Superfast Electricity

The Future of Service Cables

Consultation

July 2020

WESTERN POWER DISTRIBUTION

Serving the Midlands, South West and Wales

westernpower.co.uk

1 Overview

Western Power Distribution (WPD) is the distribution network operator (DNO) for the Midlands, South West and South Wales. We are responsible for delivering electricity to approximately 7.9 million customers in the UK.

This consultation looks at our proposal to make three phase service cables our standard service cable for all new connections.

The way that electricity is going to be used in the future is changing. The decarbonisation of heating and transport will create additional demands on our network. The electricity network needs to be ready to accept this additional demand. We build networks with a 50 year asset life so we're taking steps now to ensure we build the right network to meet the demands of both our current and future customers. We are fully committed to building a network to support the move towards Net Zero.

The Government's publication of "The Carbon Plan" (2011) set out the UK's objectives to reduce carbon emissions, with an 80% reduction to be achieved by 2050. This reduction of CO2 levels is expected to be reached through the decarbonisation of heating and transport and actions needed to support this transition of vehicle power from fossil fuel sources to electricity. The requirements of The Carbon Plan 2011 have been strengthened by the Clean Growth Strategy published in 2017 with targets to improve air quality and reduce nitrogen dioxide levels. In June 2019 Prime Minister Theresa May announced the UK's aim to eliminate its net contribution to greenhouse gas emissions by 2050. The decision will amend the Climate Change Act 2008, which had committed to an 80% decrease in greenhouse gases by 2050 from a 1990 baseline.

We are fully committed to building the right network now to support the needs of our current and future customers

These targets will all support the transition to electric vehicles and heat pumps. The Government set a target published in Driving the Future in 2015 to "ensure almost every car and van is a zero emission vehicle by 2050". In July 2018 the government published the Road to Zero strategy which set an aspiration for "at least 50%, and as many as 70%, of new car sales and up to 40% of new light van sales being ultra-low emission by 2030". In February 2020 the Government announced that "it will end the sale of all new conventional petrol, diesel cars, vans and hybrids by 2035". The Clean Growth Strategy looks at how we heat our homes, with support for home insulation and the phasing out of "high carbon fossil fuel heating in new and existing homes currently off the gas grid during the 2020s". The Future Homes Standard, changes to Part l and Part F of the Building Regulations for new dwellings, has already consulted on proposals which would see the heating load of new homes move to low carbon sources.

2 Focus on service cables

The service cable connects our customers' homes or premises to the electricity mains cable which is in the street outside their houses. It is often installed to supply a single customer and, where services are shared with adjacent properties, we are already working to split these up as customers connect Low Carbon Technologies (LCTs) such as electric vehicle chargers and heat pumps.

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The mains cables that run in local streets are normally constructed to operate as three phase cables. The energy supplied to our customers flows through three individual parts of the cable – known as phases - to help us operate an efficient network where load is evenly shared across the three phases. Historically we have connected individual domestic customers to one of the three phases in the cable. We have spread connections in a street across the phases to balance our network. Commercial customers with higher electrical demands, or customers with specialist three phase equipment, have been connected to all three phases. All of these connections are made directly onto the cables and are usually made under the pavement, so the opportunity to swap them around or balance loads is very limited. Taking a three phase cable to all of our customers meter positions allows us to be more flexible with connection balancing.

WPD sees four key benefits for us and our customers in the provision of three phase service cables:

Technical
- Improves losses management
- Allows more "connect and notify" generation to connect
- Simplifies design choices and installations

Accessibility
- Removes the requirement to revisit installations
- Allows us to balance load across our network
- Enables customers to embrace Low Carbon Technologies

Sustainability
- Avoids future excavation and cable replacement
- Supports future commitments of The Carbon Plan
- Aligns with decarbonisation commitments

Efficiency
- Involves minimal cost increase on initial installation
- Makes LCT connections simpler to manage
- Makes full use of initial build works

These four benefits underpin our plans to move forward with changes to service cable specifications and standards.

Whilst we can aggregate and diversify load profiles across our mains network, the service cable will always take the full load of the property it supplies. This can impact the level of electrical losses, the energy used to transport electricity, in our service cables. Introducing bigger cables or spreading a customer's load across our network will reduce losses. Spreading load across all three phases of our network has the added benefit of helping regulate the voltages in our cables.

Once a service cable is laid in the ground, there are very few opportunities to revisit it. If it needs to be upgraded, the works will always involve excavation on our customer's property between the pavement and their meter position. This work can involve digging across driveways and through established gardens. If we think ahead to future demands, we can avoid this work at a later date.

We are keen to understand your views on our proposals to change our service cable standards. Within this consultation, we are seeking feedback in three main areas:

- Our four key benefits
- The interface with other parties such as meter operators, house builders and electrical contractors
- The contribution to a Net Zero future of planning ahead

Questions:

1a. What are you views on the four key benefits of three phase service cables WPDS has identified?

1b. Do you agree these are the correct benefits?

1c. How could these be improved, expanded or refocussed?

3 Technical

Improved Losses Management

Historically we have connected individual domestic customers to one of the three phases in the cable. All of these connections are made directly onto the cables and are usually made under the pavement, so the opportunity to swap them around or balance loads is very limited.

Using WPD's Network Innovation Funded LV Templates project we created a monitored smart grid across South Wales. Data from that project was used to understand imbalance, amongst other network characteristics. From LV Templates monitored substations we have identified that imbalance in the low voltage network can lead to neutral currents of around 35% of the phase current. Using the societal cost of losses we have calculated that the annual potential savings from imbalance correction are in the order of £50 to £80 per kilometre of LV network affected. This means that interventions to balance low voltage networks are likely to focus on low cost, one-off options rather than solutions with an ongoing management activity. This supports our view that the best way to address low voltage balance is to provide an "above ground" facility to balance customers across phases. A three phase service cable will allow this work to be completed without excavation on networks which have poor balance.

Allows more "connect and notify" LCTs to connect

The Electricity Safety Continuity and Quality Regulations 2002 place a duty on network operators to connect small scale embedded generation. Within the regulations section 22 (2) (a) allows generation of less than 16A per phase to be connected without specific agreement of the network operator. Installers connect generation of this size and notify us of its presence. The generation capacity allowed to connect in this way is measured in amps per phase. A customer with a three phase connection can connect three times the generation as long as it is equally balanced across all three phases.

Making use of all three phases allows a customer to connect more electric vehicle charging and heat pump demand, if required. For customers who are high mileage users, a three phase connection will accommodate 22kW chargers, three times the normal domestic size. Heat pumps with greater flexibility can make use of a three phase connection.

Connecting a customer's home to all three phases offers technical advantages that cannot be realised with single phase services. WPD can balance single phase loads and revisit network balance if needed. Customers who use all three phases can increase their use of LCTs and micro generation

Simplifies design choices and installations

Through the RIIO-ED1 period from 2015 we have reduced the design options available to our planners. To offer benefits in reduced losses and to ensure we proactively uprate our new networks ready for Low Carbon Technologies, smaller mains cable and transformer sizes have been discontinued. Moving to three phase cables as a standard for services will offer the same benefits and simplify the choices made by our planners.

Our installation teams will only need to carry a single cable size and one type of termination equipment. Cable jointing will be simplified as the range of service cable options is reduced.

To support the proposed change to three phase services we have already drafted new versions of our two documents which relate to domestic installations. These can be downloaded alongside this consultation and are:

- ST:SD5A Design of Low Voltage Domestic Connections
- ST:SD5D Arrangements for LV Cut-Outs

Questions:

2a: Have we identified the correct technical benefits of three phase services?

2b: Are there other benefits or considerations to make?

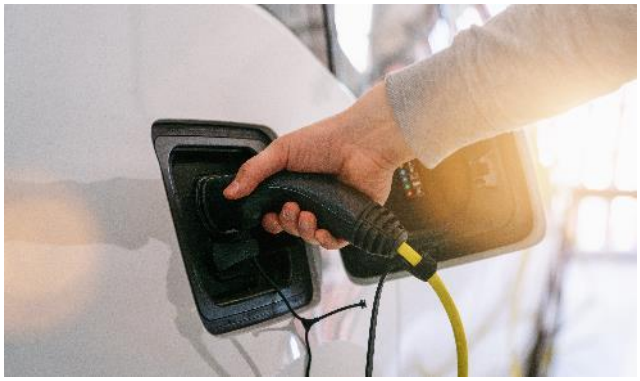
2c: Are there any aspects missing from our current assumptions?

4 Accessibility

Removes the requirement to revisit installations

A key consideration in the use of three phase service cables is that it offers a level of future proofing for our customers. The standard service cable arrangements have not significantly changed since the 1950s while our use of electricity has accelerated, increasing the peak load and utilisation of those cables. The Carbon Plan and the Clean Growth Strategy focus the UK on decarbonisation through the electrification of heating and transport; the energy requirements for this will increase use of our networks.

While customers may not yet have chosen a heat pump or electric vehicle, we expect our service cables to offer an enduring solution. Within the 50 year life of a service cable we already know that Internal Combustion Engine vehicles will no longer be a new car choice. The Clean Growth Strategy looks to a future in home heating where heat pumps will become more prevalent, starting with those in new and existing homes currently off the gas grid during the 2020s. Customers should rightly expect us to plan ahead for these changes and avoid the need to return to their homes and uprate service cables we laid in the 2020s.



Allows us to balance load across our network

Any conventional works to balance loads across our networks would involve the excavation of service joints and the physical re-jointing of cables. The costs of the work have always been prohibitive compared to the benefits realised by a balanced network.

Three phase cables move the final position of our three phases out to the customer's point of supply. It moves the connection point to a highly accessible position within the customer's meter box. Where networks require balance, the works to compete this are a simple swap of the customer's connection from one phase to another.

WPD can operate a more balanced network without the need to excavate service connections. Customers can make use of additional capacity to manage their LCT demands and usage.

Customers can embrace LCTs

As customers move to a low carbon future their use of electricity for heating and transport will increase. Whilst many of these demands can be accommodated on existing single phase services, the move to three phase would allow customers to be more flexible in their use. The volume of energy which can be transferred across the service increases threefold and offers advantages to speed and scheduling.

For example, an electric vehicle with a 100kWh battery would take around 14 hours to fully charge on a single phase 7.4kW charger. Whilst this is acceptable for low mileage users who do not require a charge every night, some high mileage use customers might require this level of charge more regularly. A three phase charger of the same size (3x7.4kW) would complete the charge in under 5 hours which allows the customer more opportunity to schedule the charge for low cost or low carbon periods of the day.

Questions:

3a: Have we identified the right areas of increased accessibility?

3b: If applicable, what other areas should we consider?

3c: What are your views on our proposal to work now to avoid revisits and upgrades in the future?

3d: Are there any aspects missing from our current approach?

5 Sustainability

Avoids future excavation and cable replacement

Customers expect to see us working on the network in the street outside their homes – but few consider that this work could extend onto their own property.

The work that may be required to upgrade a service is an additional consideration and factor for customers who are transitioning to low carbon equipment such as electric vehicles and heat pumps. Our works will always involve excavation on our customer's property between the pavement and their meter position

Within the asset life of our cables, we can reasonably expect that customers will transition and should plan for this new demand.

By being able to avoid revisiting service cables and completing additional works, we can offer a better level of customer service to our customers. Avoiding the need to carry out physical work also reduces the overall carbon impact of our activity, with less waste produced.

Sustainability requires us to make cost effective and pragmatic decisions now which ensure that the network remains efficient and economic throughout its life. The carbon impact of early replacement needs to be considered.

Supports future commitments of the Clean Growth Strategy

The Clean Growth Strategy is set to deliver a decarbonised future by 2050. We are already seeing actions to support this target such as the banning of petrol and diesel vehicles by 2035 and proposals which would see the heating load of new homes move to low carbon sources.

The electricity networks need to be ready to accept this additional demand. We build networks with a 50 year asset life so need to take steps now to ensure we build the right network for foreseeable future demands.

Aligned to decarbonisation

The Carbon Plan is the starting point for decarbonisation, with target dates of 2050. The Government's commitments were strengthened again through the Clean Growth Strategy. We also expect the drive for decarbonisation to increase, with local authorities acting upon their climate emergency commitments.

With this backdrop we must ensure that our networks are able to transition to accommodate the changed demands that they will see. Where we build new networks we must look ahead to the decarbonised future. We must ensure our installations are adequate for the expected flexibility requirements of customers who are likely to start to schedule electric vehicle charging and the use of other LCTs for low cost or low carbon periods of the day.

Questions:

4a: Is sustainability an important enabler for developing future capacity?

4b: Are we making progress in the right areas?

4c: Are there any aspects missing from our current approach?

6 Efficiency

Minimal cost increase on initial installation

A three phase installation does increase the cost of connection but only in relatively low terms. The cable used is around £5/m more expensive than the single phase alternative. To offer space for metering and termination equipment a larger meter box is also required.

The typical service cable length in a modern house is around 5m. In older pre 2000s properties this could be longer and measure between 10m and 20m.

The approximate additional costs are around £243 per connection. The cost of a single phase service connection on a housing estate with 5m of cable is around £679 while the three phase equivalent would be £922.

By making use of the initial build works for housing we can stay ahead of demand changes. We hope to avoid the "why wasn't this done when the house was built?" question for properties built in the future

Makes full use of initial build works

A key efficiency feature is to make use of works which are being undertaken. We must also look to gain maximum benefit from any works. The original construction point is the best opportunity to install a future proofed network. Whilst excavations remain open it is relatively simple to install a larger service cable. Once the ground is reinstated and landscaped we lose this opportunity. The opportunity fades further as house owner's plant and develop their gardens and driveways. We hope to avoid the "why wasn't this done when the house was built?" question for properties built in the future.

Setting the standard for the future

The change to three phase service cables looks to the future of decarbonisation. Services laid today will be in use after 2050 when Net Zero is expected to be achieved. Our customers will have transitioned to LCTs and will expect us to set standards that accommodate the changes.

As the plans to achieve Net Zero apply across the UK we would want all areas, including those outside of WPD's operational area, to consider these changes.

As a part of our proposals we will take this change request to the Energy Networks Association for consideration. There are benefits in all network operators upgrading to the same standard to support decarbonisation.

Questions:

5a: What are your views on plans to make use of the initial build works?

5b: What are your views of the installation requirements and costings?

5c: Should this change become a National Standard?

5d: Should this change be used to promote three phase installations and appliances in domestic houses as a standard?

5e: Are there any aspects missing from our current approach?

7 Summary

WPD is committed to building a smarter, more flexible network, which meets the needs of our customers now and into the future. We want to plan networks now which will make use of all new opportunities afforded by the forthcoming changes in the way electricity is generated, stored and consumed.

WPD has led the industry in developing solutions to allow Low Carbon Technologies to connect to our networks. We are keen to understand your views on our proposals for delivering a smarter, future proofed network and whether any aspects of these can be improved.

8 Responding to this consultation

We want to hear your views on the proposals presented in this consultation. It is important that we get a broad range of stakeholders' opinions and we are keen to get your feedback on the specific questions we have included throughout this consultation.

To assist with your response we have produced a questionnaire with the specific questions from the consultation reproduced in Appendix A.

Responses should be returned by 17th September 2020.

Direct online input:
https://yourpowerfuture.westernpower.co.uk/superfast-electricity-consultation

Or emailed to:
wpddsodevelopment@westernpower.co.uk.

Or by post to:
DSO Development Team
Western Power Distribution
Feeder Road
Bristol
BS2 0TB

Appendix A: Consultation Response Template

Please provide your responses in the template set out below. A standalone editable version of this template is available on our website and upon request.

Please indicate the type of stakeholder you represent

1.Domestic customer (or representative)	☐	7. Community energy scheme	☐
2.Business customer (or representative)	☐	8.Consultant	☐
3.Local authority / council officer	☐	9.Energy / utility company	☐
4.Developer	☐	10.Regulator / government	☐
5.Connections representative	☐	11Academic / education institute	☐
6.Distributed Generation developer	☐	12.Meter Owner/Operator	☐

Superfast Electricity – The future of service cables

Question	Response
Question 1a: What are your views on the four key benefits of three phase service cables?	
Question 1b: If applicable, how should these be improved, expanded or refocussed?	
Question 2a: Have we identified the correct technical benefits of three phase services?	
Question 2b: Are there other benefits or considerations to make?	
Question 2c: Are there any aspects missing from our current assumptions?	
Question 3a: Have we identified the right areas of increased accessibility?	
Question 3b: If applicable, what other areas should we consider?	
Question 3c: What are your views on our proposal to work now to avoid revisits and upgrades in the future?	
Question 3d: Are there any aspects missing from our current approach?	
Question 4a: Is sustainability an important enabler for developing future capacity?	
Question 4b: Are we making progress in the right areas?	

Question 4c: Are there any aspects missing from our current approach?	
Question 5a: What are your views on plans to make use of the initial build works?	
Question 5b: What are your views of the installation requirements and costings?	
Question 5c: Should this change become a National Standard?	
Question 5d: Should this change be used to promote three phase installations and appliances in domestic houses as a standard?	
Question 5e: Are there any aspects missing from our current approach?	

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