the capitalisation process and will have the same capitalisation rate applied to them.

10.5 We consider that a capitalisation rate of 80% for all core expenditure costs for our four DNOs is appropriate in RIIO-ED1. This rate approximates to the same capitalisation regime as experienced in the DPCR5 price review period:

- in DPCR5 pension deficit payments were treated as fast pot. We are assuming that pension deficit payments are also treated as fast pot in RIIO-ED1;
- the combined amount of 20% core expenditure cost and pension deficit payments treated as fast pot in RIIO-ED1 is close to the amount in DPCR5.

10.6 WPD does not consider that any fundamental changes have occurred in the business to materially alter the capitalisation rate. It could be argued that a decrease in the capitalisation percentage could help cash flow in the short term that inefficient businesses may require. Whereas an increase in the capitalisation rate may be preferred by investors, owners and other stakeholders who wish to see actual growth in the regulatory asset base and therefore the value of the business.

10.7 In our business risk modelling we have looked at different capitalisation rates in order to better understand how these would impact WPD's finances and credit ratings. Through this process we have concluded that more fast money (using a lower capitalisation rate) would help ratios in the short term and provide strong credit metrics, but this would be to the detriment of customers who would be paying more for little or no real gain.

Depreciation including transitional arrangements

10.8 The proposed asset lives arrangement in the RIIO-ED1 price control period are for all new electricity assets to be depreciated over 45 years, whilst all existing assets continue to be depreciated over the current lives of 20 years.

10.9 As part of the Business Plan risk modelling we have looked at the movement in the asset lives and how they impact on the financeability of the WPD companies.

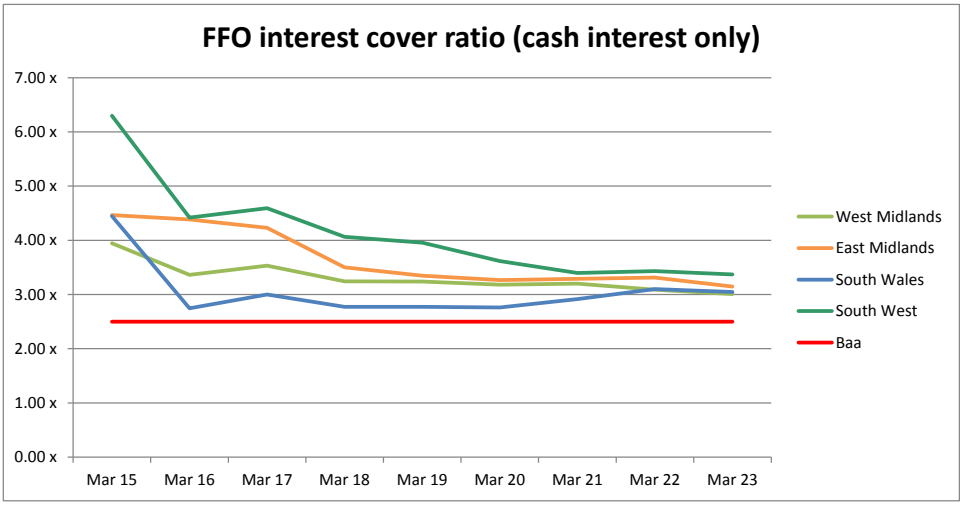
10.10 Regulatory asset lives should be more closely aligned with their economic lives; however an immediate transition causes a financial shock to WPD's credit ratings. (See appendix 6).

10.11 We have undertaken financial modelling looking at other potential options, such as having 35 year asset lives for additions in the RIIO-ED1 period only and then moving to the 45 year asset lives in subsequent periods. (See appendix 6).

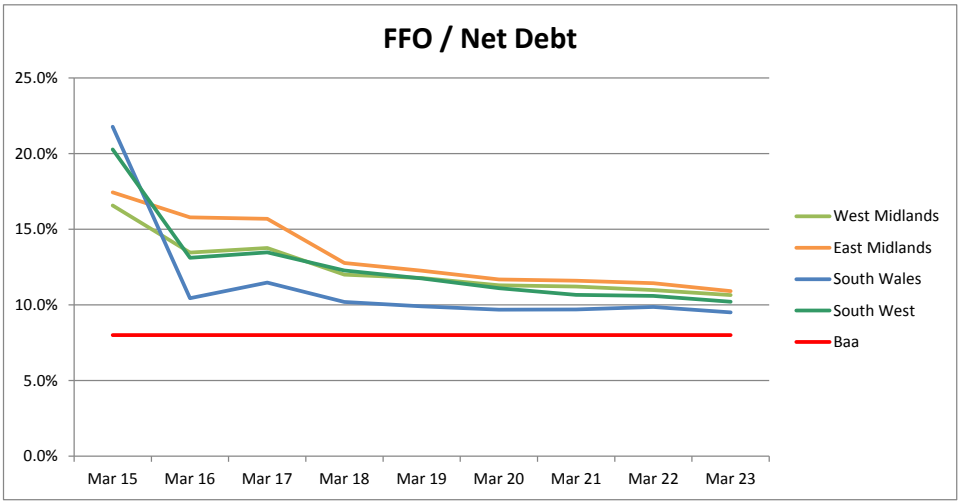
10.12 We consider that a transitional approach over the eight years of the RIIO-ED1 period is most appropriate. This will be done on a straight line basis moving from 20 years at the end of the DPCR5 period to 45 years at the end of the RIIO-ED1 period, creating an average of just under 35 years over the period. The transition is the same as that used in NGET's final proposals.

10.13 As can be seen below, we have modelled the transitional approach and it does assist the credit metrics (compared to a straight move to 45 years). The improvement is sufficient to enable WPD to maintain its investment grade credit rating rather than strongly outperform the metrics, therefore demonstrating that the requirement is not excessive.

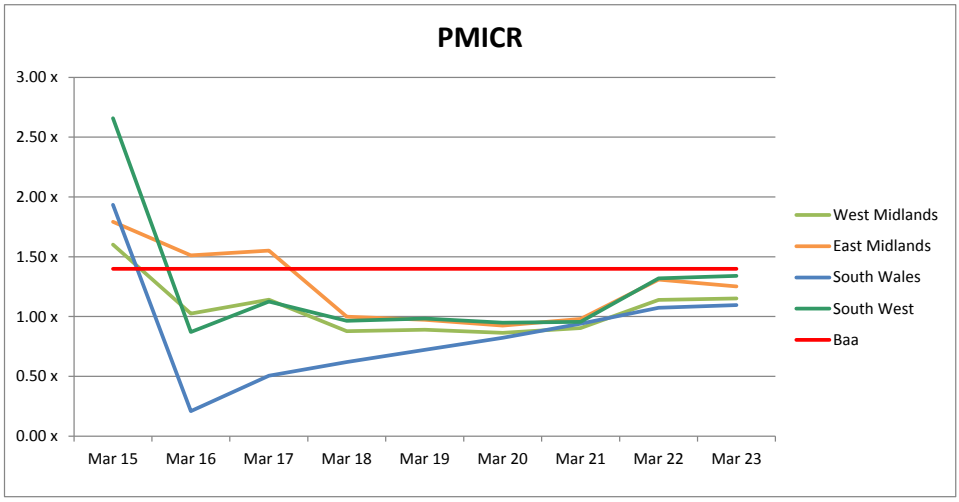
10.14 The straight move to a 45 asset life at the start of RIIO-ED1 gives the below metrics:



Source: WPD

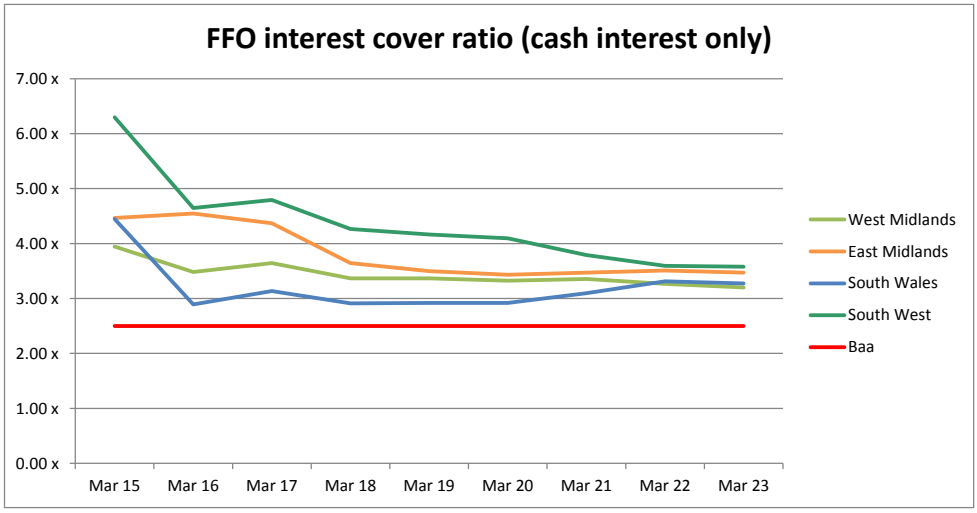


Source: WPD

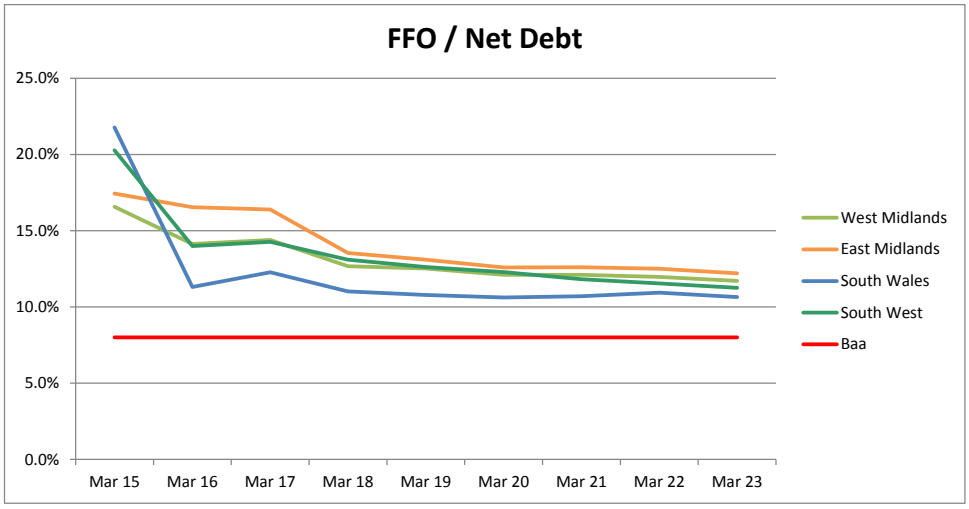


Source: WPD

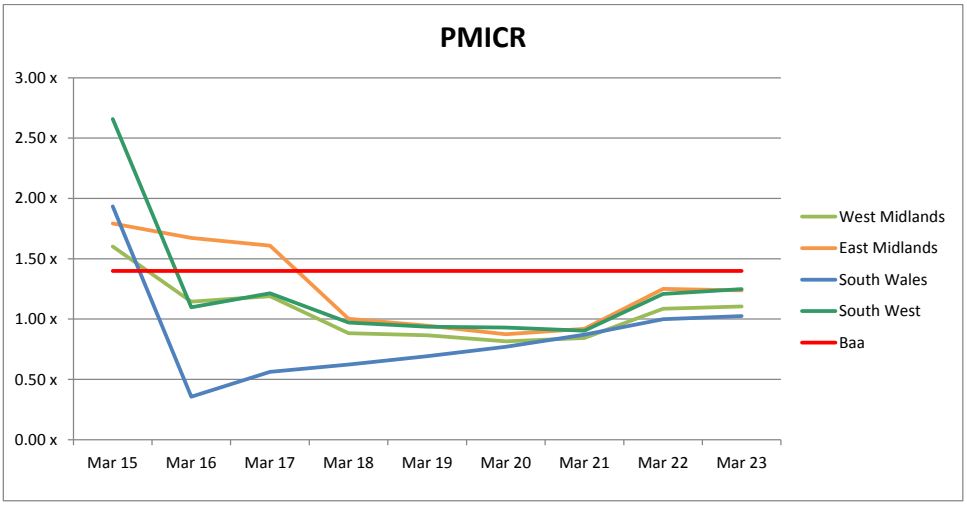
10.15 As can be seen below the transitional move to 45 years improves the metrics overall:



Source: WPD



Source: WPD



Source: WPD

10.16 In RIIO-T1, the price control for transmission companies, transitional arrangements are in place whereby SHETL, SPTL and NGET respectively have 16, 8 and 8 year transitional periods on new assets, with all three having a gradual increase in asset lives from 20 to 45 years.

10.17 We have adopted the NGET transitional arrangement which has a linear increase in asset lives from 20 to 45 years within one price control period:

Asset life applied to assets acquired in each year of RIIO-ED1								
2015/16	**2016/17**	**2017/18**	**2018/19**	**2019/20**	**2020/21**	**2021/22**	**2022/23**	**Average**
23.1	26.3	29.4	32.5	35.6	38.8	41.9	45.0	34.1

10.18 This equates to an average asset life for new assets (i.e. slow pot additions) in RIIO-ED1 of just over 34 years, which we have rounded up to 35 years. We require this transitional arrangement in order to ensure we achieve credit ratios that will maintain a minimum credit agency rating of BBB/Baa2 for our four DNOs.

11 Related party costs

11.1 All four of the WPD DNOs are part of the same corporate group. For reasons of efficiency, the DNOs operate as an integrated distribution business, with most corporate functions centralised in one of the DNOs (primarily South West). That DNO provides services to the other DNOs, the costs of which are charged to those other DNOs on an arm's length basis.

11.2 WPD also operates a single banking system with Western Power Distribution (South West) plc acting as the banker for the rest of the Group. Therefore any monies received from third parties or payable to third parties in the normal course of business use the South West bank account. Any monies outstanding to or from South West are recognised within the ledger of the respective company and interest is charged on a monthly basis. In line with licence requirements these 'trading balances' are repaid from time to time.

11.3 If money is to be loaned to another group company i.e. not a DNO, it has to first meet the regulatory requirements as a permitted company and then the terms of the loan will be made on an arms' length basis at the prevailing market rate. E.g. LIBOR or the Bank of England Base rate plus a market margin.

11.4 For each of the above related party cost transfers WPD has robust guidelines in place that have been reviewed by legal counsel to ensure they meet legal requirements as well as the regulatory ones. Appendices 15 and 16 respectively show the inter-group facility agreement and the related WPD policy respectively.

12 Taxation

Basis of tax modelling

12.1 We have modelled tax using the principles set out in current UK tax legislation and based on profits that have been calculated according to International Financial Reporting Standards.

12.2 Following the announcement by the Chancellor in March 2013 that the corporation tax rate will reduce to 20% with effect from 1 April 2015, we have used this rate in modelling the tax charge in the Business Plan.

12.3 Capital allowances have been claimed at the rates as set out in current legislation. Tax allowances for capital expenditure that is treated as deferred revenue expenditure for tax purposes are calculated at 2% of cost assuming a 50 year life on average. Ofgem in their modelling treat these assets as having an average life of 45 years for tax purposes.

12.4 Tax for price control purposes is on a cash basis so we have ignored deferred tax.

Allocation of expenditure to capital allowances pools

12.5 Total expenditure has been allocated to the various tax pools on the basis of the pattern of spend for each individual DNO rather than using a generic pattern as adopted by Ofgem.

12.6 This basis of allocation gives a more representative calculation of the cash tax payable for each company compared with a generic allocation set by Ofgem as each company has historic differences and associated expenditure profiles.

12.7 The March 2013 closing pool balances as used in the regulatory accounts for that period have been rolled forward to 31 March 2015 using the forecast of expenditure split in the Business Plan.

Generic versus specific attributions to tax pools

12.8 Ofgem will determine generic attributions to capital allowance pools based on an analysis of the Business Plans as submitted and apply these to all DNOs including those recommended for the fast-track approach.

12.9 We do not have the information needed to perform a generic allocation because companies' Business Plans have not yet been submitted.

12.10 The use of generic pools based on the Business Plans to 2023 may not reflect the actual tax cost if:-

- Companies' plans are not accurate, and
- Companies do not have a homogenous asset acquisition strategy if, for example, they purchase rather than lease vehicles.

12.11 We have used our actual attribution to tax pools based on the expenditure forecast.

Timing of tax payments

12.12 Ofgem have proposed moving from modelling tax cash flows on a tax statutory basis to modelling cash flows on the basis of the change incurred in the year. Under the statutory basis, half the tax is paid in the year the liability arises with the other half due in the following year. Ofgem will consider a compensating adjustment where a DNO forecasts that it will be materially disadvantaged.

12.13 Using Ofgem's formula for calculating the effect as set out in Table F14a in the Financial Issues ED1 Business Plan data tables, the excess to be considered for adjustment is:-

- WPD South West £9.28m
- WPD South Wales £7.84m

12.14 We have made this adjustment in WPD South West and WPD South Wales. There is no excess for WPD East Midlands or WPD West Midlands.

Adjustments following Ofgem review

12.15 Following the review by Ofgem of WPD's Business Plan, the associated Business Plan Data Templates and the Price Control Financial Models (PCFM), changes were made to the tax allowance to align with the final PCFM. These changes relate to tax pool allocation categories, tax allowance calculations and implied interest calculations.

13 Business rates

13.1 We have assumed that the next revaluation will take effect in England and Wales in 2017/18, and that rateable values will increase in line with projected RAV increases. We have also assumed that the same transitional relief mechanism will apply as for the 2010 revaluation i.e. first year cap of 12.5% increase, second year 17.5% and third year 20%.

13.2 Our forecast assumptions follow the approach recommended by Gerald Eve (chartered surveyors and commercial property consultants) in their letter to WPD dated 16th April 2013 which is attached in appendix 17.

13.3 The full impact of the next forecast revaluation is to increase business rates by 17% in RIIO-ED1 period; as detailed below by DNO:

Annual business rates (£m)									
	2015/16	**2016/17**	**2017/18**	**2018/19**	**2019/20**	**2020/21**	**2021/22**	**2022/23**	**Total**
West Midlands	25.7	25.7	29.0	34.0	40.4	40.4	40.4	40.4	276.0
East Midlands	34.0	34.0	38.2	44.9	52.9	52.9	52.9	52.9	362.7
South Wales	15.1	15.1	19.1	19.1	19.1	19.1	19.1	19.1	144.8
South West	14.4	14.4	16.2	19.0	20.6	20.6	20.6	20.6	146.4
WPD Total	**89.2**	**89.2**	**102.5**	**117.0**	**133.0**	**133.0**	**133.0**	**133.0**	**929.9**

13.4 We will endeavour, as in previous revaluations, to ensure that business rate charges made on the four WPD DNOs are minimised in the next revaluation review.

14 Pensions

Business context

14.1 In 2003, Ofgem set out their pension principles for the treatment of pension costs and applied these through three successive price control reviews – covering electricity distribution, gas and electricity transmission and gas distribution. Following a detailed review of the pension schemes of all of the price controlled energy networks in 2008 and 2009, Ofgem published their conclusions in DPCR5 Final Proposals applying solely to electricity distribution.

14.2 In 2010, Ofgem published a further document 76/10 dated 22 June "Price Control Treatment of Network Operator Pension Costs under Regulatory Principles".

14.3 In December 2012, Ofgem published an open letter consultation on their proposed Pensions Deficit Allocation Methodology (PDAM). The letter made it clear that Ofgem's funding commitment does not cover the cost of future service of those employees still active in the scheme after the relevant cut-off dates for each price control, i.e. the incremental deficit, or that related to non-regulated activities. The PDAM was formally introduced by Ofgem on 12th April 2013.

Pension defined benefits costs - General

14.4 WPD has prepared a forecast of its pension costs for the WPD and Central Networks Groups defined benefit (DB) schemes – the two schemes where there is an element relating to the distribution business. These are both groups within the Electricity Supply Pension Scheme (ESPS). Both DB schemes are closed to new members.

14.5 The forecasts are based on the most recent Actuarial Valuations (WPD Group as at 31/03/10 and Central Networks Group as at 30/06/11) rolled forward to 31/12/12. The updated roll forward valuation has been prepared and certified by the scheme actuary in accordance with the guidelines set out in Appendix 6, paragraph 1.38 of the RIIO-ED1 Strategy Decision Document. The reports can be found in Appendices 18 and 19.

14.6 The projected deficits based on independent actuaries' estimates calculated in accordance with the above for our two schemes at 31st December 2012 are:

- WPD Group £893m (of which £881m is 31 March 2010 deficit)
- Central Networks Group £577m (of which £570m is 31 March 2010 deficit)

14.7 The pension deficit repair payments to be made in our plan relating to the deficits referred to above are set out in the table below:

Deficit repair payments (existing deficit) (£m)					
	CN Group of ESPS		WPD Group of ESPS		
	West Midlands	East Midlands	South Wales	South West	WPD Total
DPRC5 Annual Average	21.0	20.6	21.4	34.5	97.5
RIIO-ED1 Annual Average	31.4	30.8	35.8	57.8	155.8
RIIO-ED1 Total (8 years)	**250.9**	**246.2**	**286.3**	**462.6**	**1,246.1**

14.8 It should be noted that markets have been very volatile between 31 March 2012 and 31 March 2013 and so there may be a material variance between the forecasts determined on a "Roll-Forward" basis and the actual outturn of the 2013 actuarial valuations. Any differences

between the forecast and the actual outturn valuation will be taken into account in the 2014 Reasonableness Review prior to setting the RIIO-ED1 pension allowances.

14.9 It should be noted that the above forecasts will be subject to the DPCR5 true-up process and the Annual Iteration Process as set out in appendix 6 of the RIIO-ED1 Strategy Decision Documents (26d/213) and in subsequent triennial actuarial valuations.

14.10 All pension costs are reported on a cash basis, i.e. cash payments of contributions, Pension Protection Fund (PPF) levies, pension scheme administration costs and deficit funding by the licensee.

14.11 The pension costs are projected as required in the Instructions for Completing ED1 Financial Issues Business Plan Data Templates.

14.12 The projected ongoing pension costs from 1st April 2015 onwards are included in our plan are set out below:

Ongoing pension costs – Final salary schemes (£m)					
	CN Group of ESPS		WPD Group of ESPS		
	West Midlands	**East Midlands**	**South Wales**	**South West**	**WPD Total**
DPRC5 Annual Average	10.4	9.8	7.4	11.9	39.5
RIIO-ED1 Annual Average	8.5	8.5	7.1	11.3	35.4
RIIO-ED1 Total (8 years)	**67.8**	**67.6**	**57.1**	**90.5**	**283.0**

Derivation of pension defined benefits costs

14.13 Having determined the projected ongoing deficit based on the 31 December 2012 updates it is assumed that at the 31 March 2013 valuations the Trustees will be consistent with each scheme's Statement of Funding Principles and/or Statement of Investment Principles. (See appendices 20 and 21.)

14.14 The Business Plan assumes that the projected ongoing deficit as at 31 March 2013 will be repaired over 10 years from 1st April 2014 which is the period agreed with the Trustees and accepted by the Pension Regulator (TPR) in the deficit recovery plan relating to the June 2011 CN Group Inaugural Triennial Valuation.

Reporting of pension defined benefits costs

14.15 Projected payments related to the former Electricity Association (EASL or EATL) pension liabilities are excluded from the Pensions section of this Business Plan and as they are not pension costs of the distribution business. They are reported as atypical operating costs in the main Cost RIG tables.

14.16 We report total pensionable pay of active members employed in the distribution business of the primary DB scheme only. Defined Contribution (DC) pension costs are discussed below.

14.17 WPD does not operate a salary sacrifice system. Employee contributions do not therefore include a salary sacrifice element and are projected in millions of Pounds Sterling (£m). It should be noted that the £m might not necessarily equate to "Total Pensionable Pay in £m x Employee Contribution Rate (expressed as a percentage)" because some employees – e.g. employees who joined after the schemes were closed or those with over 40 years' service but who are under normal retirement age do not pay employee contributions.

14.18 We break down the total normal employer's contributions for the relevant scheme to show ongoing costs, PPF levy and scheme administration costs.

14.19 The Business Plan does not include any pension related severance costs.

14.20 The Business Plan does not include making direct payments for pension hedging and contingent asset costs.

14.21 The Regulatory Fraction is the proportion of the company's pension scheme funded through the price control mechanism and is applied to the deficit at 31 March 2010 (The Established Deficit). The regulatory fraction is calculated in accordance with the PDAM.

14.22 Overall this means that subject to the Reasonableness Review, subsequent valuations and the annual iteration process, 78.6% of the WW Group 2010 deficit and 80.9% of the CN Group 2010 established deficit will be funded through allowed revenues. Similarly, 91.6% of the WW Group Incremental Deficit and 93.4% of the CN Group Incremental Deficit will be funded through allowed revenues.

14.23 The Incremental Deficit is the portion of the deficit relating to the period since 31 March 2010). Funding requirements of the incremental deficit for DB schemes have been calculated on the roll-forward basis in accordance with the PDAM dated 12 April 2013. Copies of the Scheme Actuary's Report and certificates are included in Appendices 22 and 23.

14.24 The Established Deficit is attributed to each licensee and the regulatory fraction is applied. The DNO element of the Incremental Deficit is then attributed to each licensee and treated as part of totex and attributed across cost categories – e.g. DUoS and non-DUoS. The method of attribution is taken from the Costs and Volumes tables consistent with the attribution of ongoing pension costs.

Pensions defined contribution schemes

14.25 The employer's cash contribution for the primary DC scheme, the WPPS 2010 Section is also included the Business Plan. The contribution rates into the scheme vary and so we have used an average contribution percentage based on the 31 December 2012 actuals that is adjusted to reflect (1) the replacement of ESPS members by members of the DC scheme as ESPS members retire and (2) the projected rise in total employees according to the operational requirements projected elsewhere in this Business Plan.

14.26 The defined contribution pension costs included in our plan are set out below:

Ongoing pension costs – Defined contribution schemes (£m)					
	West Midlands	**East Midlands**	**South Wales**	**South West**	**WPD Total**
DPRC5 Annual Average	0.7	0.8	0.2	0.4	2.1
RIIO-ED1 Annual Average	2.1	2.1	0.7	1.0	5.9
RIIO-ED1 Total (8 years)	**16.9**	**16.9**	**5.2**	**8.3**	**47.3**

Pension Protection Fund levies

14.27 We have estimated the PPF Levies for the CN and WPD Groups for 2013/14 in line with the PPF's most recent guidance as at 31 December 2012. We assume that ESPS PPF Levies remain constant at 2.4% for WPD and 1.7% for CN. These payments are included in the employer's contribution to ongoing expenses.

14.28 Each pension scheme's administration costs remain a constant fraction of pensionable pay as determined in the most recent actuarial valuations.

14.29 In line with current ESPS practice, investment management fees and expenses are included in the expected return on assets (ERoA) assumed for each scheme.

Derivation of pension defined benefits allowances

14.30 Having determined the Ongoing Deficit based on the 31/12/12 update in each scheme, we then subtract the Incremental Deficit.

14.31 The appropriate Regulatory Fraction is then applied to the balance to determine the Established Deficit and in accordance with the guidance set out in DPCR5 and the June 2010 Pension document we use Ofgem's Factors Method to determine the Annual Allowance in 2012/13 money assuming a funding period of 12 years from 1st April 2013 and a discount factor of 2.6%. This plan includes allowances for 8 of these 12 years (the RIIO-ED1 period) as shown previously in this document, and will be subject to review and possible variation, as previously stated.

14.32 The projected Annual Allowance for the Established Deficit is then allocated to "Fast Money" and the projected cost of funding the Incremental Deficit is allocated to totex.

14.33 It should be noted that after the submission of WPD's Business Plan in June 2013, Ofgem applied an adjustment to the RIIO-ED1 Pension Deficit Repair Allowance included in our plan. This adjustment was made to the Established Deficit before the application of the Factors Method described above, and is therefore included in the Annual Allowance for the RIIO-ED1 period.

De-risking and contingent assets

14.34 De-risking is assumed to occur within the scheme by increasing the level of liability matching assets as the funding level improves.

14.35 WPD does not envisage the use of Contingent Assets for de-risking purposes and accordingly no allowances are being sought.

True-ups

14.36 True-ups in respect of DPCR5 to date have been agreed with Ofgem (subject to the 2014 Reasonableness Review) and the results included in the plan.

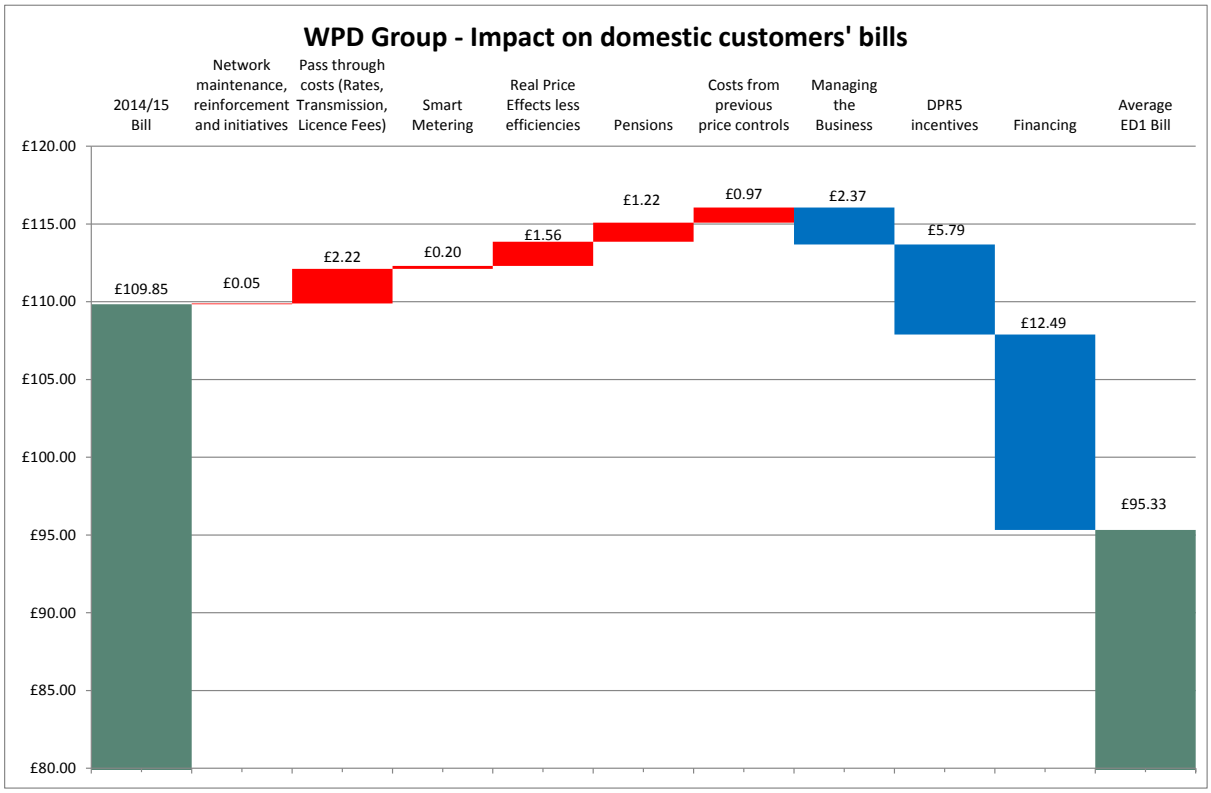
15 Impact on customers' bills

15.1 Within this Business Plan we set out detailed forecasts for the costs of carrying out the plan and the financing costs we incur to enable us to do so.

15.2 Over RIIO-ED1 our charges reduce by an average of 13.2% before inflation.

Impact on customers' bills

15.3 The change in bills is driven by a number of key areas of expenditure. This is shown for domestic customers in the chart below for our four DNOs combined:



Source: WPD

15.4 For our four DNOs the detailed impact on both domestic and business customers' bills is shown below:

How this will impact domestic customer bills

In 2012/13 prices

WPD West Midlands	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
Percentage change in distribution costs	n/a	-10.2%	0.9%	-5.4%	1.0%	1.0%	1.0%	1.0%	1.0%
Annual change in £'s	n/a	-£10.29	£0.81	-£4.97	£0.88	£0.87	£0.88	£0.89	£0.89
Total distribution charge	£101.17	£90.88	£91.69	£86.72	£87.60	£88.47	£89.35	£90.24	£91.13

WPD East Midlands	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
Percentage change in distribution costs	n/a	-8.2%	0.9%	-4.1%	1.0%	1.0%	1.0%	1.0%	1.0%
Annual change in £'s	n/a	-£7.26	£0.74	-£3.34	£0.78	£0.78	£0.80	£0.81	£0.81
Total distribution charge	£88.11	£80.85	£81.59	£78.25	£79.03	£79.81	£80.61	£81.42	£82.23

WPD South Wales	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
Percentage change in distribution costs	n/a	-22.7%	0.9%	-1.2%	1.0%	1.0%	1.0%	1.0%	1.0%
Annual change in £'s	n/a	-£28.73	£0.89	-£1.19	£1.01	£0.97	£0.99	£0.98	£1.02
Total distribution charge	£126.28	£97.55	£98.44	£97.25	£98.26	£99.23	£100.22	£101.20	£102.22

WPD South West	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
Percentage change in distribution costs	n/a	-17.0%	0.9%	-0.5%	1.0%	1.0%	1.0%	1.0%	1.0%
Annual change in £'s	n/a	-£23.35	£1.06	-£0.58	£1.17	£1.15	£1.16	£1.17	£1.18
Total distribution charge	£137.52	£114.17	£115.23	£114.65	£115.82	£116.97	£118.13	£119.30	£120.48

WPD Total (weighted average)	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
Percentage change in distribution costs	n/a	-13.4%	0.9%	-3.3%	1.0%	1.0%	1.0%	1.0%	1.0%
Annual change in £'s	n/a	-£14.69	£0.87	-£3.14	£0.94	£0.94	£0.94	£0.95	£0.96
Total distribution charge	£109.85	£95.16	£96.03	£92.89	£93.83	£94.77	£95.71	£96.66	£97.62

Notes

1 Revenues are profiled on a "Po/x basis"; revenues fall in 2015/16 and thereafter increase by 1.0% in real terms other than for DPCR5 IIS
2 DPCR4 losses excluded because of uncertainty
3 Smart metering included
4 K factor included in 2014/15
5 DPCR5 tax trigger impact included in 2014/15 and thereafter zero
6 DPCR5 IIS included in 2014/15, 2015/16 and 2016/17 and thereafter zero
7 IFI and LCNF included for DPCR5; NIA and NIC excluded for RIIO-ED1
8 Domestic bill represents Profile 1

How this will impact business customer bills

In 2012/13 prices

WPD West Midlands	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
Percentage change in distribution costs	n/a	-10.2%	0.9%	-5.4%	1.0%	1.0%	1.0%	1.0%	1.0%
Annual change in £'s	n/a	-£24.79	£1.95	-£11.97	£2.11	£2.11	£2.10	£2.14	£2.16
Total distribution charge	£243.71	£218.91	£220.86	£208.89	£211.01	£213.12	£215.22	£217.36	£219.52

WPD East Midlands	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
Percentage change in distribution costs	n/a	-8.2%	0.9%	-4.1%	1.0%	1.0%	1.0%	1.0%	1.0%
Annual change in £'s	n/a	-£18.30	£1.87	-£8.44	£1.97	£1.98	£2.00	£2.03	£2.04
Total distribution charge	£222.01	£203.71	£205.58	£197.14	£199.11	£201.09	£203.10	£205.13	£207.17

WPD South Wales	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
Percentage change in distribution costs	n/a	-22.7%	0.9%	-1.2%	1.0%	1.0%	1.0%	1.0%	1.0%
Annual change in £'s	n/a	-£85.85	£2.66	-£3.58	£3.04	£2.91	£2.94	£2.94	£3.04
Total distribution charge	£377.44	£291.59	£294.25	£290.67	£293.70	£296.61	£299.55	£302.49	£305.54

WPD South West	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
Percentage change in distribution costs	n/a	-17.0%	0.9%	-0.5%	1.0%	1.0%	1.0%	1.0%	1.0%
Annual change in £'s	n/a	-£51.77	£2.34	-£1.29	£2.60	£2.54	£2.57	£2.60	£2.63
Total distribution charge	£304.88	£253.11	£255.45	£254.16	£256.76	£259.31	£261.88	£264.48	£267.10

WPD Total (weighted average)	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
Percentage change in distribution costs	n/a	-13.4%	0.9%	-3.3%	1.0%	1.0%	1.0%	1.0%	1.0%
Annual change in £'s	n/a	-£36.94	£2.18	-£7.91	£2.37	£2.35	£2.36	£2.39	£2.42
Total distribution charge	£276.37	£239.44	£241.62	£233.71	£236.09	£238.43	£240.80	£243.19	£245.61

Notes

1 Revenues are profiled on a "Po/x basis"; revenues fall in 2015/16 and thereafter increase by 1.0% in real terms other than for DPCR5 IIS
2 DPCR4 losses excluded because of uncertainty
3 Smart metering included
4 K factor included in 2014/15
5 DPCR5 tax trigger impact included in 2014/15 and thereafter zero
6 DPCR5 IIS included in 2014/15, 2015/16 and 2016/17 and thereafter zero
7 IFI and LCNF included for DPCR5; NIA and NIC excluded for RIIO-ED1
8 Business bill represents Profile 3

Impact on suppliers

15.5 The revenues that we will recover from suppliers are detailed in accordance with DCUSA DCP66A tables. They will be updated every quarter and published separately. http://www.dcusa.co.uk/Public/Documents.aspx?t=10

15.6 WPD understand that charging volatility is a key issue for suppliers and that suppliers seek stable and predictable pricing structures with longer charge notification periods. WPD support the recommendations of Ofgem's October 2012 decision in relation to measures to mitigate volatility arising from the price control settlement. As part of our plan we have therefore clearly set out the evolution of revenues and charges in an industry common format. We have committed to updating and publishing this information every three months.

15.7 Through our work with suppliers we are aware of other proposals in addition to those in the Ofgem decision document requiring longer notice periods for charges. We are willing to work with suppliers and Ofgem on this issue and look forward to discussions that investigate the merits of an approach whereby the industry fixes its DUoS prices further in advance of price application so that we can better understand if the transfer of risk from suppliers to distribution businesses is in the best interests of both suppliers and end use customers.

16 WPD's revenue request for RIIO-ED1

16.1 In the Business Plan we have explained and shown forecasts for the following:

- core expenditure - capital expenditure, network operating costs and indirects;
- pensions – normal and deficit contributions;
- rates and licence fees;
- transmission exit charges;
- financing costs - cost of debt and cost of equity.

16.2 Our core expenditure costs (totex costs) are split between fast pot and slow pot as previously explained under "Funding the Business Plan":

- fast pot costs incurred in RIIO-ED1 are recovered in RIIO-ED1;
- slow pot costs incurred in RIIO-ED1 are spread over a number of years (known as RAV depreciation) to reflect the long term value of network assets.

16.3 Our customer bills are therefore made-up of the following items:

- fast pot costs (including normal pensions);
- depreciation (including normal pensions) on RIIO-ED1 slow pot costs;
- depreciation on previous price control slow pot costs;
- pensions deficit repair payments (including true-up from previous price controls);
- rates and licence fees;
- transmission exit charges;
- tax payments;
- financing costs.

16.4 In addition customer bills may also be adjusted for the following items:

- The fast track reward is included in our plan;
- DPCR5 IQI incentive/cost true-up: our plan takes into account variances between slow pot allowances and actual expenditure in DPCR5 that will be dealt with in RIIO-ED1;
- DPCR5 incentives: our plan does *not* include rewards such as IIS earned in DPCR5 but paid in RIIO-ED1;
- RIIO-ED1 incentive rewards such as IIS are *not* included in the plan;
- DPCR4 losses incentive: our plan does *not* include any reward or penalty for the close-out of the DPCR4 losses mechanism which now seems likely to be settled in 2015/16 and 2016/17 although the amount has yet to be determined.

16.5 We have also considered how our revenues are profiled over the RIIO-ED1 period. WPD would prefer that customers receive a significant one-off reduction in charges in year one of RIIO-ED1 (2015/16) rather than gradually spreading the reduction over a number of years, in order to provide more stability in our charges. Following consultation with our owner we have profiled our revenues so that a there is a one-off reduction of 13.8% in 2015/16 followed thereafter by an increase of 1.0% per annum before inflation for the remainder of the RIIO-ED1 period.

16.6 In total our revenue for RIIO-ED1 included in the Business Plan is £10.4bn in 2012/13 prices as detailed in the table below:

WPD Revenue Requirement in RIIO-ED1 (£m in 2012/13 prices)

West Midlands	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	Total
Fast Pot Costs	52.1	52.1	50.6	51.5	53.1	54.1	53.6	54.1	**421.2**
Depreciation on Slow Post Costs (RAV)	169.5	173.1	174.9	176.5	177.2	178.2	162.7	161.6	**1,373.6**
Pension Deficit Repair Payments	20.7	20.7	20.7	20.7	20.7	20.7	20.7	20.7	**165.7**
Rates and Licence Fees	28.3	28.3	31.3	36.5	42.7	43.4	41.8	41.8	**294.1**
Transmission Exit Charges	12.7	13.0	13.2	13.2	13.5	14.1	14.1	14.1	**108.0**
DPCR5 IQI Incentive/Costs True-up	1.2	1.2	1.3	1.3	1.4	1.5	1.5	1.6	**11.0**
Financing Costs	74.7	76.1	77.3	78.5	79.7	81.1	82.8	84.9	**635.1**
Taxation Payments	18.0	17.9	17.7	16.8	15.5	15.2	15.9	15.9	**133.0**
Fast Track Reward	6.5	6.5	6.3	6.4	6.6	6.8	6.7	6.8	**52.6**
Total - Unprofiled Revenues	**383.7**	**389.1**	**393.3**	**401.5**	**410.5**	**415.0**	**399.8**	**401.5**	**3,194.4**
Revenue Profiling	2.1	0.4	0.1	-4.1	-9.1	-9.6	9.6	11.9	**1.4**
Total - Profiled Revenues	**385.8**	**389.6**	**393.4**	**397.4**	**401.4**	**405.3**	**409.4**	**413.4**	**3,195.8**

East Midlands	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	Total
Fast Pot Costs	57.0	55.7	49.6	50.5	49.9	51.9	54.5	53.0	**422.2**
Depreciation on Slow Post Costs (RAV)	161.1	166.4	170.1	171.1	171.7	171.7	153.3	154.3	**1,319.6**
Pension Deficit Repair Payments	20.4	20.4	20.4	20.4	20.4	20.4	20.4	20.4	**163.3**
Rates and Licence Fees	36.7	36.8	40.6	47.6	55.3	56.0	54.4	54.4	**381.6**
Transmission Exit Charges	10.5	10.5	10.9	10.9	11.6	11.9	12.6	13.8	**92.9**
DPCR5 IQI Incentive/Costs True-up	3.5	3.6	3.8	4.0	4.2	4.3	4.5	4.8	**32.6**
Financing Costs	71.1	73.5	75.2	76.3	77.5	78.7	80.6	83.0	**615.9**
Taxation Payments	16.2	15.8	15.6	14.6	13.2	13.2	13.4	13.3	**115.3**
Fast Track Reward	7.1	7.0	6.2	6.3	6.2	6.5	6.8	6.6	**52.8**
Total - Unprofiled Revenues	**383.7**	**389.8**	**392.4**	**401.6**	**410.0**	**414.6**	**400.5**	**403.4**	**3,196.2**
Revenue Profiling	2.3	0.0	1.2	-4.0	-8.5	-9.1	9.1	10.2	**1.1**
Total - Profiled Revenues	**386.0**	**389.8**	**393.6**	**397.6**	**401.5**	**405.5**	**409.6**	**413.7**	**3,197.3**

South Wales	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	Total
Fast Pot Costs	29.4	29.4	28.0	29.8	27.3	27.4	26.4	26.9	**224.6**
Depreciation on Slow Post Costs (RAV)	83.9	85.0	78.7	78.0	76.6	75.7	75.1	74.5	**627.6**
Pension Deficit Repair Payments	21.6	21.6	21.6	21.6	21.6	21.6	21.6	21.6	**172.9**
Rates and Licence Fees	16.3	16.3	20.1	20.3	20.1	20.5	19.7	19.7	**153.0**
Transmission Exit Charges	8.5	8.5	8.5	8.6	8.6	8.6	8.6	8.8	**68.8**
DPCR5 IQI Incentive/Costs True-up	2.3	2.4	2.5	2.7	2.8	2.9	3.1	3.2	**21.9**
Financing Costs	32.2	33.4	34.7	36.1	37.6	38.8	40.1	41.3	**294.2**
Taxation Payments	7.5	7.2	6.3	5.8	5.9	5.8	6.1	6.1	**50.8**
Fast Track Reward	3.7	3.7	3.5	3.7	3.4	3.4	3.3	3.4	**28.1**
Total - Unprofiled Revenues	**205.4**	**207.6**	**204.0**	**206.6**	**204.0**	**204.7**	**204.1**	**205.5**	**1,641.8**
Revenue Profiling	-6.7	-7.0	-1.5	-1.9	2.7	4.0	6.7	7.4	**3.7**
Total - Profiled Revenues	**198.7**	**200.6**	**202.5**	**204.6**	**206.7**	**208.7**	**210.8**	**212.9**	**1,645.5**

South West	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	Total
Fast Pot Costs	43.0	43.0	42.1	42.9	42.1	42.6	42.6	44.6	**342.9**
Depreciation on Slow Post Costs (RAV)	111.7	115.4	117.7	119.0	120.2	120.9	109.1	109.1	**923.1**
Pension Deficit Repair Payments	35.2	35.2	35.2	35.2	35.2	35.2	35.2	35.2	**281.3**
Rates and Licence Fees	16.3	16.3	17.8	20.8	22.1	22.7	21.4	21.4	**158.9**
Transmission Exit Charges	8.7	8.7	8.7	8.7	9.2	9.2	9.2	9.2	**71.8**
DPCR5 IQI Incentive/Costs True-up	4.3	4.5	4.7	4.9	5.1	5.4	5.6	5.9	**40.4**
Financing Costs	47.5	49.7	51.8	53.8	55.7	57.6	59.8	62.3	**438.2**
Taxation Payments	11.6	11.0	10.3	9.2	8.7	8.3	8.5	7.9	**75.5**
Fast Track Reward	5.4	5.4	5.3	5.4	5.3	5.3	5.3	5.6	**42.9**
Total - Unprofiled Revenues	**283.6**	**289.2**	**293.5**	**300.0**	**303.6**	**307.1**	**296.7**	**301.2**	**2,375.0**
Revenue Profiling	3.3	0.4	-1.1	-4.5	-5.3	-5.8	7.6	6.1	**0.7**
Total - Profiled Revenues	**286.9**	**289.6**	**292.4**	**295.4**	**298.4**	**301.3**	**304.3**	**307.3**	**2,375.7**

WPD Combined	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	Total
Fast Pot Costs	181.5	180.3	170.4	174.7	172.4	175.9	177.1	178.6	**1,410.9**
Depreciation on Slow Post Costs (RAV)	526.1	540.0	541.4	544.6	545.7	546.4	500.2	499.5	**4,243.9**
Pension Deficit Repair Payments	97.9	97.9	97.9	97.9	97.9	97.9	97.9	97.9	**783.1**
Rates and Licence Fees	97.6	97.8	109.8	125.2	140.3	142.5	137.2	137.2	**987.6**
Transmission Exit Charges	40.4	40.7	41.3	41.5	43.0	43.9	44.6	45.9	**341.5**
DPCR5 IQI Incentive/Costs True-up	11.2	11.7	12.3	12.9	13.5	14.1	14.8	15.5	**105.9**
Financing Costs	225.5	232.8	239.0	244.7	250.5	256.3	263.3	271.4	**1,983.5**
Taxation Payments	53.4	51.9	49.9	46.4	43.3	42.5	43.8	43.3	**374.6**
Fast Track Reward	22.7	22.5	21.3	21.8	21.6	22.0	22.1	22.3	**176.4**
Total - Unprofiled Revenues	**1,256.4**	**1,275.7**	**1,283.3**	**1,309.7**	**1,328.1**	**1,341.5**	**1,301.1**	**1,311.6**	**10,407.4**
Revenue Profiling	1.0	-6.2	-1.2	-14.6	-20.2	-20.6	33.0	35.7	**6.9**
Total - Profiled Revenues	**1,257.4**	**1,269.5**	**1,282.0**	**1,295.1**	**1,308.0**	**1,320.9**	**1,334.1**	**1,347.3**	**10,414.3**

17 Appendices

Appendix A1 - Relationship bank questionnaire

17.1 We have asked 10 of our key relationship banks for feedback on certain aspects of our Business Plan, especially in relation to the cost of debt.

17.2 These banks not only assist us in market debt issuance but they also provide committed bank facilities to us that can be used on a daily basis to provide short term funding between bond issuances..

17.3 These organisations have a diverse range of experts that deal with debt markets on a daily basis, review credit ratings and assess companies' creditworthiness as well as having excellent understanding of other financial instruments such as derivatives.

17.4 It is therefore useful to gain this additional insight to help gain assurance over the robustness of our financial assumptions.

17.5 The questionnaire used can be downloaded from the WPD website using this link http://www.westernpower.co.uk/docs/About-us/Stakeholder-information/Our-future-business-plan/Supporting-Financing-plan/Bank-investor-questionnaire.aspx

Appendix A2 – Key bond investor questionnaire

17.6 In additional to the relationship bank questionnaire we have also undertaken non-deal roadshows in both London and Edinburgh to engage with our bond investors.

17.7 Many of these investors have already invested in WPD debt but we wanted to share our thoughts on RIIO-ED1 with them and then ask for feedback in the form of this questionnaire.

17.8 As this group of stakeholders will be important in the financing of the business their answers have helped to refine the financing plan.

17.9 The questionnaire used can be downloaded from the WPD website using this link http://www.westernpower.co.uk/docs/About-us/Stakeholder-information/Our-future-business-plan/Supporting-Financing-plan/Bond-investor-questionnaire.aspx

Appendix A3 – Relationship bank questionnaire responses

17.10 A summary of the responses received from our relationship banks are given in this document.

17.11 Where common answers have been given they have been collated.

17.12 All answers are shown on a no names basis. http://www.westernpower.co.uk/docs/About-us/Stakeholder-information/Our-future-business-plan/Supporting-Financing-plan/Bank-investor-responses.aspx

Appendix A4 – Key bond investor questionnaire responses

17.13 A summary of the responses received from our relationship banks are given in this document.

17.14 Where common answers have been given they have been collated.

17.15 All answers are shown on a no names basis. http://www.westernpower.co.uk/docs/About-us/Stakeholder-information/Our-future-business-plan/Supporting-Financing-plan/Bond-investor-responses.aspx

Appendix A5 - Credit rating agency methodologies

17.16 This appendix contains details of how the three key credit rating agencies, Moody's, Standard and Poor's and Fitch rate corporate organisations such as WPD. Details are given as to both the qualitative and the quantitative analysis that is performed and details of any key financial ratios that are used to help derive the credit ratings of the business they are rating. Where available, details of the methods used to rate WPD specifically are given.

17.17 A grid is provided at the end of the appendix that provides details how the agency's individual ratings can be aligned.

Moody's methodology

17.18 Moody's use four factors in order to determine the credit rating of a company. These factors all receive a different weighting.

- Regulatory environment and asset ownership model (40%)
- Efficiency and execution risk (10%)
- Stability of business model and financial structure (10%)
- Key credit metrics (40%)

Regulatory environment and asset ownership model

17.19 Under the first factor Moody's scores the UK regulatory environment in the Aaa rating category because it is well-established and transparent. Moody's consider that Ofgem has a track record of taking sophisticated and iterative approach including shared financial models. Reflecting the characteristics of the UK electricity distribution sector, where direct ownership of network assets is under licence, DNOs, such as the WPD ones, map to the Aa rating category under the 'Asset Ownership Model' sub-factor.

17.20 Moody's state that under the regulatory framework, DNOs are subject to efficiency targets during the period of the price control and hence map to the A rating category for the Moody's sub-factor 'Cost and Investment Recovery'. Revenue risk is scored Aa as DNOs have very limited exposure to volumes of electricity distributed, with charges able to be adjusted to reflect any over or under-recovery of revenue in later years.

Efficiency and execution risk

17.21 For the second factor Moody's recognise that South wales and the South West have strong operational performance and are ranked higher versus their peers and are part of one of the best groups for cost efficiency. For these businesses Moody's score them in the A rating category. For East Midlands and West Midlands Moody's score these DNOs as Baa, due to

their historic performance. Moody's do however recognise that these networks will benefit from the various synergies and relative efficiency of the wider WPD group.

17.22 In the Moody's sub-category of 'Scale and Complexity of Capital Programme', they map the WPD DNOs to the Ba rating, based upon the expected investment programmes.

Stability of business model and financial structure

17.23 Under the third factor Moody's consider that all four DNOs map to the A rating category under the sub-factor 'Ability and Willingness to Pursue Opportunistic Corporate Activity'. This is because the companies are simple with a single purpose and are focused solely on their core regulated activities of managing and operating the electricity distribution network. In addition, Moody's state that the various regulatory ring-fence provisions offer additional creditor protection. Based upon the expectation that licensees will maintain a conservative financial policy and leverage consistent with the level implied in the allowed return set by the regulator, Moody's assign a Baa rating for the 'Ability and Willingness to Increase leverage' sub-factor for the DNOs. Finally for this category Moody's score the WPD DNOs at Aa for the 'Targeted Proportion of Operating Profit Outside of Core Regulated Activities' sub-factor, given the regulator ring fence provisions limit the level of de-minimis activities.

Key credit metrics

17.24 The final factor is the Key Credit Metrics. In assessing the financial risk of a UK regulated distribution company, Moody's focuses on a number of key ratios including net debt: RAV and the adjusted interest cover ratio (PMICR). This is a Moody's calculation to measure interest cover after deducting RAV depreciation from funds from operations ("FFO"). The gearing levels at WPD's four licenced entities is in the low 60%s or lower which means that the companies are well positioned compared to Moody's expectation for the Baa1 rating category.

17.25 Moody's credit ratio tests for different credit rating levels are shown below:

Rating sub-factor	A	Baa	Ba
3yr adjusted Interest Cover Ratio OR 3yr FFO Interest Cover	≥2.0x –4.0x OR ≥3.5x – 5.0x	≥1.4x – 2.0x OR ≥2.5x – 3.5x	≥1.1x – 1.4x OR >1.5x – 2.5x
3yr Debt/RAV	>45 – 60%	>60 – 75%	>75 – 90%
3yr FFO/Net Debt	≥12 – 20%	≥8 – 12%	≥4 – 8 %
3yr RCF/Capex	≥1.5 – 2.5x	≥1.0 – 1.5x	≥0.5 – 1.0x

(3yr is the average over a three year period)

Standard and Poor's

17.26 Standard & Poor's Ratings Services employs credit analysis, supplemented by quantitative models as appropriate. The analysis follows a systematic framework, called the 'Rating Methodology Profile' tailored to the type of company. Business risk and financial risk are the main elements of corporate and financial institution analysis.

17.27 When assessing business risk, the analysis commonly includes country risk, industry characteristics, competitive position, cost efficiency, and profitability relative to peers. Industry characteristics typically encompass growth prospects, volatility, and technological change, as well as the degree and nature of competition. An organisation's strategy, operational effectiveness, and financial risk tolerance will shape its competitiveness in the marketplace and the strength of its financial profile. Risk management is an increasingly important analytical factor in the financial services sector. Credit, market, and trading risks are assessed. Standard

& Poor's Ratings Services attaches great importance to management's philosophies and policies concerning financial risk.

17.28 Financial risk analysis begins with an evaluation of the firm's accounting principles employed, particularly any unusual practices or underlying assumptions. Key financial indicators generally fall into the following categories: profitability, leverage, cash flow adequacy, liquidity, and financial flexibility. For financial institutions and insurers, critical factors are asset quality, reserves for losses, asset/liability management, and capital adequacy. The specific ratios analysed vary by industry and may include profit margins, return on investment, debt/capital, debt/cash flow, and debt service coverage. Cash flow analysis and liquidity assume heightened significance for firms with speculative-grade ratings ('BB+' and lower). Trends over time and peer comparisons are evaluated.

17.29 Rating Methodology Profile categories may be scored, but there is no precise formula for combining the scores to produce ratings. The analytical variables are interrelated and the weights are not fixed. A company's business-risk profile determines the level of financial risk appropriate for any rating category. A well-positioned firm can tolerate greater financial risk, for a given rating, than a poorly positioned organisation. Two firms with identical financial metrics may be rated very differently to the extent their business challenges and prospects differ.

17.30 The combined risk profile ratings are showing below:

Business and Financial Risk Profile Matrix						
Business Risk Profile	Financial Risk Profile					
	Minimal	Modest	Intermediate	Significant	Aggressive	Highly Leveraged
Excellent	AAA	AA	A	A-	BBB	--
Strong	AA	A	A-	BBB	BB	BB-
Satisfactory	A-	BBB+	BBB	BB+	BB-	B+
Fair	--	BBB-	BB+	BB	BB-	B
Weak	--	--	BB	BB-	B+	B-
Vulnerable	--	--	--	B+	B	CCC+

17.31 These rating outcomes are shown for guidance purposes only. Actual rating should be within one notch (rating) of indicated rating outcomes.

17.32 The Business Risk profile of the four WPD DNOs is considered by Standard and Poor's to be in the 'excellent' category. The main support for this being:

- The stability of most of the WPD group's operating revenues.
- A well established and transparent UK regulatory framework.
- Good operating performance, recognised by Ofgem.

17.33 The Financial Risk profile of the four WPD DNOs is considered to be in the aggressive category. This is based upon the below methodology:

Financial Risk Indicative ratios (Corporates)			
	FFO/Debt (%)	**Debt/EBITDA (x)**	**Debt/Capital (%)**
Minimal	>60%	<1.5	<25%
Modest	45% - 60%	1.5 – 2.0	25% - 35%
Intermediate	30% - 45%	2.0 – 3.0	35% - 45%
Significant	20% - 30%	3.0 – 4.0	45% - 50%
Aggressive	12% - 20%	4.0 – 5.0	50% - 60%
Highly Leveraged	<12%	>5.0	>60%

Fitch

17.34 For Fitch, the two core measures for electricity distribution networks are PMICR and Debt/regulated capital. The ranges of these two measures for different credit ratings are shown below:

Issue Default Rating	Senior Unsecure Rating	Expected Ratio
A-	A	Adjusted PMICR > 1.9x, Debt/RCV <60%
BBB+	A-	Adjusted PMICR 1.6x - 1.9x, Debt/RCV 60%-75%
BBB	BBB+	Adjusted PMICR 1.4x - 1.6x, Debt/RCV 75%-85%
BBB-	BBB	Adjusted PMICR 1.3x - 1.4x, Debt/RCV 85%-90%

Credit Rating Grid

Moody's		S&P		Fitch		
Long-term	Short-term	Long-term	Short-term	Long-term	Short-term	
Aaa	P-1	AAA	A-1+	AAA	F1+	Prime
Aa1		AA+		AA+		High grade
Aa2		AA		AA		
Aa3		AA-		AA-		
A1		A+	A-1	A+	F1	Upper medium grade
A3	P-2	A-	A-2	A-	F2	
Baa1		BBB+		BBB+		Lower medium grade
Baa2	P-3	BBB	A-3	BBB	F3	
Baa3		BBB-		BBB-		
Ba1	Not prime	BB+	B	BB+	B	Non-investment grade speculative
Ba2		BB		BB		
Ba3		BB-		BB-		
B1		B+		B+		Highly speculative
B2		B		B		
B3		B-		B-		
Caa1		CCC+	C	CCC	C	Substantial risks
Caa2		CCC				Extremely speculative
Caa3		CCC-				In default with little prospect for recovery
Ca		CC				
		C				
C		D	/	DDD	/	In default
/				DD		
/				D		

Targeted credit ratings

Appendix A6 – Risk modelling scenario outputs

17.35 WPD asked NERA Economic Consulting to perform financial risk modelling.

17.36 Numerous financial scenarios were created for the four DNOs and then these were reviewed under different regulatory parameters such as amending the cost of equity, changing the profile of asset lives, amending the gearing or altering the capitalisation rate.

17.37 The output from these scenarios were in the form of key credit rating metrics shown graphically and measured against the standards expected from the credit rating agencies to be comfortably investment grade.

17.38 This analysis has provided us guidance as to which regulatory parameters would allow us to maintain our investment grade credit ratings without introducing financial inefficiency that would impact the cost to customers.

17.39 The NERA presentation of the risk modelling scenario outputs can be downloaded from the WPD website using this link http://www.westernpower.co.uk/docs/About-us/Stakeholder-information/Our-future-business-plan/Supporting-Financing-plan/NERA-Risk-Modelling-Outputs.aspx

Appendix A7 – WPD risk exposure under the RIIO-ED1 regulatory framework

17.40 This appendix describes the assumptions used to assess WPD's risk exposure under the RIIO-ED1regulatory framework. It describes the statistical distributions of the risk factors that have been simulated and how they feed through into each of the WPD DNO's EBITDA and operating cash flows.

17.41 NERA Economic Consulting undertook this work at the request of WPD. http://www.westernpower.co.uk/docs/About-us/Stakeholder-information/Our-future-business-plan/Supporting-Financing-plan/NERA-WPD-Risk-Exposure-Report.aspx

Appendix A8 – Risk modelling methodology

17.42 Ofgem require DNOs to submit well-justified Business Plans that set out their strategy to manage risks and uncertainties in an efficient way.

17.43 Ofgem also expect DNOs to propose appropriate levels for notional gearing and cost of equity that are consistent with their cash flow risk.

17.44 In order to undertake this risk modelling we engaged NERA Economic Consulting. NERA are recognised specialists familiar with the electricity distribution regulatory framework.

17.45 To perform the work NERA used WPD's cost forecasts and applied Ofgem's proposed regulatory mechanisms to derive statistical distributions for key financeability metrics for the four DNOs. NERA sought input from us in order to create scenarios regarding key regulatory parameters.

17.46 The output from this work has been used as a basis for assessing the overall financeability of the WPD Business Plan.

17.47 The NERA presentation of the risk modelling methodology can be downloaded from the WPD website using this link http://www.westernpower.co.uk/docs/About-us/Stakeholder-

information/Our-future-business-plan/Supporting-Financing-plan/NERA-Modelling-Methodology.aspx

Appendix A9 - Issues associated with the cost of debt allowance

Introduction

17.48 This appendix provides an overview of the key characteristics of the two iBoxx indices that Ofgem propose to use. It shows the diversity of the various A rated and BBB rated businesses that were included in the respective index at 31 March 2013. It also shows the average maturity of the debt within both indices.

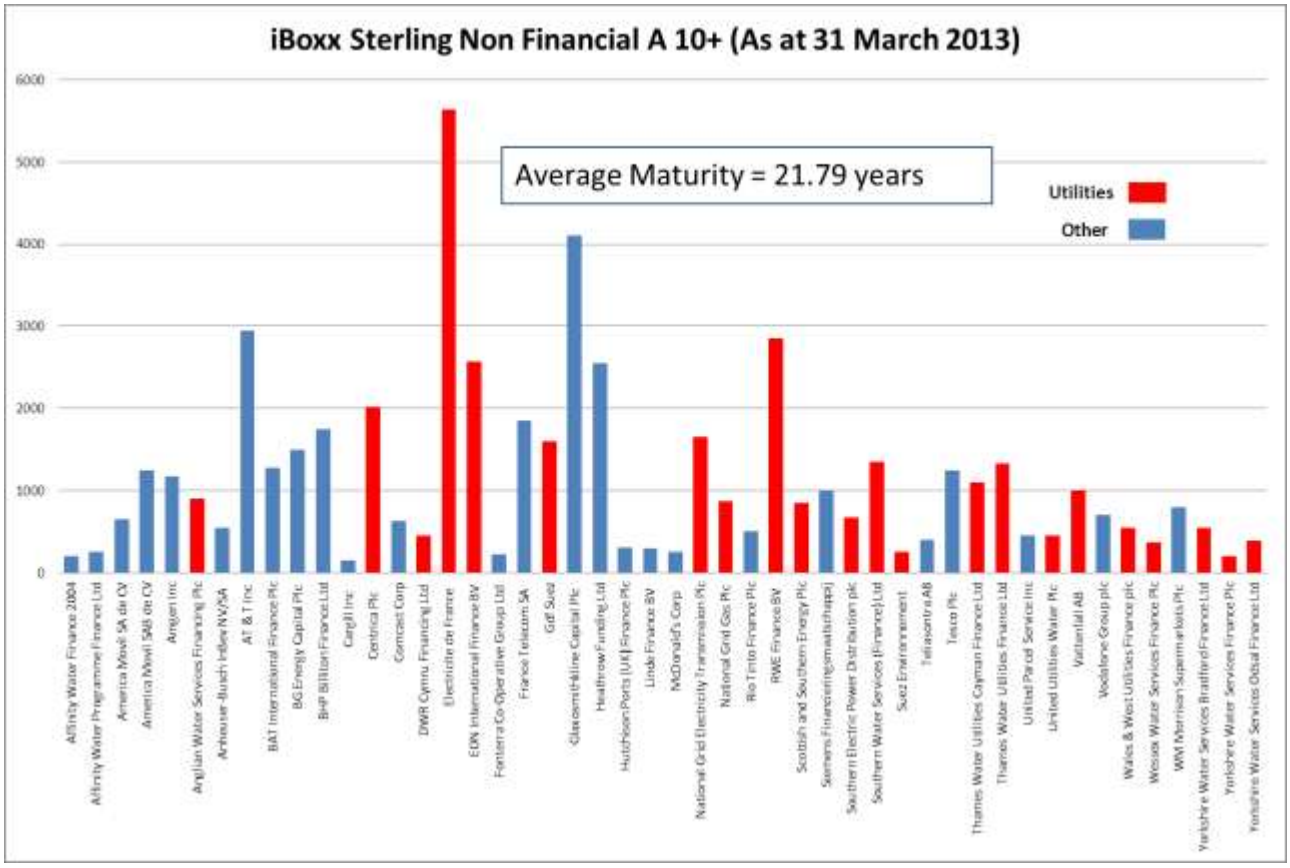
17.49 Details are given as to how the 10 year rolling average used to calculate the cost of debt allowance is derived.

17.50 This appendix also highlights risks that this methodology introduces, such as issuing debt at times of price spikes, or long periods of low rates. Also explained are other risks associated with debt issuance such as interest rate risk, market risk and tenor risk

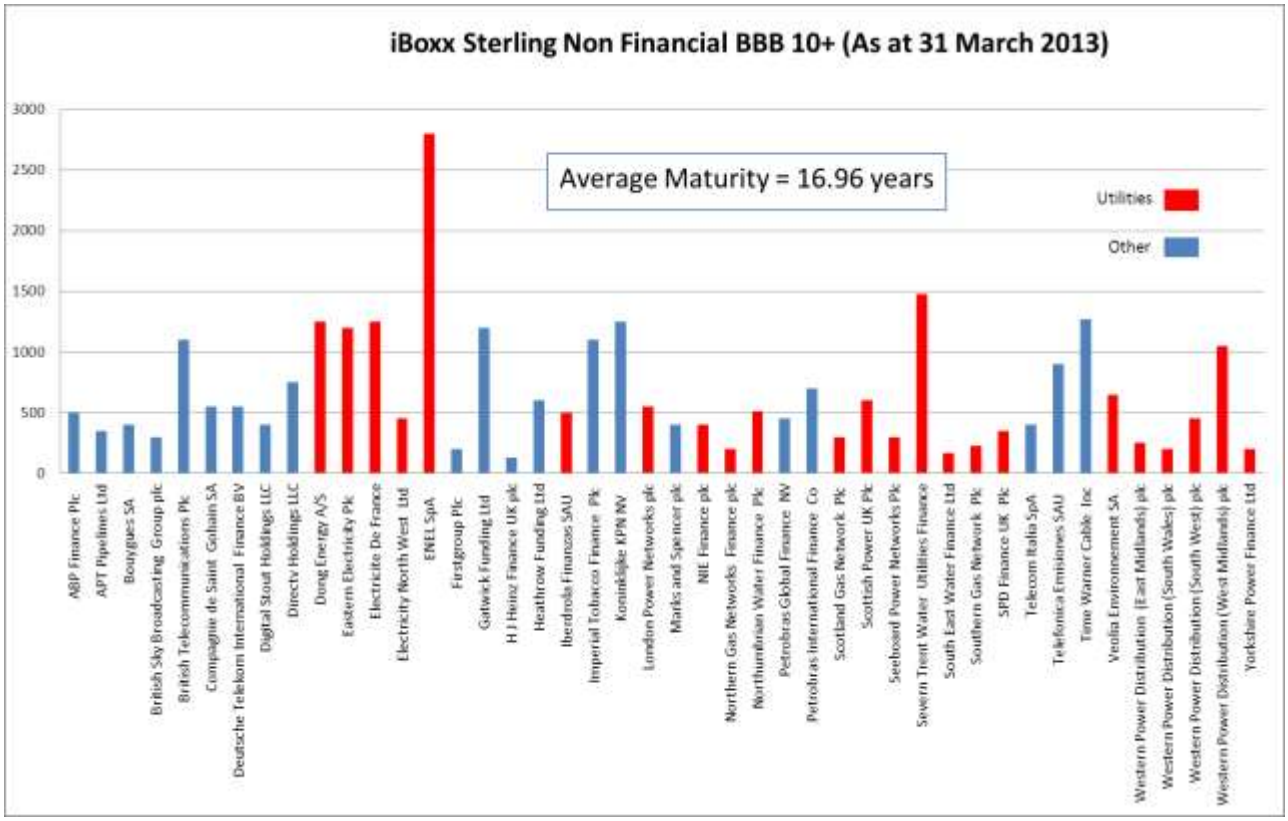
iBoxx indices

17.51 Ofgem have determined that under RIIO-ED1 the cost of debt will be calculated from a 10 year rolling average of real rates that will be determined from the arithmetical average of the iBoxx A rated and BBB rated non-financial indices less the implied 10-year gilt inflation break evens published daily by the Bank of England. The mechanistic nature of the proposal means the removal of one of the controlling elements that is available to the regulator at each price control. The statutory duty to ensure financeability remains, but gearing assumptions and equity return allowances become the only levers to ensure that the duty is met.

17.52 The make-up of the two iBoxx indices as at 31st March 2013 is shown in the following charts.



Source: WPD



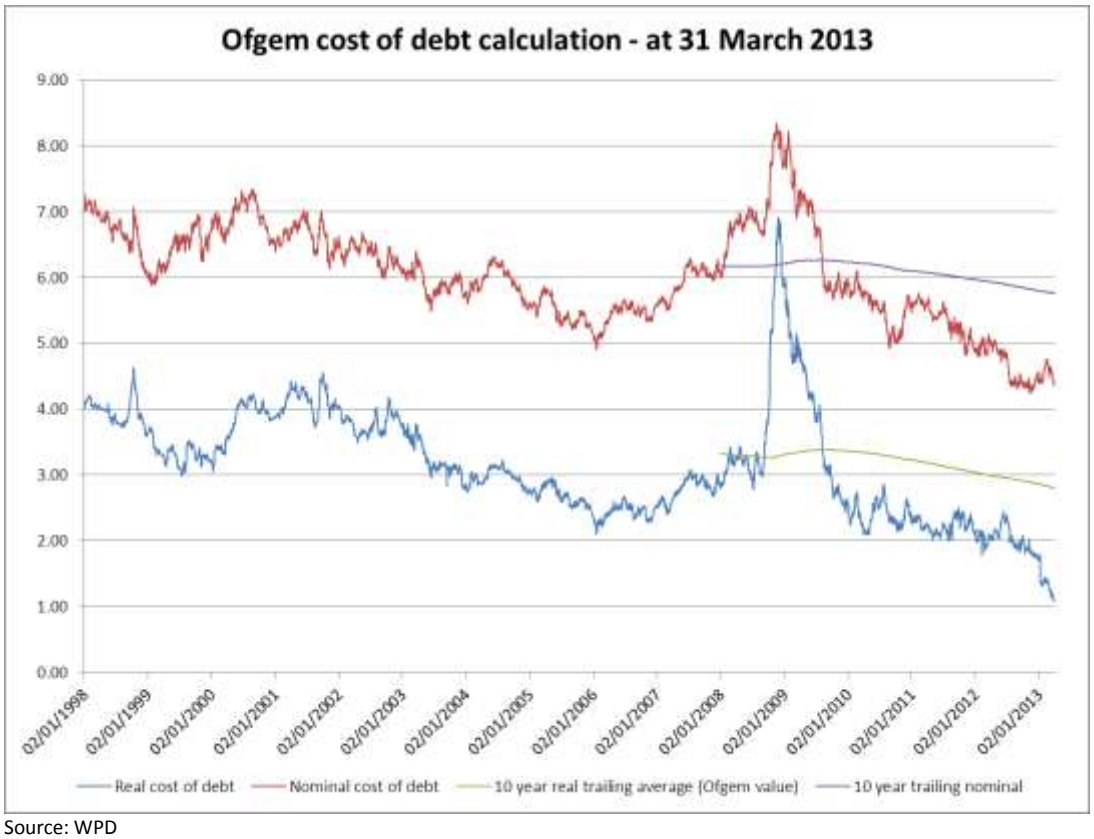
Source: WPD

17.53 The composition of the iBoxx indices will change over time with changes to the underlying corporate profiles. At present utility representation in the indices is approximately 50%. Notwithstanding that uncertainty, the Ofgem methodology should not penalise companies in the long run.

17.54 The proposed index methodology introduces a rolling 10 years of daily price points to be averaged out to generate the nominal cost of debt allowed to be recovered. Logically the match would be to issue 1/2530 (10 years of work days) of a company's debt portfolio on each and every daily setting in the form of 10 year inflation linked debt – this assumes that the cost of debt of the existing portfolio already matches that calculated under RIIO. Clearly this is impractical. The impact of averaging the cost of debt allowance may naturally lead companies to more frequent and smaller quantum issuance of debt and the tenor may be forced to align more with the RIIO-ED1 calculation of 10 years. If this occurs wholesale in the market then investors, who traditionally prefer longer dated debt may expect higher premiums in order to justify them purchasing debt that would not be their preferred choice.

17.55 There is a risk that DNOs lock in significant funding amounts where there are high spikes in rates, an example of which can be seen from the graph below in the 12 month period August 2008 to August 2009.

- If the spike becomes a long term trend, the impact of averaging is that the recovery of such costs will occur, but will take time. If there is a substantial trend higher, coverage ratios may be impacted and ratings at risk.
- Worse still, if the spikes are short lived the impact of averaging means that the company may never fully recover the higher funding costs.



Source: WPD

17.56 The opportunity of benefitting from the downward spikes also exists, but given that rates are currently low, the potential benefits appear to be limited. Also the ability access the market when short term downward spikes occur will create its own financing risk as investors may not wish to purchase debt at such low rates.

17.57 The iBoxx indices do not take account of Index linked bond. These bonds are a useful tool for utilities as they align with revenue streams and regulatory asset growth. However the credit spreads on such bonds have been wider than conventional bond spreads for at least the last 24 months (to March 2013) and are currently some 10 to 20 bps higher. As the index does not capture this extra cost, it will not be included in the creation of the debt allowance.

17.58 Similarly any bonds with maturity duration of less than ten years will also be excluded from the index as will any debt not issued within a sterling market.

17.59 We have investigated the possibility of mimicking Ofgem's cost of debt to establish if WPD could swap the coupon on existing debt obligations so as to match the profile of Ofgem's debt allowances during RIIO-ED1. We have discussed this with our relationship banks and it has proved to be difficult to achieve a necessary high degree of correlation and meet the accounting requirements for derivatives.

17.60 In the absence of workable derivatives the RIIO-ED1 method of calculating debt allowances therefore could incentivise DNOs to issue an average of 10% of their forecast debt level each year in order to minimise risk. The costs of redemption make such an approach too expensive to refinance existing debt prior to maturity.

17.61 We have assumed that going forward financing will be spread as evenly across RIIO-ED1 as we can. The WPD proposal is to issue benchmark bonds, preferably in the sterling arena, and then potentially tapping these as required. Existing committed bank facilities will be used to cover any shortfall in financing in intervening periods between debt issuance and also if market timing is not appropriate. Alongside this proposal we would seek to enter into interest rate swaps in order to provide a higher degree of certainty of debt cost and also to be able to take advantage of favourable movements in the market prior to actual debt issuance.

17.62 This approach offers a simple and transparent methodology. Any additional issuance costs incurred via this process should be minimal. Also this approach allows us to manage our portfolio without being locked into a complex financing structure.

17.63 The above proposed approach should assist in mitigating some of the risks that the RIIO-ED1 cost of debt calculation introduces, as can be seen below.

17.64 **Interest rate risk.** To the extent that interest rates remain low, historically issued debt will become relatively expensive, particularly once the higher historical settings drop out of the index. Should interest rates rise dramatically causing debt costs to rise, the rolling average mechanism within the allowed cost of debt means that it will take a period of time before the rolling average rises sufficiently to recoup these higher borrowing costs. (Ofgem refer to this as embedded debt costs.)

17.65 **Market timing risk.** There is increased market timing risk of future issuances – to the extent that a bond pricing takes place at a time when rates are relatively high before falling again. The index is unlikely to reflect this higher cost of funding.

17.66 **Curve risk.** To the extent that issuance is longer than 10 years, the interest rate environment prevalent at the time of issuance will fall out of the index after 10 years leaving WPD at risk to the rolling average being different to the historic cost of debt.

17.67 **Tenor risk**. The iBoxx indices underlying the cost of debt currently have an average life of 22 and 17 years respectively; the implied inflation and rolling average is 10 years. There is a risk that in order to align with the RIIO-ED1 cost of debt the tenor of debt issued does not align with the requirements of the investor and/or company.

17.68 **Index setting risk.** The index is observed on a spot starting basis, but applied with a lag effect. The lag effect will even out over time, but may cause intra year volatility to those strategies that attempt to replicate a spot setting index.

Appendix A10 – Cost of debt modelling under Ofgem's RIIO-ED1 method

17.69 NERA Economic Consulting undertook a preliminary assessment of the cost of debt modelling under Ofgem's RIIO-ED1 method.

17.70 NERA's modelling uses both historic and forecast information to assess where the allowed cost of debt could move to during the RIIO-ED1 period and how this would impact WPD from both our existing debt portfolio as well as future debt issuances.

17.71 The NERA presentation on their view of the Ofgem method and the impact that this would have on the WPD can be downloaded from the WPD website using this link http://www.westernpower.co.uk/docs/About-us/Stakeholder-information/Our-future-business-plan/Supporting-Financing-plan/NERA-Cost-of-Debt-Modeling.aspx

Appendix A11 – WPD's cost of debt under Ofgem's RIIO-ED1 method

17.72 NERA Economic Consulting has looked at the Ofgem's proposal for a Weighted Cost of Debt Index i.e. the iBoxx index. They have considered the iBoxx index against other measures and concluded as to their usefulness.

17.73 NERA have looked at the 10 year trailing average method and compared it to the actual firms financing costs that are made up of existing embedded debt as well as the cost of future debt.

17.74 They have considered a 5 year trailing average and also a Capex/RAV weighted average to assess how reasonable the 10 year training average method actually is in comparison.

17.75 The NERA presentation on WPD's cost of debt can be downloaded from the WPD website using this link http://www.westernpower.co.uk/docs/About-us/Stakeholder-information/Our-future-business-plan/Supporting-Financing-plan/NERA-Weighted-cost-of-debt-index.aspx

Appendix A12 – Ofgem's estimate of the "Halo Effect"

17.76 NERA Economic Consulting have assessed the so called 'Halo Effect' and how they believe Ofgem has considered it to work (it is considered that utility companies benefit from a market bias, or 'halo', that allows them to issue debt more cheaply than the other similarly rated corporates and therefore justifies not allowing for issuance costs to be included in the cost of debt calculation.)

17.77 The NERA presentation on their view of the Halo Effect can be downloaded from the WPD website using this link http://www.westernpower.co.uk/docs/About-us/Stakeholder-information/Our-future-business-plan/Supporting-Financing-plan/NERA-Analysis-of-Ofgem-s-Halo-Effect.aspx

Appendix A13 – Cost of capital estimation for RIIO-ED1

17.78 NERA Economic Consulting undertook initial estimates and issues facing WPD under the RIIO-ED1 methodology for cost of capital.

17.79 NERA have looked at the various regulatory precedents such as DPCR5, RIIO-GD1 and RIIO-T1. They have also looked at empirical market evidence of the various values used within the proposed cost of capital calculations.

17.80 The analysis assesses the various elements of the cost of capital: the risk free rate; the equity risk premium; the beta of the industry and also the gearing, and then combines these values to calculate an applicable cost of capital.

17.81 The NERA presentation on their view of cost of capital can be downloaded from the WPD website using this link http://www.westernpower.co.uk/docs/About-us/Stakeholder-information/Our-future-business-plan/Supporting-Financing-plan/NERA-Cost-of-Capital-Estimation.aspx

Appendix A14 – Cost of equity (conversion of an asset beta to an equity beta)

17.82 A beta is the measure of the volatility, or systematic risk, of a security of portfolio in comparison to the market as a whole. This is often used in capital pricing models, with a beta of 1 representing a portfolio with the same risk as the market, less than one being less risky and greater than 1 being more risky.

17.83 The asset beta is the beta value that is dependent only on the assets of the company. The asset beta should remain the same no matter what the company's level of debt is. If a firm had no debt then the equity beta should be the same as the asset beta. As a company with no debt is considered less risky (and beta is a measure of risk) then the asset beta will always be less than the equity beta. This is because the equity beta takes the level of debt of the company into account.

17.84 Often the asset beta is shown; however for the Ofgem cost of capital calculation an equity beta is required.

17.85 NERA Economic Consulting carried out analysis on the cost of equity and their report can be downloaded from the WPD website using this link http://www.westernpower.co.uk/docs/About-us/Stakeholder-information/Our-future-business-plan/Supporting-Financing-plan/NERA-Cost-of-Capital-Estimation.aspx

Conversion of asset beta to equity beta

17.86 We have used the Miller formula: $ß_{Equity} = ß_{Asset} / (1\text{-gearing})$ as specified in Miller (1977) for getting from the asset beta to the equity beta.

17.87 Technically speaking, the asset beta can be defined as the weighted average of an equity beta and a debt beta. The full formula is:

$ß_{Asset} = ß_{Equity} * \text{Equity}/ (\text{Equity}+\text{Debt}) + ß\text{Debt} * \text{Debt}/ (\text{Equity}+\text{Debt})$.

17.88 However, the conventional approach is to assume that the return on debt carries no market risk, i.e. $ß_{Debt} = 0$ and we can rewrite the relationship between the unlevered asset beta and equity beta to:

$ß_{Equity} = ß_{Asset}$ / (Equity/(Equity+Debt)

17.89 or simply:

$ß_{Equity} = ß_{Asset}$ / (1-gearing) where gearing is defined as Debt/ (Equity+Debt).

Appendix A15 – Inter group facility agreement

17.90 This document is the agreement between the various WPD companies (including the DNOs) for use of common bank and treasury facilities in order to ensure compliance with our licence conditions. http://www.westernpower.co.uk/docs/About-us/Stakeholder-information/Our-future-business-plan/Supporting-Financing-plan/WPD-Inter-company-Policy.aspx

Appendix A16 – Inter company policy

17.91 This document outlines the WPD group policy on how inter-business loans are set-up and reported. This policy also represents best practise for all inter business loans or similar agreements to ensure consistent regulatory, accounting and taxation treatment. http://www.westernpower.co.uk/docs/About-us/Stakeholder-information/Our-future-business-plan/Supporting-Financing-plan/WPD-Inter-company-Policy.aspx

Appendix A17 – Business rate assumptions

17.92 Gerald Eve, a partnership of chartered surveyors and property consultants, provided WPD with a forecast business rate report. This report has been used as the basis for calculating the amount of business rates that will be payable by the 4 WPD DNOs up to and during the RIIO-ED1 period.

17.93 The Gerald Eve report can be downloaded from the WPD website using this link http://www.westernpower.co.uk/docs/About-us/Stakeholder-information/Our-future-business-plan/Supporting-Financing-plan/Business-Rates-Assumption.aspx

Appendix A18 – Updated valuation of the WPD Group Electricity Supply Pension Scheme (ESPS)

17.94 This report has been prepared by AON Hewitt, the WPD Pension scheme's actuary. The purpose of this report is to provide an approximate update of the funding position of the Western Power Distribution Group of the Electricity Supply Pension Scheme (the "WPD Group") as at 31 December 2012.

17.95 This report was commissioned by the pension fund trustees and includes information that Ofgem requires in line with the PDAM which is set out in Ofgem's Pension Regulatory Instructions and Guidance dated 12 April 2013.

17.96 The Aon Hewitt report can be downloaded from the WPD website using this link http://www.westernpower.co.uk/docs/About-us/Stakeholder-information/Our-future-business-plan/Supporting-Financing-plan/WPD-Group-of-the-ESPS-Updated-Valuation-as-at-31st.aspx

Appendix A19 – Updated valuation of the CN Group Electricity Supply Pension Scheme (ESPS)

17.97 This report has been prepared by AON Hewitt, the WPD Pension scheme's actuary. The purpose of this report is to provide an approximate update of the funding position of the Central Networks Group of the Electricity Supply Pension Scheme (the "CN Group") as at 31 December 2012.

17.98 This report was commissioned by the pension fund trustees and includes information that Ofgem requires in line with the PDAM which is set out in Ofgem's Pension Regulatory Instructions and Guidance dated 12 April 2013.

17.99 The Aon Hewitt report can be downloaded from the WPD website using this link http://www.westernpower.co.uk/docs/About-us/Stakeholder-information/Our-future-business-plan/Supporting-Financing-plan/CN-Group-of-the-ESPS-Updated-Valuation-as-at-31st.aspx

Appendix A20 – The WPD Group ESPS Statement of Funding Principles

17.100 This document provides details of the statement that ensures that the WPD ESPS Group Trustee meet their statutory objective under section 222 of the Pensions Act 2004.The statutory funding objective is to have sufficient and appropriate assets to cover the Group's technical provisions. These technical provisions are the amounts that will be needed to pay the Group benefits that relate to service up to the valuation date, if the assumptions made are borne out in practice.

17.101 The statement was prepared by the Group Trustee of the Western Power Distribution Group of the Electricity Supply Pension Scheme after obtaining advice for the Scheme Actuary.

17.102 The Aon Hewitt report can be downloaded from the WPD website using this link http://www.westernpower.co.uk/docs/About-us/Stakeholder-information/Our-future-business-plan/Supporting-Financing-plan/WPD-Group-of-the-ESPS-Statement-of-Funding-Princip.aspx

Appendix A21 – The CN Group ESPS Statement of Funding Principles

17.103 This document provides details of the statement that ensures that the CN ESPS Group Trustee meet their statutory objective under s.222 of the Pensions Act 2004.The statutory funding objective is to have sufficient and appropriate assets to covers the Group's technical provisions. These technical provisions are the amounts that will be needed to pay the Group benefits that relate to service up to the valuation date, if the assumptions made are borne out in practice.

17.104 The statement was prepared by the Group Trustee of the Central Networks Group of the Electricity Supply Pension Scheme (ESPS) after obtaining advice for the Scheme Actuary,

17.105 The Aon Hewitt report can be downloaded from the WPD website using this link http://www.westernpower.co.uk/docs/About-us/Stakeholder-information/Our-future-business-plan/Supporting-Financing-plan/CN-Group-of-the-ESPS-Statement-of-Funding-Principl.aspx

Appendix A22 – Inputs for the WPD ESPS Group Pensions Deficit Allocation Methodology

17.106 This document has been prepared for WPD by AON Hewitt, who are the Scheme Actuary of the WPD Group of the Electricity Supply Pension Scheme (ESPS). The document sets out the approach taken to produce the inputs required by Ofgem's Pensions Deficit Allocation Methodology (PDAM) following the Updated Valuation as at 31 December 2012.

17.107 The Aon Hewitt report can be downloaded from the WPD website using this link http://www.westernpower.co.uk/docs/About-us/Stakeholder-information/Our-future-business-plan/Supporting-Financing-plan/WPD-Group-of-the-ESPS-PDAM-Report-as-at-31st-Decem.aspx

Appendix A23 – Inputs for CN Group ESPS Pensions Deficit Allocation Methodology

17.108 This document has been prepared for WPD by AON Hewitt, who are the Scheme Actuary of the CN Group of the Electricity Supply Pension Scheme (ESPS). The document sets out the approach taken to produce the inputs required by Ofgem's Pensions Deficit Allocation Methodology (PDAM) following the Updated Valuation as at 31 December 2012.

17.109 The Aon Hewitt report can be downloaded from the WPD website using this link http://www.westernpower.co.uk/docs/About-us/Stakeholder-information/Our-future-business-plan/Supporting-Financing-plan/CN-Group-of-the-ESPS-PDAM-Report-as-at-31st-Decemb.aspx

2015-2023

RIIO-ED1 **BUSINESS PLAN**

SA-08 Supplementary Annex – Business Performance, Efficiency and Benchmarking

June 2013 (Updated April 2014)

WESTERN POWER DISTRIBUTION

Serving the Midlands, South West and Wales

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1 Introduction

1.1 This document is a supplementary annex to the Western Power Distribution (WPD) Business Plan for the eight year period from 1st April 2015 to 31st March 2023.

1.2 It describes WPD's record of operational performance and customer service compared to other companies in the sector. We then describe the day to day arrangements for managing business efficiently. Finally, we set out of the results of the cost benchmarking we have done. In short we start with comparative outputs, and then ensure that costs we have included in the Business Plan to maintain and improve that level of performance have been and continue to be efficient. The document relates to efficiency across the four WPD distribution licences of West Midlands, East Midlands, South Wales and South West.

1.3 The eight year period aligns with the next regulatory price control review period, known as RIIO-ED1; the first for electricity distribution to be determined using Ofgem's Revenue = Incentives, Innovation and Outputs framework. The Business Plan, supplementary annexes, detailed cost tables and financial models form the submission under RIIO-ED1 to the regulator Ofgem (Office for Gas and Electricity Markets), who will use the information to determine allowed revenues.

Structure of this document

1.4 We appreciate that the readers of the WPD Business Plan suite of documents will range from regulatory experts and well informed stakeholders through to new customers who may have had little previous knowledge of WPD.

1.5 This document is aimed at readers who require a more detailed understanding of the efficiency of our business. A less detailed description can be found in the main Business Plan Overview document.

1.6 This document is subdivided into the following sections:

Chapter	Title	Content
2	**WPD's performance**	A brief description of the key regulatory measures of performances, comparing WPD's performance to other DNOs.
3	**What makes WPD efficient**	An overview of the organisation structure and business processes that lead to efficiency in WPD.
4	**Cost benchmarking**	An introduction to cost benchmarking and the methods used.
5	**WPD's disaggregated cost model**	An overview of the results from the model developed by WPD to assess costs and cost drivers at a disaggregated level of detail.
6	**Unit cost review by Parsons Brinckerhoff**	An overview of the independent assessment carried out for WPD that compared units costs across a range of activities.
7	**IT costs review**	A summary of the result of an independent assessment of WPD's IT costs carried out by Deloitte LLP.
8	**Summary**	Conclusions that WPD is an efficient business.
Appendices		The appendices provide links to supporting documentation and reports.

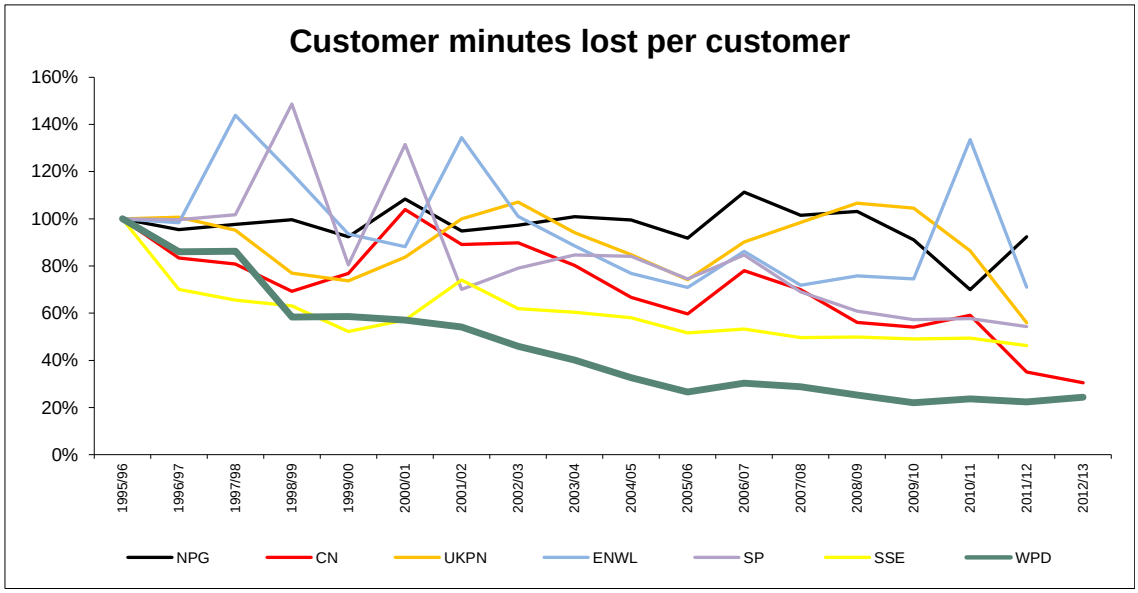
2 WPD's benchmarked performance against Ofgem measures

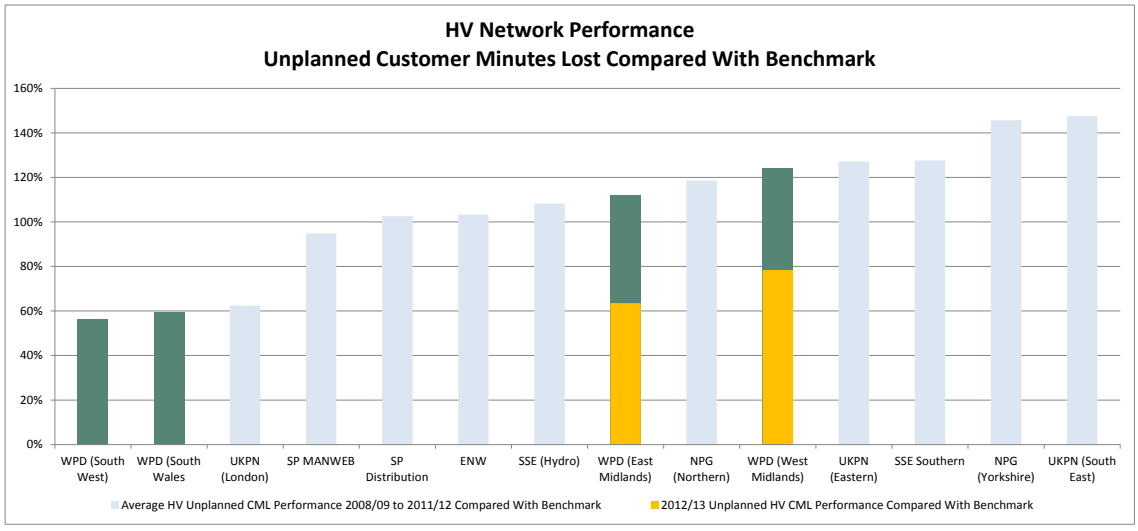
2.1 Efficiency is the measure of how successfully resources are applied to achieve outcomes. An efficient organisation uses the right volume and mix of inputs and fully uses them to maximise its outputs. It is therefore important to start with the outputs.

2.2 Efficiency is usually measured by comparative analysis to similar organisations within the same industry or through comparisons of discrete functions that are deployed at similar sized organisations. Efficiency can also be measured by internal comparative analysis to compare the performance of similar business units. 'Benchmarking' is the process that seeks to rank performance and efficiency based upon comparative analysis.

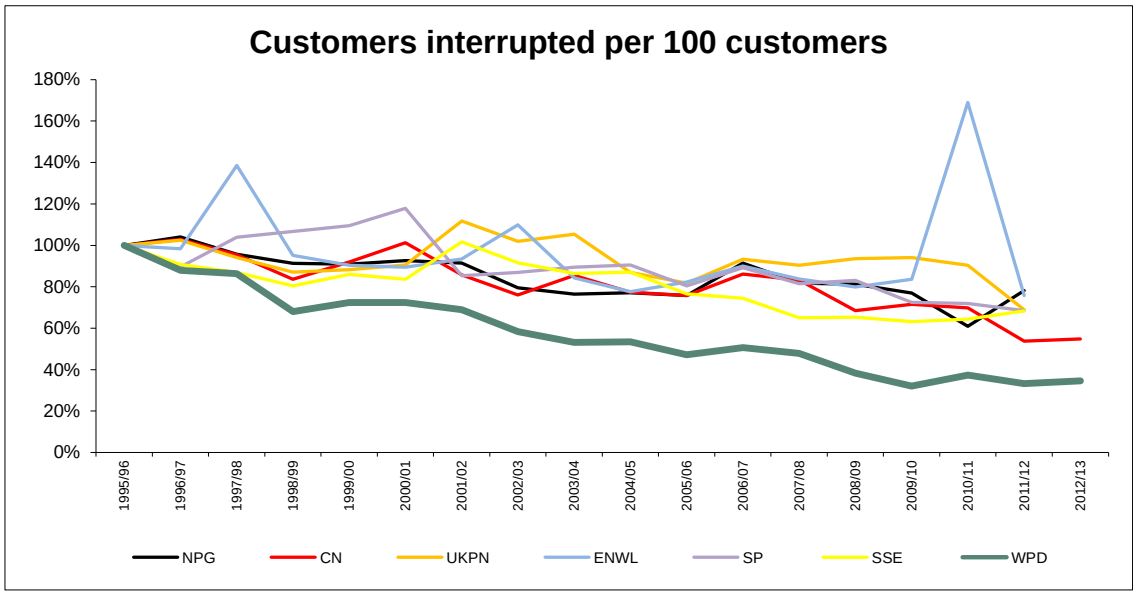
2.3 Ofgem's key measures of performance are Customer Minutes Lost (CMLs) Customer Interruptions (CIs) , The Broad Measure of Customer Satisfaction survey and the number of Guaranteed Standard of Performance failures.

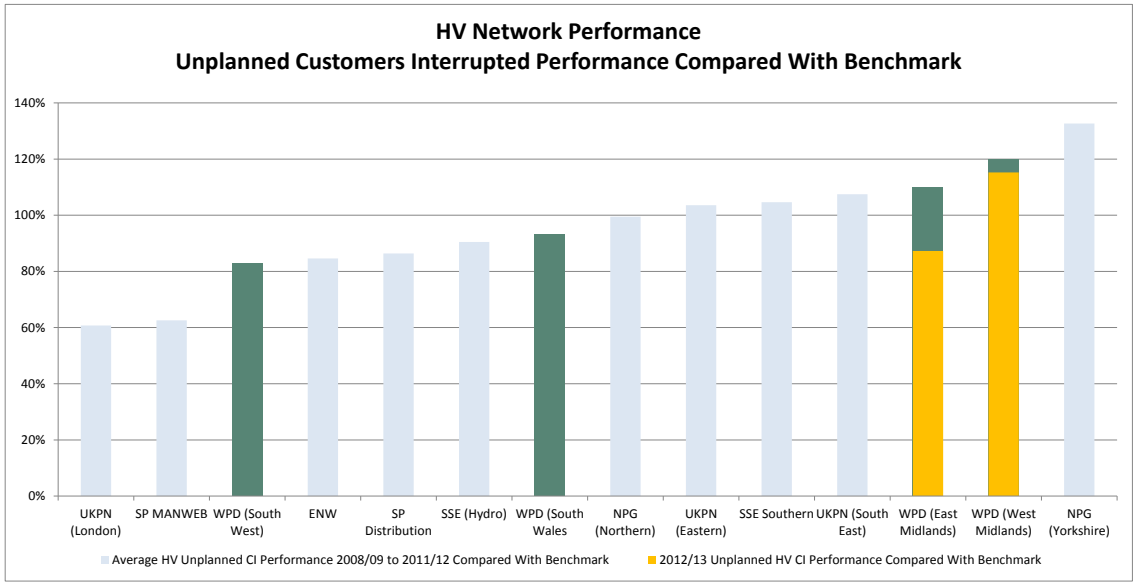
2.4 WPD's record of delivery is second to none. In particular we have the best and the most improved CML performance as can be seen below:



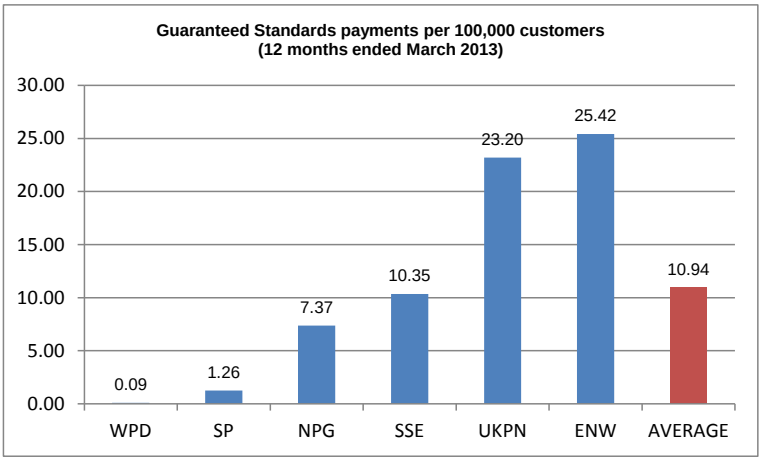


2.5 WPD also has the most improved CI performance and top quartile CI performance in 2012/13 as can be seen from the charts below.



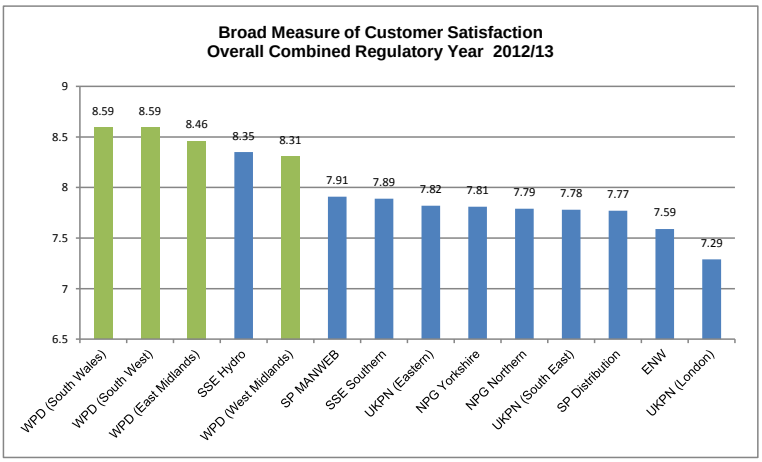


2.6 WPD consistently performs well against the Guaranteed Standards of Performance and has the lowest level of payments per 100,000 customers as demonstrated in our 2012/13 relative performance shown below:

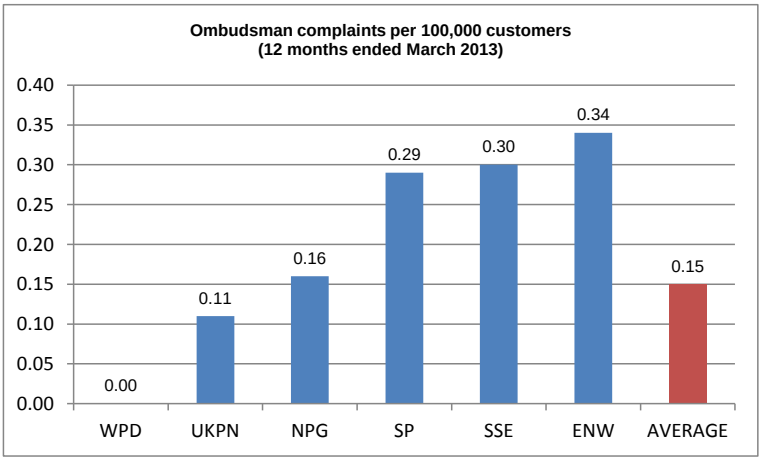


2.7 Our call centres answer at least 99% of call within 20 seconds and have an average speed of answering no supply calls of less than 2 seconds

2.8 This level of performance is reflected in the Broad Measure of Customer Satisfaction survey, whose 2012/13 result is shown below:



2.9 As a result of this level of service WPD has the lowest level of Ombudsman complaints of any DNO group. It is now 8 years since WPD South West or WPD South Wales have had an Ombudsman complaint upheld against them.



3 What makes WPD efficient

3.1 It is important to be able to demonstrate that the costs incurred in producing these exceptional results are efficient.

3.2 Overall the benchmarking (detailed later in this document) has shown WPD to be an efficient business. This affirms our regular analysis and our understanding informed through the acquisition of the two Midlands DNOs.

3.3 It is important to reflect on the underlying reasons for WPD's relative efficiency position to ensure that the successful attributes can continue to be incorporated into our future business plans and strategies.

3.4 Key WPD features that provide efficiency are:

- company culture;
- organisational structure;
- model of insourcing workforce;
- asset acquisition practices.

3.5 As previously stated, in April 2011, WPD acquired the distribution licences for the East Midlands and West Midlands. By December 2011, the businesses had been integrated into the WPD group and were being operated using the WPD business model. Annual cost savings of the merged businesses of £119m were achieved. Below we illustrate how some of the key WPD features and business practices helped us to achieve these savings.

Organisational structure

3.6 WPD operates a low overhead business with a small number of layers of management. There are only three levels between front line staff and the Board. These are team managers (TMs), distribution managers (DMs) and network services managers (NSMs).

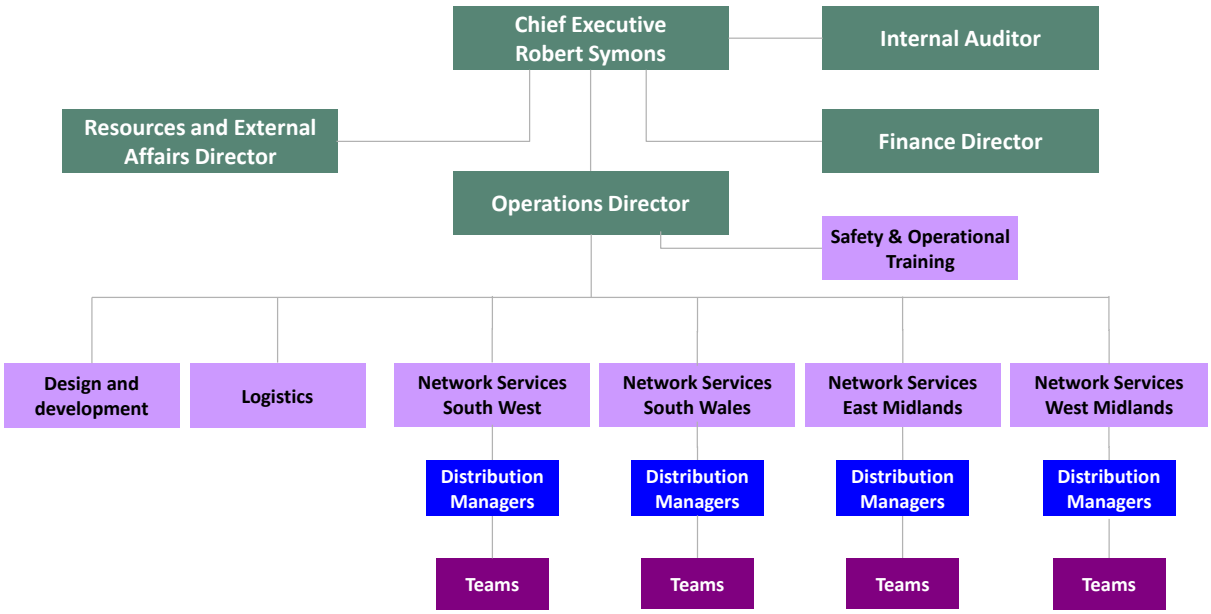
3.7 TMs are responsible for 30 staff on average. They have responsibility for a specific geographical area for day-to-day business operations and their team will include a mixture of staff with different skills including:

- planners who design projects and determine project costs;
- wayleave officers that negotiate rights of way and access onto land;
- technicians that manage the delivery of projects and carry out operational preparation of the network;
- team supports that deal with customer calls and carry out a wide range of administrative duties
- craft staff consisting of overhead linesmen, jointers and fitters who carry out the work.

3.8 Each team is broadly self-sufficient, except where volumes of work dictate that resources are shared between teams. DMs are responsible for a wider geographic area that will have up to 8 TMs and their respective staff. They are responsible for all day-to-day aspects of safety, physical delivery and delivery costs in their areas, along with managing the day-to-day requirements of their depots.

3.9 DMs report to NSMs, of which there are four in WPD, each covering a WPD licence area.

3.10 It should be noted that all levels of management are actively involved in driving network performance and customer services. The structure allows rapid and clear communications between senior management and all staff.



Geographically based teams

3.11 Team responsibilities are organised geographically. This means that all the people required to plan and deliver all the differing work activities in a particular geographic area are part of the same team. This reduces the number of hand-offs that would occur in a functional organisation and speeds up communication. Any queries can also be quickly resolved, for example technicians delivering work can quickly speak to the planners that have designed the projects.

3.12 Locally based teams provide flexibility. At times of severe weather, resources can be directed across areas to assist with fault repair.

3.13 Stores are located close to the workforce. This reduces travel time and aids operational efficiency by focusing skilled resources on the key activities requiring those skills.

3.14 Geographically based teams help to reinforce our corporate values. Teams are responsible for the outputs and customer service delivered within their area. This empowers thinking and helps with the development of innovation and initiatives to achieve our goals.

Delegated personal responsibility

3.15 Staff are encouraged to take personal responsibility. This applies to everything they do. This reduces bureaucracy in the organisation and speeds up decision making. It is an empowering culture which matched with the geographical team structure helps our workforce to see the link between the activities they perform and the outcome achieved in terms of safety, customer service and network performance.

Insourcing

3.16 We use our own staff for the majority of the work that we carry out. This avoids the need to pay management fees and profit margins to contractors or 'Alliance' organisations.

3.17 It also has the benefit of enabling us to retain expertise (and create succession plans) within the company and provides flexibility as we are able to readily redirect staff to resolve issues as they arise.

3.18 Contractors are still used for certain work areas such as tree clearance and excavation activities. These contracts are tightly managed with regular reviews and management action taken as appropriate and are reviewed periodically to assess whether it is still advantageous economically or in respect of customer service to keep them outsourced.

3.19 WPD avoids using turnkey projects i.e. those where complete responsibility for design and build is handed over to third parties. Where specialist skills are required or additional resource are needed to deal with high volumes of work, external resources are used but projects are retained under the control of WPD.

3.20 The Alliance contracts that were previously operated in the Midlands are no longer in place and any direct skilled staff required have been brought into the employment of WPD. Significant savings have been made as a result of this because the previous Alliance structures:

- created duplication of staff (and cost);
- slowed communication and response to business need (affecting delivery);
- caused confusion with respect to understanding who was responsible for what (affecting cost and delivery);
- started to remove the experience and knowledge of staff within the business as the ability to create succession and to pass on relevant information and experience was removed (reducing long term effectiveness).

3.21 By using staff that are part of the business we are able to develop a workforce that reflects our values for safety and customer service delivery. Ideas and innovations to improve our business come from our employees. An outsourcing model would not be able to foster and develop ideas from its frontline workforce. To support this model WPD developed its own 'in-house' apprentice scheme that aims to develop skilled craftsmen who can carry out high quality work. The programme demands that apprentices carry out sufficient repetitions of certain tasks so that they become fully conversant with the requirements.

3.22 Practical work is supplemented by task records that the apprentices use to produce detailed reports for each type of task. Once sufficient tasks are completed, apprentices sit rigorous trade tests before being allowed to progress through the scheme and become craftsmen.

3.23 This thorough approach to training our own craftsmen increases the quality of work that is produced and ensures that training is wholly relevant to the work that they will be performing. This is both efficient and reduces the likelihood of workmanship related failures of assets.

3.24 Overall our insourcing philosophy has contributed significantly to WPD being efficient.

Asset acquisition practices

3.25 It is WPD strategy to specify and purchase assets that:

- are fit for purpose;
- comply with Industry, British and International Standards, where available;
- comply with all relevant statutory and regulatory requirements, in particular in respect of safety of employees and the public and also the environment;
- are, as far as possible, "off the shelf", with the minimum special construction
- achieve the best compromise between reliability, cost and impact on objectives.

3.26 Keeping to standard products and minimising variations has a number of benefits:

- it helps us to drive an efficient product acquisition process through volumes and low overhead procurement cost;
- it enables us to be efficient in associated overheads such as the number of policies supporting the use of equipment or training hours dedicated to equipping employees to deploy the equipment;

- it helps WPD to operate a unified asset management system where the same equipment and techniques are adopted.

3.27 New types of assets are introduced in a controlled manner assessing compliance to standards and only after successful field trials to ensure that they provide the anticipated benefits and minimise risk to safety and reliability.

3.28 We periodically review specifications to ensure they remain current to industry developments. Before entering into fixed term equipment supply contracts we also review the relevant specifications to ensure that we procure the most up to date equipment. Our specifications will have evolving requirements so that equipment with improved functionality or reduced costs can be procured.

3.29 When implementing new systems we consider various alternatives and select those that provide reliability as well as low costs. We do not choose our suppliers simply on price and this is detailed in the procurement practices listed below.

3.30 We aim to award only those contracts that provide the 'most economically advantageous tender' (MEAT). In doing so we consider the performance of a product as well as the best price.

3.31 The process of using MEAT allows us to consider all factors, not just price. The functional capability of the product, on-going support, maintenance and contractual terms and conditions are all factors in the overall 'economical cost' of a product. Focusing on price alone can be more costly in the longer term, especially where low prices are coincident with lower manufacturer liabilities and shorter warranty periods. Using the MEAT approach, all of these things can be taken into consideration to ensure that the best overall value is achieved.

3.32 Tenders are evaluated against pre-set criteria with weightings applied to different elements to gain the right balance between price, technical capability and service level.

Frequent tendering

3.33 Tendering is the most frequently used method of purchasing goods and services throughout WPD.

3.34 The tenders are conducted in accordance with the Utilities Contract Regulations 2006 where appropriate.

3.35 The duration of contracts is set to provide suppliers with a reasonable commitment allowing for better levels of service to be achieved (such as reduced lead times or prices) balanced with ensuring we can return to the market to ensure ongoing competition and take advantage of market developments..

Ensuring competition in the market

3.36 In order to increase competition in the tendering process, we use the Achilles Utilities Vendor Database to source suppliers. In developing a vendor list, we consider a wide range of potential suppliers and include small and medium enterprise in the process to ensure that the competition is open to the wider market. This process can also identify innovative techniques and processes with added value.

3.37 In some cases it is prudent to use the 'Call for Competition' process to increase the number of potential suppliers. This process involves issuing an advertisement in the Official Journal of the European Union detailing the requirement. Interested parties (who subscribe to OJEU and receive notification of upcoming tenders issued by the UK utility sector) are then invited to express their interest, which in turn forms the 'Invitation to tender' list.

Using multiple suppliers

3.38 When contracts are placed for strategic items, they are dual sourced wherever possible and where markets allow. This means that we do not get tied to single suppliers (and higher prices in the long term). It also encourages competition on price and ensures we receive their focus on performance, quality, reliability and customer support.

Volume discounts

3.39 The large scale of the activities we carry out across the four licence areas means that in some cases we are purchasing high volumes of components. This means that we can take advantage of volume discounts. For example we have recently consolidated the types of jointing resin across all 4 WPD DNOs and have been able to achieve negotiated price reductions of some 32% compared to the previous contracts.

Regulatory approval of procurement processes

3.40 Ofgem has given approval to the procurement processes that are to be used for the acquisition of devices and materials for the WPD FlexDGrid LCNF project. The processes for this innovation project are representative of the general procurement processes used in WPD. The WPD submission detailing the processes can be found in appendix A7 and the Ofgem response can be found in appendix A8.

4 Cost benchmarking

4.1 In addition to the Ofgem comparisons of performance WPD routinely uses internal benchmarking statistics to assess relative performance in terms of key inputs and outputs of each DNO licence area and underlying distribution area. Extensive Key Performance Information has been developed and is reviewed monthly by the management team. Where appropriate targets are set and performance management initiatives are pursued to achieve goals.

4.2 Each year WPD uses comparative RRP data to understand its relative efficiency to other DNO groups. This provides the stimulus to scrutinise areas of perceived inefficiency and to look for innovative ways of improving efficiency.

4.3 Further benchmarking work has been performed for RIIO-ED1. The purpose was to confirm our understanding of WPD business efficiency and ensure that the costs we are requesting are set at a business efficient rate.

4.4 The following chapters summarise the benchmarking work performed and the implications of the findings.

Benchmarking methods and results

4.5 For the purposes of regulatory assessment, benchmarking is a process of comparison under which the costs incurred by companies are analysed and compared in order to determine what the right amount of cost to be incurred by each business should be.

4.6 As set out in Ofgem's 'Strategy decisions for the RIIO-ED1 electricity distribution price control - Tools for cost assessment', Ofgem will use a number of methods to assess each company's cost submissions in their business plans.

4.7 The first of the two principal methods is a 'bottom–up' or disaggregated approach. This approach subdivides the business into a number of activities and then compares the cost of each activity by how much work is involved. For example, if 1,000 poles need to be inspected and each pole should cost £10 to inspect then the total cost of inspection should be £10,000. The sum of the predicted costs for all activities is then the total cost allowance for the company.

4.8 The second principal method is the 'top-down' or 'totex' approach. This method takes each company's costs in total and then uses regression and other statistical techniques to determine a comparable efficiency level for each company. This method is described more fully in Frontier Economics' paper attached as Appendix A3.

4.9 A top-down approach uses well known statistical techniques and does not require a view to be taken about what an activity should cost, nor does it require a view to be taken about the volume of work that is to be done. However, crucially, the top-down approach cannot distinguish between a company that spends less because it is efficient and a company that spends less because it has just not done the work that the cost allowances were supposed to cover. Further, given the data available, the statistical techniques used cannot distinguish between costs that vary between companies because of the scale of task driven by the network and costs that vary between companies because of differences in efficiency.

4.10 As set out below, WPD has either used consultants to compare costs across DNOs or across businesses generally, or we have used the bottom-up method to compare costs using shared RRP data.

4.11 We have not relied on top-down benchmarking as we have had detailed analysis undertaken which leads us to conclude that it is unreliable.

4.12 Prof Stan Zachary and Dr. Richard Gibbens have advised that the top-down model developed for RIIO-ED1 is not fit for purpose because there are insufficient data points to enable statistical methods to be of any use. A copy of their report is at Appendix A1. Their conclusion states in relation to the totex approach proposed by Frontier Economics that:

> *"We are of the opinion that, for all the reasons outlined above, an econometric approach to DNO benchmarking is so unreliable as to produce efficiency scores which might almost as well have been randomly generated. We therefore believe that the nature of the problem, and of the available data, is such that the proposed approach is simply not feasible for this purpose."*

4.13 Deloitte LLP also reviewed the Frontier Economics model and have also concluded that the model does not produce reliable results. A copy of their report is at Appendix A2

4.14 In short, there is insufficient data to use statistical techniques to produce reliable conclusions based on totex and if such statistical techniques based on totex are used, the conclusions reached are unreliable.

4.15 WPD developed a cost assessment model that analyses costs at a disaggregated level. This model has since been adopted by Ofgem for use in RIIO-ED1. The model uses Regulatory Reporting Pack (RRP) data as the basis for benchmarking. The model has been shared with all DNOs and discussions undertaken with them during the course of its development. One of the main benefits of the model is that it provides a mechanism to analyse and compare unit costs.

4.16 WPD has taken a proportionate approach to benchmarking to ensure both that the most significant areas are benchmarked or tested and that a significant proportion of total costs have been examined to test their efficiency.

4.17 In particular, the conclusions of the disaggregated model in relation to network investment and maintenance have been confirmed by PB (who reviewed unit costs – Appendix A4).

4.18 Deloitte LLP also benchmarked non-operational IT and telecoms costs (Appendix A5).

5 WPD disaggregated unit cost model

5.1 The disaggregated unit cost model enables unit cost benchmarking at the most detailed level of information contained within the annual Regulatory Reporting Pack (RRP) and covers all totex.

5.2 The inputs to the model are the detailed costs and volumes in the RRP for each DNO.

5.3 The model then calculates the actual unit costs for each activity for each DNO and also the average unit cost for each activity across all DNOs.

5.4 By using the average unit costs multiplied by actual volumes of work in each DNO the model then computes the "predicted cost" for each activity – i.e. what that DNO's costs for each activity would have been had their unit costs been the industry average .

5.5 The model then determines a value of efficiency by comparing actual costs to predicted costs. This is expressed as a percentage so that to the extent that a DNO's costs are greater than 100% of the predicted costs they are inefficient, and to the extent that a DNO's costs are less than 100% of the predicted costs that DNO is efficient.

5.6 Inputs to the model also include an assumption on a level of fixed costs for each activity and the choice of an appropriate cost driver:

- fixed costs do not change with the scale of an activity nor the size of a DNO. For example, network policy is an activity with fixed costs, because engineering policies are required regardless of the size of the DNO. However, the range of policies may vary by DNO so that costs are not totally fixed for the whole activity;
- the acquisitions of South Wales Electricity in 2000 and Central Networks in 2011 has enabled WPD to have a good understanding of how costs vary with scale. WPD's view is that fixed costs amount in total to around £16m for a DNO Group.
- variable costs change in proportion to the increase in volume of an activity for example fault costs vary in line with the number of fault incidents;
- for each activity there will be a variable cost per unit of activity and also a fixed cost that will not vary with the level of activity;
- the cost driver is the unit of activity, the measure of the volume of activity with which the costs change in proportion e.g. for pole inspection the cost driver is the number of poles on the network or volume of spans cleared in the activity of tree cutting.

5.7 WPD's view on the cost driver for each activity is contained in WPD's disaggregated unit cost model which can be viewed in Appendix A6.

5.8 The different business structures and operational choices made by the different companies can mean that the relative efficiency for certain activities are not directly comparable. For example the choice to replace PCs every four years in WPD may increases the apparent costs of PC provision over RIIO-ED1 but significantly reduces the maintenance and other operating costs e.g. it negates the need for a help desk function. These trade-offs between activities result in some activities appearing very efficient at the expense of other activities appearing less so. The existence of these trade-offs means that the efficiency frontier is not simply the sum of the most efficient unit costs from each DNO. The model avoids such 'cherry-picking' by using the total of the actual and predicted costs for all activities to derive an overall efficiency for each DNO.

5.9 The disaggregated model is the best available approach to determining efficiency because:

- all DNOs essentially “do the same thing” which is to install, maintain and repair assets. This means that a comparison at a detailed level provides a meaningful result. The networks were built to similar standards and differences in costs will therefore be driven by how a DNO chooses to organise and manage their operations;

- there is no requirement for regional adjustments. Volumes of work drive costs - labour costs, contractor and asset costs do not vary nationally (other than inside the M25);

- there is no need to make adjustments for customer density or sparsity because the volume of work drives the cost, and network characteristics will have already been taken into account in the volume of work. For example, a DNO with a higher proportion of overhead lines will have a higher number of poles to inspect and the cost driver for pole inspection is the number of poles on the network;

- The cost drivers have a direct causal relationship with the cost incurred. For example, the cost of faults will be driven by the number of fault incidents.

5.10 Analysing data at a detailed level can raise concerns about the treatment of trade-offs between activities and unexpected spurious results. However any spurious results are usually down to inaccurate completion of the RRP and the existence of trade-offs does not diminish the usefulness of the model, because the model assesses efficiency at the total cost level and therefore the impact of trade-offs is accounted for. In fact the model provides an assessment of the effectiveness of different trade-off decisions taken by DNOs.

Results from disaggregated benchmarking model

5.11 The latest year for which WPD has data for all DNOs is 2011/12.

5.12 In undertaking this analysis it must be recognised that 2011/12 is not a representative year for assessing WPD efficiency in the WPD West Midlands and WPD East Midlands DNOs because this was the year during which theses DNOs were completely reorganised following the acquisition by WPD of Central Networks (CN) on 4 April 2011.

5.13 During the remainder of 2011 the two Midlands DNOs were fully integrated into WPD’s organisational structure. Changes to working methods resulted in many process modifications, the acquisition of additional depots and the reorganisation of the company structures.

5.14 The re-organisation led to around 800 direct staff redundancies and approximately 800 further redundancies from Alliance and other Central Networks supply partners. All of these changes were achieved by December 2011.

5.15 2012/13 will therefore be the first representative year for comparing WPD’s four DNOs with all other DNOs (when this data is available).

5.16 The results for the 2010/11 and 2011/12 provide the following comparable efficiencies;

DNO Group	Rank	Efficiency %
Scottish & Southern Energy (SSE)	1	90%
WPD South West and South Wales	2	92%
Northern Powergrids (NPG)	3	93%
Electricity North West (ENWL)	4	100%
Scottish Power and Manweb	=5	103%
WPD (CN) – West Midlands and East Midlands	=5	103%
UK Power Networks (UKPN)	7	110%

5.17 In order to ensure that the costs included within this Business Plan are efficient we have used the available data for other companies for 2011/12 but have replaced the data for WPD West and East Midlands with the unit cost forecasts for RIIO-ED1.

5.18 This enables us to forecast the new relative efficiency where we have made significant improvements in West and East Midlands following the efficiency improvements that have been implemented following acquisition.

5.19 We have then rerun the comparison (having first restated the 2015/16 cost data in 2011/12 terms to ensure comparability). The result in rankings are therefore predicted to be:

DNO Group	Rank	Totex Efficiency %
WPD (four DNOs)	1	88%
Scottish and Southern Energy (SSE)	2	92%
Northern Power Grid	3	96%
Electricity North West (ENWL)	4	102%
Scottish Power	5	106%
UK Power Networks (UKPN)	6	113%

5.20 The results show that the increased efficiency of the former CN companies has lowered the industry average unit costs, but that despite this lowering, the WPD group is the most efficient in the sector.

5.21 As discussed below, WPD's network costs and IT costs have also been independently benchmarked by Parsons Brinckerhof and Deloitte LLP.

5.22 Therefore, not only have all of our costs been benchmarked by the disaggregated model, but 63% of direct network expenditure (asset replacement 37%, troublecall 16%, I&M 4% and tree cutting 6%) and 100% of non-operational IT has been independently benchmarked.

6 Unit Cost Review by Parsons Brinckerhoff (PB)

6.1 PB were engaged to provide WPD with an expert view on the efficiency of the unit costs we have used in building up our proposed expenditure forecast for the RIIO ED1 period.

6.2 Their full report is included at Appendix A4.

6.3 In conclusion PB stated:

> *"Following our analysis we conclude that the unit costs proposed by WPD for the RIIO ED1 submission for these activities are efficient".*

6.4 The PB review of unit costs was in respect of Asset Replacement costs, Inspection and Maintenance (I&M) costs (including Tree Cutting) and Trouble Call unit cost.

6.5 The costs across the four WPD DNOs were analysed to understand how they were built up and to identify differences. Where differences existed they were investigated to seek a rationale for them.

6.6 The costs used within the RIIO-ED1 forecasting calculations were verified by comparing them to the costs used for planning the work content and materials requirement for specific work categories on the WPD asset work management system, known as CROWN

6.7 CROWN holds data with respect to both raw material and labour input costs and also the standard work elements that are combined to create the specific activity types undertaken.

6.8 PB confirmed that CROWN contained up to date cost information and was being used appropriately to derive forward cost projections for RIIO-ED1.

6.9 In addition PB confirmed that the material supply contracts were established following an efficient market tested approach for seeking competitive quotations and post tender negotiation techniques in line with best practice.

6.10 They also confirmed that these material inputs had been correctly used to develop the forecast unit costs inferring a market-based efficient cost price base.

6.11 PB also reviewed two years of historical unit costs data using data submitted to Ofgem by all DNOs. This allowed them to benchmark the WPD DNOs against other DNOs and establish relative efficiency percentages.

Asset Replacement

6.12 PB took a sample of the 25 asset categories with the highest forecast expenditure over the RIIO-ED1 period to test their efficiency across the four WPD DNOs. This represents some 40% of the asset replacement expenditure by cost.

6.13 PB's main conclusion for asset replacement costs was that WPD unit costs have historically been low when compared to other DNOs. This is especially the case for the South Wales and South West DNOs.

6.14 The application of the same working practices and organisational structure in the West Midlands and East Midlands licence areas will bring downward pressure on unit costs.

6.15 The analysis of DNO specific unit costs on a weighted cost basis demonstrates that WPD are ranked first in South Wales and second in the South West.

6.16 The forward cost forecasts remove the historic inefficiency in the West Midlands and East Midlands following the successful adoption of the common WPD structures, practices and operating procedures achieved in 2011.

6.17 PB report that unit cost forecasts for RIIO-ED1 across all four of the WPD DNOs are in line with the low historical costs of WPD South Wales and WPD South West and are efficient.

6.18 PB concluded that:

> *"Our analysis has concluded that historically Asset Replacement unit costs have been low when benchmarked against other DNOs. This is especially the case for South West and South Wales. Since these unit costs have been demonstrated to have been deliverable we have no reason to believe that the company will not be able to deliver similar efficiencies going forward based on the present company-wide procurement principles and working practices."*

Inspection and Maintenance (I&M)

6.19 Of the 75 Ofgem categories, PB ranked the top 25 according to the RIIO ED1 total forecast I&M spend with PB's analysis focused on these 25.

6.20 These 25 activities account for nearly 90% of the total I&M spend.

6.21 PB investigated differences between the four WPD DNOs and the efficiency of the unit costs when compared against the normalised values for other DNOs.

6.22 Where forecast unit costs were found to be less efficient, this was discussed with WPD and if appropriate the forecast unit costs were revised to lower values.

6.23 PB concluded that:

> *"WPD has given significant thought and attention to forecasting I&M unit costs. The most appropriate cost driver has been selected, major issues investigated and resolved and the efficiency of individual items has been assessed.*
>
> *The efficiency of WPD's unit costs is improving and each of WPD's four businesses will move towards a more consistent overall cost.*
>
> *WPD have estimated that the impact of adopting the revised forecast unit costs will improve relative efficiency to below benchmark.*
>
> *Following these revisions, PB considers WPD's forecast unit costs for I&M in RIIO-ED1 overall to be efficient."*

Tree Clearance

6.24 Tree Cutting is a subsection of I&M examined by PB.

6.25 In order to understand WPD's unit costs, PB spent time in WPD's offices and spoke to key people within the business. PB worked through WPD's spreadsheets and calculations and discussed with WPD any issues or anomalies.

6.26 Our forecast unit costs are taken directly from the three-year average of costs for 2009/10 to 2011/12, inflated to 2011/2012 prices. One forecast unit cost is produced for the four DNOs.

6.27 For spans inspected at all voltage levels, contracts are in place, and so the forecast unit cost is based on these contracts.

6.28 PB concluded that:

> *"Due to the differences in how costs are divided by different DNOs, it is difficult to compare WPD's performance against other DNOs item by item.*
>
> *Tree cutting contracts are awarded following competitive tendering processes in line with WPD Procurement practices.*
>
> *Tree cutting activities are subject to continuous field audit with actions taken as appropriate to ensure consistency of delivery against contract specifications.*
>
> *Overall, we have seen no evidence that WPD's unit costs are not efficient."*

Trouble Call Costs

6.29 Trouble Call is the term applied to the activity for the resolution of faults, which cause interruptions to customer supplies.

6.30 There are 50 Trouble Call items identified by Ofgem for RIIO-ED1 reporting split across three different types of incident:

- non-damage incidents (Items 1-4): Supplies to customers are interrupted but no failed asset has been identified and it is possible to restore supplies without undertaking any repair;
- damage incidents requiring minimum repair (Items 5-27): Supplies to customers are interrupted and it is necessary to undertake repairs in order to restore supplies. The repair work is classified as the minimum required to returning the asset affected back to service.
- damage incidents that require more extensive repair (Items 28-50): Supplies to customers are interrupted and it is necessary to undertake initial repairs in order to restore supplies, but the full repair work is extensive and classified as capital asset replacement in accordance with Ofgem's reporting rules. The costs included in these types of incident relate to the costs associated with initial repairs, supply restoration and making the network safe. The cost of the capital asset replacement (the full repair work) was not included.

6.31 Of the 50 Ofgem item categories, PB ranked the top 10 according to the average total volumes across the four WPD DNOs between 2009/10 and 2011/12 multiplied by the RIIO-ED1 forecast unit cost.

6.32 PB's analysis focused on these 10 which accounts for 94% of the total forecast Trouble Call cost.

6.33 PB worked through WPD's spreadsheets and calculations, and discussed with WPD any issues or anomalies. Where appropriate, WPD revised their forecast unit costs.

6.34 PB concluded that:

> *"overall efficiency is good at South West (4th), East Midlands (6th) and South Wales (7th), although West Midlands is 12th. However, West Midlands was affected by a large third-party cable claim and also a number of abnormally costly faults.*
>
> *PB's analysis highlighted four items of concern which WPD looked at.*
>
> *For three of these, the forecast unit cost was lowered to be consistent with the GB DNO average, and for one it was found that a problem with the Cost Assessment model was affecting the figures.*
>
> *Overall, PB believes WPD's forecast unit costs to be efficient."*

7 IT Costs Review

7.1 WPD engaged Deloitte LLP to provide an independent expert view on the efficiency of WPD IT costs specifically analysing non-operational IT costs.

7.2 WPD's IT department has the aim to deliver a 'no frills', highly resilient and available IT function based on a lean structure, without reliance on contractors or outsourcing. The WPD IT department works closely with the core business to deliver IT systems that directly contribute to WPD's business performance.

7.3 Deloitte LLP undertook two approaches to benchmarking: first, a bottom up approach benchmarking the costs of WPD's key IT services after the Central Networks integration against wider industry peer groups including leading IT benchmarking datasets and secondly, a top down comparison of costs across all DNOs for the period between 2007/8 and 2012/13.

IT Benchmarking

7.4 Deloitte LLP's bottom-up benchmarking assessed the efficiency of non-operational IT and telecoms on a 'business as usual' basis that had been used to calculate the non-operational IT and telecoms costs for the period 2015 to 2023, as stated in the Business Plan.

7.5 Deloitte LLP compared the costs against a worldwide dataset of companies with comparably sized IT functions using key performance indicators (KPIs) including midrange computing data centre and hosting costs, midrange computing staffing costs, mainframe data centre and hosting costs, end user computing costs, data network costs, mobile network costs as well as application development and application maintenance staff costs.

7.6 The detailed cost data for *bottom-up* benchmarking was not available for the non-WPD DNOs. Therefore, notwithstanding the caution with which top-down benchmarking results should be treated, Deloitte LLP used top-down benchmarking to rank WPD's efficiency relative to other DNOs in order to provide as full a picture as possible of our relative efficiency.

7.7 The top down benchmarking of costs considered three different scale variables as cost drivers:

- number of full time employees;
- circuit length;
- number of customers.

7.8 The results of the benchmarking, which are consistent across three different specifications of cost modeling, show that in 2009/10 South Wales and South West are at or near the top quartile of efficiency across the DNOs.

7.9 The datasets for East Midlands and West Midlands pre-date the acquisition and show that costs in these DNOs were 30% higher than in South Wales and the South West. Following the integration of all four of the WPD DNO IT systems the WPD group cost has reduced by 35% in 2012/13. On the assumption that IT costs remain level for other DNO groups, WPD would rank 1st in 2012/13.

7.10 In their report (appendix A5) Deloitte LLP concluded that:

> *"WPD's South West and South Wales IT activities were efficient relative to other DNOs in 2009/10. Acquiring two less efficient DNOs could have led to weaker productivity. Instead, the bottom-up benchmarking for the post-merger organisation shows that productivity improved further compared to 2 DNO WPD group in 2009/10. Most importantly the increase in IT costs for WPD from its efficient cost base of £12.6m when it was South Wales and South West, to the larger group comprising two more DNOs in 2011/12 of £25.2m, is no more than would be expected given the availability of economies of scale. Thus while the scale of the WPD business increased by 158% (as measured by circuit length), total non-operational IT*

costs increased by only 100%. In this way, the overall WPD efficiency improvement across the four DNOs exceeds the strength of economies of scale indicated by the top down results."

7.11 In conclusion, WPD's forecasted costs for non-operational IT and telecoms are efficient.

8 Summary

8.1 WPD is an efficient business.

8.2 Our processes are efficient - from the way we procure materials and services to the local team structure that plans and delivers the work. The structure of the business, our emphasis on personal responsibility and the fact that we delegate responsibility as far down the organisation as is sensible reduces the number of 'handoffs'.

8.3 The majority of work is carried out by our own staff, which means that we are not paying for the management fees and profit margins of contractors. Our view of efficiency is complemented by the assessment and benchmarking by independent organisations.

9 Appendices

Appendix A1 – Report from Professor Stan Zachary and Dr Richard Gibbens

9.1 Professor Stan Zachary and Dr Richard Gibbens have assessed the suitability of a 'top down' benchmarking approach proposed by Frontier Economics, stating that it is unreliable for benchmarking DNOs. Their full report can be found at http://www.westernpower.co.uk/docs/About-us/Stakeholder-information/Our-future-business-plan/Supporting-Business-Efficiency-information/Gibbons-Zachary-commentary-on-Frontier-Economics-t.aspx

Appendix A2 – Deloitte LLP review of Frontier Economics model

9.2 Deloitte LLP have reviewed the Frontier Economics 'top down' benchmarking model and have concluded that the model does not produce reliable results. A copy of their report can be found at http://www.westernpower.co.uk/docs/About-us/Stakeholder-information/Our-future-business-plan/Supporting-Business-Efficiency-information/Deliotte-review-of-Frontier-Economics-Totex-Model.aspx

Appendix A3 – Totex 'top down' benchmarking model

9.3 Frontier economics were commissioned by Ofgem to develop a methodology for the benchmarking costs. Volume 1 of their report can be found at http://www.westernpower.co.uk/docs/About-us/Stakeholder-information/Our-future-business-plan/Supporting-Business-Efficiency-information/Frontier-Economics-Total-cost-benchmarking-at-RIIO.aspx

9.4 Volume 2 can be found at http://www.westernpower.co.uk/docs/About-us/Stakeholder-information/Our-future-business-plan/Supporting-Business-Efficiency-information/Frontier-Economics-Total-cost-benchmarking-at-(1).aspx

Appendix A4 – Parsons Brinckerhoff review of WPD unit costs

9.5 WPD commissioned Parsons Brinckerhoff to carry out a review of unit costs across the industry for a range of activities including asset replacement, inspection and maintenance, tree clearance and faults. Their report can be found at http://www.westernpower.co.uk/docs/About-us/Stakeholder-information/Our-future-business-plan/Supporting-Business-Efficiency-information/Parsons-Brinckerhoff-review-of-WPD-unit-costs.aspx

Appendix A5 – Deloitte LLP review of WPD's IT costs

9.6 Deloitte LLP were commissioned by WPD to benchmark non-operational IT and telecoms costs across the industry. They carried this out using both bottom up and top down approaches. The bottom up report can be found at http://www.westernpower.co.uk/docs/About-us/Stakeholder-information/Our-future-business-plan/Supporting-Business-Efficiency-information/Deloitte-LLP-review-of-efficiency-of-WPD-IT-functi.aspx

9.7 The top down report can be found at http://www.westernpower.co.uk/docs/About-us/Stakeholder-information/Our-future-business-plan/Supporting-Business-Efficiency-information/Deloitte-LLP-review-of-efficiency-of-WPD-IT-fu-(1).aspx

Appendix A6 – WPD's disaggregated cost model

9.8 WPD's disaggregated cost model contains comparative data and also identifies the cost driver for each activity. The model is in two parts; the first normalises each activity and can be found at http://www.westernpower.co.uk/docs/About-us/Stakeholder-information/Our-future-business-plan/Supporting-Business-Efficiency-information/WPD-disaggregated-cost-driver-normalisation-model.aspx

9.9 The second part uses the normalized data to carry out the comparative benchmarking and can be found at http://www.westernpower.co.uk/docs/About-us/Stakeholder-information/Our-future-business-plan/Supporting-Business-Efficiency-information/WPD-disaggregated-cost-driver-analysis-model.aspx

Appendix A7 – WPD's innovation procurement process

9.10 This document aims to provide an overview of WPD's Innovation Procurement Process, detailing the legal obligations and requirements to appropriately procure goods and services for Low Carbon Networks Fund projects. It is specifically for the procurement of fault level mitigation technologies for the FlexDGrid project, but it is representative of the general procurement processes that are adopted in WPD. The full report can be found at http://www.westernpower.co.uk/docs/About-us/Stakeholder-information/Our-future-business-plan/Supporting-Business-Efficiency-information/WPD-Innovation-Procurement-Processes-Report.aspx

Appendix A8 – Ofgem's approval of WPD's fault level technologies procurement report

9.11 Ofgem gave approval for WPD's Innovation Procurement Process. The full response can be found at http://www.westernpower.co.uk/docs/About-us/Stakeholder-information/Our-future-business-plan/Supporting-Business-Efficiency-information/Ofgem-approval-of-WPD-FlexDGrid-procurement.aspx

2015-2023

RIIO-ED1 **BUSINESS PLAN**

SA-09 Supplementary Annex – Data assurance

June 2013 (Updated April 2014)

WESTERN POWER DISTRIBUTION

Serving the Midlands, South West and Wales

SA-09 Data assurance
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1 Introduction

1.1 This document is a Supplementary Annex to the Western Power Distribution (WPD) Business Plan for the eight year period from 1st April 2015 to 31st March 2023.

1.2 It sets out the background to internal control within WPD, the data assurance processes that we have followed in the development of the plan and provides guidance on how the plan complies with Ofgem's Business Plan assessment criteria.

1.3 It relates to all four WPD distribution licences of West Midlands, East Midlands, South Wales and South West.

1.4 The eight year period aligns with the next regulatory price control review period, known as RIIO-ED1; the first for electricity distribution to be determined using Ofgem's Revenue = Incentives, Innovation and Outputs framework. The Business Plan, Supplementary Annexes, detailed cost tables and financial models form the submission under RIIO-ED1 to the regulator Ofgem (Office for Gas and Electricity Markets), who will use the information to determine allowed revenues.

Structure of this document

1.5 We appreciate that the readers of the WPD Business Plan suite of documents will range from regulatory experts and well informed stakeholders through to new customers who may have had little previous knowledge of WPD.

1.6 This document is aimed at readers who require a more detailed understanding of the data assurance approach we have taken in developing the Business Plan.

1.7 This document is subdivided into the following sections:

Chapter	Title	Content
2	**Data assurance**	A brief description of the internal control framework in WPD, the overall approach to data assurance and the external and internal reviews that have provided assurance about the data being used in the Business Plan.
3	**Business Plan assessment criteria**	This section provides an indication of how the plan aligns to the assessment criteria defined by Ofgem in their RIIO-ED1 Strategy document.

2 Data assurance within WPD

Internal controls and Enterprise Risk Management (ERM)

2.1 WPD's governance and control structures have been designed to meet its needs as an electricity distribution network operator in a business efficient manner. The organisational design embeds many of these control and governance requirements. A core feature is the flat organisational structure with a culture that empowers employees to take personal responsibility.

2.2 The oversight of governance, risk management and internal control arrangements reside with the WPD Board. A core document is the Standards and Management policy that sets out the matters that are devolved to the executive and those decisions reserved for Board approval.

2.3 The executive have established an organisational structure with roles and responsibilities that are designed to meet organisational goals and embed a robust controls framework. The structure reflects the principles of the Committee of Sponsoring Organizations of the Treadway Commission (COSO) and embeds the five components of effective internal control – control environment, risk assessment, control activities, information and communication, and monitoring activities.

2.4 Risks are managed by our process owners. They are responsible for designing and managing the necessary controls with internal audit verifying the completeness and adequacy of contols. Process owners operate within the wider framework of the corporate Enterprise Risk Management system. This provides visibility of the key and emerging risks and the actions or controls that manage or mitigate the risks.

2.5 WPD uses an in-house internal audit function to provide independent assurance over internal controls and risk management. The Audit and Business Controls Manager (Head of Internal Audit) reports to the Chief Executive Officer but is also accountable to both the WPD Board and the parent company Audit Committee. The programme of internal audit work is approved by the Board and reflects the main risk priority areas.

2.6 A key area of risk management in relation to the delivery of Business Plan outputs is WPD's Disaster Recovery and Business Continuity arrangements. Although a variety of threats can be recognised and planned for, such as the impact of fuel shortages, flu pandemics and severe weather events, of overriding importance is the ability to take effective action to respond to and manage *unforeseen* events. Core to maintaining operational service is the IT infrastructure supporting key systems. WPD has developed extensive IT disaster recovery arrangements which are described more fully in the Supplementary Annex SA-05 'Expenditure'. Our business model of local team based service delivery is highly resilient from a business continuity perspective because our systems are replicated at multiple locations.

2.7 When unforeseen disaster events do happen, we are able to redeploy people and equipment quickly and use neighbouring distribution centres. Our structure is complemented by a range of other supporting actions such as maintenance of contingent stock, ramp up facilities, equipped and trained homeworkers and emergency control room facilities. We keep our plans under review and frequently test them to ensure they remain effective. Network operational resilience is detailed in the supplementary Annex SA-05 'Expenditure' (sections 14 – flood defences, 15 – black start, 16 – substation and network security, 18 – security of critical network infrastructure and 19 – high impact, low probability events.)

WPD data control arrangements

2.8 WPD's preference is to design and build core systems and controls that align with the associated reporting requirements. WPD believes that strong system design taken together with automated controls reduce the need to rely on an additional layer of checkers to identify and correct errors. Resources are targeted at the core business processes to build in the necessary controls to achieve reporting accuracy. Where possible, WPD is automating data aggregation, extraction and input into reporting templates.

2.9 WPD aims to produce regulatory and public data that is accurate by:

- allocating responsibility for meeting reporting data requirements to named process owners. They are responsible for maintaining business processes which are aligned with reporting requirements and ensuring controls are in place to capture and record the required data;
- operating IT systems that are designed to enforce complete and accurate data capture that complies with reporting requirements;
- automating the aggregation of data and the completion of regulatory templates to minimise manual intervention;
- following a formalised approach with method statements and standard checklists in the preparation, review and sign-off of each regulatory return;
- employing a regulatory team to assist in understanding regulatory compliance requirements, co-ordinating the completion of compliance activities and undertaking certain regulatory returns or checking activities as appropriate;
- using an in-house internal audit team to perform periodic independent process audit reviews to check that business processes are well designed and that controls are operating effectively;
- using an in-house internal audit team to complete independent pre-publication data checks on key reports.

2.10 WPD's approach aligns with Ofgem's Data Assurance Guidance published on 17th February 2013 which sets out a common framework for the DNOs to assess data risks and communicate data assurance plans and activity to Ofgem. The guidance is being trialled for the remainder of DPCR5 with a view to adoption as a new licence condition for RIIO-ED1.

2.11 WPD recognises that data accuracy is critical to managing the business effectively, allowing regulatory oversight and to properly inform our stakeholders on the progress against our outputs. We continue to invest in initiatives that will reduce data risks or enhance the information available to inform our decision making. Recent examples include projects aimed at enhancing primary data capture and the use of software to automate the extraction and reporting of data for annual regulatory submissions.

Data assurance / audit work performed on the Business Plan

Ernst & Young review

2.12 We have engaged Ernst & Young to perform audit work in relation to the preparation of our Business Plan. Their work has covered:

- a review of a sample of expenditure forecasts included in the Business Plan against the principles and guidance set out in 'Prospective Financial Information: Guidance for UK Directors' issued by the Institute of Chartered Accountants in England and Wales (ICAEW);
- checking data reported in the sample of expenditure forecasts through to source data;
- a review of the treatment of a sample of key assumptions used in the plan;
- reviews of the integrity of key database models supporting the Business Plan;

2.13 Ernst & Young have issued a private opinion to the directors of WPD covering this work.

Internal audit review of the Business Plan governance arrangements

2.14 An internal audit review was completed to assess the overall adequacy of control arrangements for preparing the Business Plan. The overall aim was to ensure that key risks had been identified and suitable controls deployed to mitigate or manage those risks. The report concluded that arrangements for overseeing and co-ordinating the development of the WPD Business Plan were well controlled. The following tables below are taken from the audit report and set out how key governance requirements were achieved.

WPD has established a clear strategic direction underpinning the development of the plan	
Requirements	**Control Actions**
Within the context of the regulated sector and the RIIO framework, the strategic direction is established through an understanding of stakeholder requirements and priorities. . It is important that: • The stakeholder engagement process accurately identifies existing satisfaction with WPD performance (strengths and weaknesses). • The stakeholder engagement processes accurately capture stakeholder future priorities (opportunities and threats). It is important that there is an effective process for understanding stakeholder priorities. Specifically: • Stakeholders are fully engaged – e.g. the full range of stakeholders is identified and the process of engagement allows them to put forward their views. • Stakeholder views and priorities are correctly interpreted. • Competing or conflicting stakeholder priorities are reconciled to establish a balanced and fair strategic direction. • WPD modelling of costs to achieve certain outcomes is accurate.	• The stakeholder engagement process has been utilised as both the mechanism for identifying strategic priorities, determining the scale of activities and for moderating / checking WPD's interpretation of stakeholder requirements (i.e. further engagement was completed on a draft plan). • The initial phases of stakeholder engagement were about identifying the main groups of stakeholders and their areas of interest. • 'Willingness to pay' research was then completed to understand and weight competing priorities. Initial customer research was blind of feasibility – i.e. it sought to build up a true understanding about how much value stakeholder groups attributed to output improvements. This was used to inform the magnitude of appropriate incremental spend. • Costed options were then put to stakeholders in Business Plan development workshops. Costing information was based on detailed modelling and recognised diminishing returns as appropriate. The stakeholder feedback informed the development of draft proposals and allowed WPD output target levels to be defined. This provided the main strategic guidance required for all the other Business Plan components. • Whilst there are risks associated with data interpretation of often subjective material, the process of using a final round of Business Plan workshops to consult on proposed plans provided a robust test assessment and allowed further stakeholder feedback to refine the plans.

Arrangements are in place for the management oversight and co-ordination of plan development.	
Requirements	**Control Actions**
• Ensuring all necessary actions are identified and allocated. • Managing progress and achieving deadlines • Recognition of key dependencies in completing sections • Consistently enacting the WPD strategic decisions	• Overall framework for governance established. Core price control team established under Network Services Manager leadership. Network Services Manager seconded to full time role of Price Control Manager. Core team includes all relevant senior managers from specialist areas covering finance, regulatory requirements, engineering planning and forecasting and network services. The team has an in-depth knowledge of the regulatory requirements and a detailed knowledge of WPD operations. Price Control Manager accountable to the Executive and in turn the Board. • Responsibilities within the core team have been established. Plan broken into sections and allocated to relevant subject matter expert. • Subject experts responsible for the draft delivery of the plan for their section. This includes related compliance checks, data controls, assumptions and sensitivity analysis. • Core team meets at least fortnightly. Collective review of whole plan helps ensure no gaps in task identification. The group reviews developments in regulatory requirements to ensure that they are incorporated into actions. • On-going action list maintained with target timescales.

Arrangements are established for managing content and updates in draft versions of the plan	
Requirements	**Control Actions**
• Consistent voice or writing style from differing contributors. • Consistent commentary and data within the plan. • Authorisation and approval of edits and updates. • Typos / errors are corrected.	• Draft versions of plan subject to counter review by core team and overall editing by lead manager to provide consistent style. • Audit checks on data consistency through the plan. • Version control protocols adopted. Restrictions made to limit users making amendments without approval.

Risks are managed in relation to key assumptions, compliance requirements and data accuracy.	
Requirements	**Control Actions**
Key assumptions: • Key assumptions or external factors that could significantly affect the Business Plan are recognised. • Sensitivity around assumptions are understood. • Mechanism established to balance assumption risk between shareholders and customers. • Assumption value utilised for plan is based on robust analysis. Compliance requirements: • Ofgem information requirements for items that must be included or addressed by the Business Plan are fully recognised. • Business Plan compliance requirements are fully addressed. Data Accuracy: • Data is complete – i.e. fully extracted from underlying source systems. • Data is accurate – i.e. source systems contain accurate data. • Data is consistent within the Business Plan	• The significant key assumption areas have already been identified and defined by Ofgem within the RIIO-ED1 strategy decision documents. This sets out some of the compliance requirements for DNOs to explain how the uncertainty is to be addressed. • Consideration of the uncertainty factors / key assumptions is addressed through the relevant component parts of the Business Plan. Where possible external expertise have been utilised to provide best professional view on likely outcome of unknown factors to assist the justification of the WPD assumption value. • Each area of uncertainty has been expanded upon within the plan to accommodate external factor outcomes that are different to expectations. • Ernst & Young engaged to review the treatment of a sample of key assumptions. • A compliance schedule has been developed from detailed analysis of Ofgem's Strategy document to identify the Ofgem requirements within a RIIO-ED1 well justified Business Plan. Overall responsibility for recognising compliance requirements allocated. These were communicated to the other team members who were responsible for meeting compliance within their sections. A compliance internal audit was completed to confirm that regulatory compliance requirements have been adequately controlled. • Data accuracy. Generally mature underlying data capture systems with financial accounts subject to external audit and other systems subject to a rolling programme of internal audits. In relation to the Business Plan, Ernst & Young review completed on a sample of forecast figures in the plan reviewing data completeness and accuracy in relation to underlying systems. Further internal audit reviews were completed on the 2012-13 data data extraction for the Business Plan Data Templates as well as independent checks on consistency of Business Plan data and narrative. • Further core team and Independent expert reviews performed on draft versions of the plan to check for data and narrative consistency.

Internal audit review of 2012/13 data extraction for inclusion in the Business Plan Data Templates

2.15 An internal audit review was completed to provide assurance over the completeness and accuracy of 2012-13 data extraction for inclusion in the Business Plan Data Templates. Much of the data was extracted using the new Hyperion computer system implemented to assist with regulatory reporting. The review considered how key risks were managed and covered sample checks in key areas.

2.16 The internal audit review confirmed that risks had been recognised and controlled. No material errors were detected.

Independent review of the Business Plan

2.17 Independent reviews by internal audit, line managers and third parties have been completed on draft versions of the Business Plan. These have sought to:

- Verify that data contained within the plan is consistent throughout the document.
- Check that narrative is consistent with data

2.18 All matters identified were discussed with management and have been resolved. No material errors were detected.

Internal audit review of the management of compliance requirements within the Business Plan

2.19 There are a number of Business Plan information requirements stipulated by Ofgem to enable it to be treated as well justified. In general, the requirements are intended to ensure that Ofgem has sufficient information to enable it to complete its assessment. An internal audit review was completed to provide assurance over the adequacy of arrangements for managing compliance requirements.

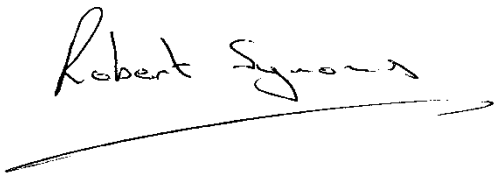
2.20 The audit looked at the arrangements for recognising and recording regulatory compliance requirements as well as the mechanisms for managing the achievement of the requirements. Sample checks were made against specific compliance requirement to verify that the matter is addressed with the Business Plan.

2.21 The internal audit confirmed that processes for meeting Business Plan regulatory compliance requirements had been well managed. The audit did not identify any unaddressed compliance requirements.

Statement on the completeness of WPD's Business Plan submission

2.22 The Directors confirm that the RIIO-ED1 Business Plan 2015-2023 for Western Power Distribution (South Wales) plc, Western Power Distribution (South West) plc, Western Power Distribution (East Midlands) plc, Western Power Distribution (West Midlands) plc have been provided in accordance with Ofgem's 'Strategy decision for the RIIO-ED1 electricity distribution price control' published on 4th March 2013.

2.23 Director signatures:



Robert Symons, Chief Executive Officer

Charl Oosthuizen, Finance Director

Phil Swift, Operations Director

Dave Harris, Resources & External Affairs Director

3 RIIO-ED1 Assessment Criteria

3.1 Ofgem's RIIO model outlines the criteria against which Business Plans should be assessed and these have been specified in Ofgem's Strategy decision document for RIIO-ED1. There are five core criteria and a series of questions that Ofgem will use to assess this Business Plan. This section provides an overview of how the plan meets each of the assessment criteria.

Process: Has the DNO followed a robust process?

Is the Business Plan clearly presented, with all key content included?

3.2 Our plan follows the requirements set out in Ofgem's RIIO-ED1 Strategy documents and is structured to facilitate easy referral from Ofgem strategy requirement to the relevant section in the WPD Business Plan. All key content has been included.

Has the DNO engaged with stakeholders, and explained how this has influenced its Business Plan?

3.3 WPD has undertaken the most extensive stakeholder engagement programme ever and stakeholder impact on the plan is reflected throughout the document. For a summary see the WPD Business Plan Overview document, section 6 'Developing a plan for our stakeholders'.

3.4 For a detailed overview see the Supplementary Annex SA-01 'Stakeholder Engagement' which explains the stakeholder engagement strategy and the impact it has had on the Business Plan.

Has the DNO submitted, and justified, all data templates and the PCFM?

3.5 PCFM and data templates are fully complete and included in data upload. The data templates include justification required by Ofgem.

Does the Business Plan provide a strategy for long-term delivery?

3.6 Our strategy for long-term delivery is set out in the WPD Business Plan Overview document, sections 5 'Developing a plan for our business' and section 6 'Developing a plan for our stakeholders'

3.7 Further details on the ways in which the plan provides for long-term delivery are provided in Supplementary Annex SA-05 'Expenditure', Supplementary Annex SA-04 'Outputs' and Supplementary Annex SA-03 'Innovation'.

Outputs: Does the plan deliver the required outputs?

Has the Business Plan covered the outputs specified in our strategy decision or provided clear and compelling justification for any departures from the strategy decision?

3.8 Supplementary Annex SA-04 'Outputs' details the outputs specified in the Ofgem Strategy decision document along with WPD's response. Additional voluntary outputs have been incorporated into our plan based upon engagement with our stakeholders.

Has the DNO explained the resource implications for delivery of each output identified?

3.9 We have explained our approach for achieving each of the outputs in the Supplementary Annex SA-04 'Outputs'. We have mapped out core expenditure to the relevant outputs.

3.10 The resource requirements for the delivery of outputs has been considered for each output. For example, see section in Supplementary Annex SA-05 'Expenditure' section 42 on workforce renewal.

Has the DNO explained how it will deliver outputs, and justified output baseline/forecast?

3.11 Supplementary Annex SA-04 'Outputs' details our approach for achieving each of our output targets. The results of stakeholder engagement are detailed in Supplementary Annex SA-01 'Stakeholder engagement' which describes the outputs our stakeholders would like us to deliver.

Has the DNO explained the quality of its existing outputs and secondary deliverable information (including information on asset health, criticality and asset risk) and how it plans to improve this information in future?

3.12 Supplementary Annex SA-05 'Expenditure' sets out our approach for managing information relating to outputs and secondary deliverables along with our plans for refining the accuracy of data and the robustness of our secondary deliverables modeling systems.

Resources (efficient expenditure): Are the costs of delivering the outputs efficient?

Has the DNO demonstrated that cost projections are efficient?

3.13 Supplementary Annex SA-08 'Business Performance, Efficiency and Benchmarking' sets out how we have assessed the efficiency of our cost projections.

How does the plan compare with others/ does it reflect wider best-practice?

3.14 Supplementary Annex SA-08 'Business performance, efficiency and benchmarking' sets out our benchmarking methodology and the results of benchmarking.

Has the DNO demonstrated that their financial costs are efficient (e.g. through market-testing)?

3.15 Supplementary Annex SA-07 'Financing the plan' describes how the plan will be financed and the steps taken to ensure financial costs are efficient.

Has the company explained cost projections in context of historical performance?

3.16 Our historical performance is set out in the WPD Business Plan Overview document, section 4 'Our track record'. Further details are included in Supplementary Annex SA-08 'Business efficiency, performance and benchmarking'. Forecast spending plans are detailed in the Supplementary Annex SA-05 'Expenditure' along with the context of our spend and activity during DPCR5.

Has the company demonstrated a consideration of alternative approaches to achieving value for money in the delivery of its outputs?

3.17 Our historical business performance is reviewed in the WPD Business Plan Overview document, section 4 'Our track record'. Overall business efficiencies and key WPD characteristics that have delivered that efficiency are described in the Supplementary Annex SA-08 'Business performance, efficiency and benchmarking'. Specific options for material items of expenditure are assessed in the Cost Benefit Analysis in Supplementary Annex SA-05 'Expenditure'. Our innovation strategy and the way in which alternative "smart" solutions are integrated into our plans is included in Annex SA-03 'Innovation', as well as section 8 'Innovation' of the core document.

Has the company clearly linked its expenditure to relevant outputs and secondary deliverables?

3.18 We have explained our approach for achieving each of the outputs in the Supplementary Annex SA-04 'Outputs'. We have mapped out core expenditure to the relevant outputs. Refer to Supplementary Annex SA-05 'Expenditure' and Supplementary Annex SA-04 'Outputs'.

Resources (efficient financing): Are the proposed financing arrangements efficient?

Does the Business Plan conform with the financial policies specified in the strategy, are any departures well-justified?

3.19 Supplementary Annex SA-07 'Financing the plan' specifies all the financial assumptions used in determining finance costs. Details of our policies and explanations for our assumptions are stated. There are no departures from financial policies.

Has the DNO provided evidence that financial costs are efficient?

3.20 Supplementary Annex SA-07 'Financing the plan' describes how the plan will be financed and the evidence required to show that financial costs are efficient.

Is the data in the plan consistent and has the DNO explained cost projections in context of historical performance?

3.21 Our approach to data validation is explained in Supplementary Annex SA-09 'Data Assurance'.

3.22 Our historical performance is set out in the WPD Business Plan Overview document, section 4 'Our track record'. Forecast spending plans are detailed in the Supplementary Annex SA-05 'Expenditure' along with the context of our spend and activity during DPCR5. Amounts shown for all years up to and including 2012/13 are actual and the forecasts for 2013/14 and 2014/15 have been prepared on a consistent basis with both our internal budgeting and the RIIO-ED1 forecasts included in the plan.

Uncertainty & risk: How well does the plan deal with uncertainty and risk?

Has the DNO clearly articulated the key uncertainties it faces and considered how it will address them (e.g. including uncertainty mechanisms)?

3.23 Supplementary Annex SA-06 'Uncertainty', Supplementary Annex SA-03 'Innovation' and the Overview document at section 11 'Uncertainty' set out the uncertainties we face and how we will address them.

Has the DNO considered risk and how to mitigate those risks?

3.24 Supplementary Annex SA-06 'Uncertainty' details those risks where no uncertainty mechanism is required because WPD will bear the risk. This supplementary annex provides an overview of our governance and risk management arrangements. Specific spending to address network operational risks is detailed within Supplementary Annex SA-05 'Expenditure'.