WESTERN POWER DISTRIBUTION

Serving the Midlands, South West and Wales

Contents

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.

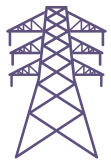
The UK's electricity system is undergoing a rapid period of change as distribution network customers invest in generation and alter their consumption behaviours to influence a lower carbon future. To enable a greater volume of demand, generation and storage to be connected, our networks are becoming smarter and more active. Creating a more efficient and flexible system will benefit all customers and empower them to be at the centre of the energy revolution.

We recognise that the change from a Distribution Network Operator (DNO) to a Distribution System Operator (DSO) is essential to driving performance and efficiency from our network and ensuring it can meet the future energy demands of all our customers. The enhanced capabilities we are developing will also give our customers the freedom to access other opportunities within the developing energy system.

Within a rapidly changing energy landscape, our aim is to keep our business simple, to deliver on our promises and continue to innovate. 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.

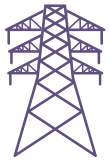
Our engagement will have to be creative and widespread through multiple channels.

This document is part of that process. All of our stakeholders will benefit as we transition to managing more active networks and informing them of our immediate next steps and guided trajectory will help them to transition with us. Through detailing the expected benefits and timescales, we can help support the delivery of the UK's Industrial Strategy.



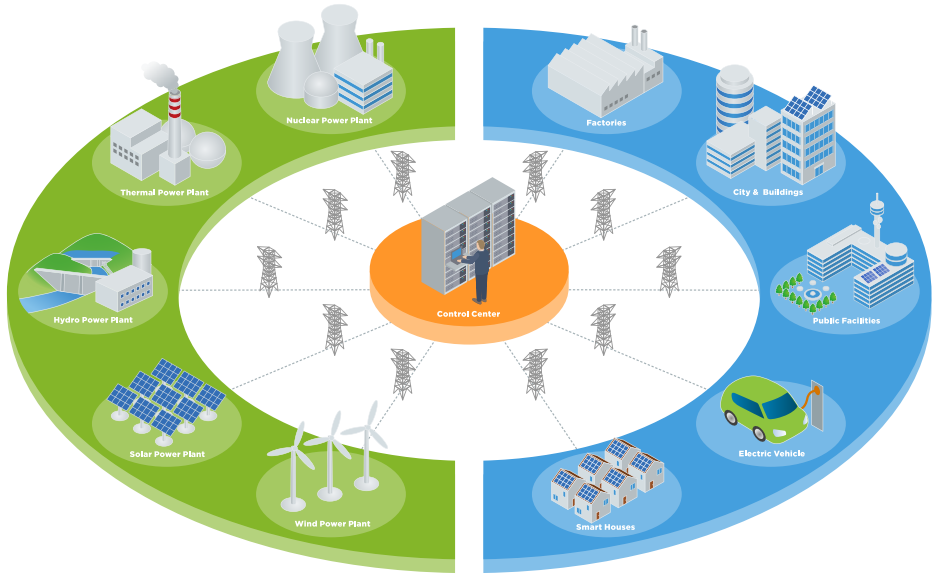
9.5GW

Installed distributed energy resources within WPD area



75,055GWH

Energy distributed across WPD networks in 2016/7



Role of the Distribution System Operator

> CREATING A MORE EFFICIENT AND FLEXIBLE SYSTEM WILL BENEFIT ALL CUSTOMERS AND EMPOWER THEM TO BE AT THE CENTRE OF THE ENERGY REVOLUTION.

Western Power Distribution has a proven track record on delivering industry leading performance across a number of key distribution network operator activities. Its experience in adapting to change provides a strong platform for coordinating the electrical systems of the future.

1

KEEP THE LIGHTS ON BY OPERATING OUR NETWORK ASSETS EFFECTIVELY

2

MAINTAIN EQUIPMENT SO THAT THE NETWORK IS IN A CONDITION TO REMAIN RELIABLE

3

FIX THE NETWORK IF EQUIPMENT GETS DAMAGED OR IS FAULTY

4

CONNECT CUSTOMERS BY UPGRADING EXISTING NETWORKS OR BUILDING NEW ONES

As we transition to becoming a Distribution System Operator (DSO), and we take on additional roles within the developing energy system these roles will require an increased level of coordination with existing operators and consumers, as well as the creation of new forms of coordination with emerging energy system participants.

1

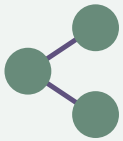
PROMOTE INNOVATION, FLEXIBILITY AND NON-NETWORK SOLUTIONS

2

FACILITATE NEUTRAL MARKETS FOR MORE EFFICIENT WHOLE SYSTEM OUTCOMES

3

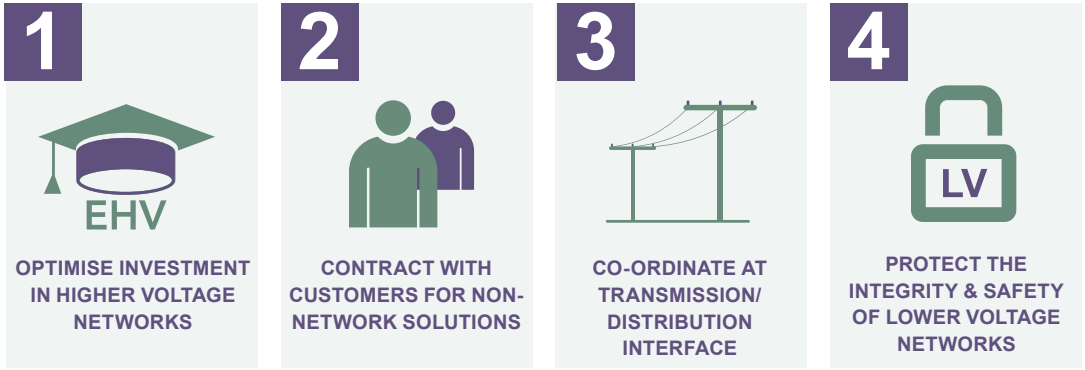
IMPROVE THE RESILIENCE AND SECURITY OF THE ELECTRICITY SYSTEM AT A LOCAL LEVEL

4

DRIVE COMPETITION AND EFFICIENCY ACROSS ALL ASPECTS OF THE SYSTEM

Role of the Distribution System Operator

As energy becomes more decentralised and its consumption becomes more varied, the Distribution System Operator will have a significant role in optimising actions at a local level and ensuring regional resources can support delivery of an efficient and resilient system.

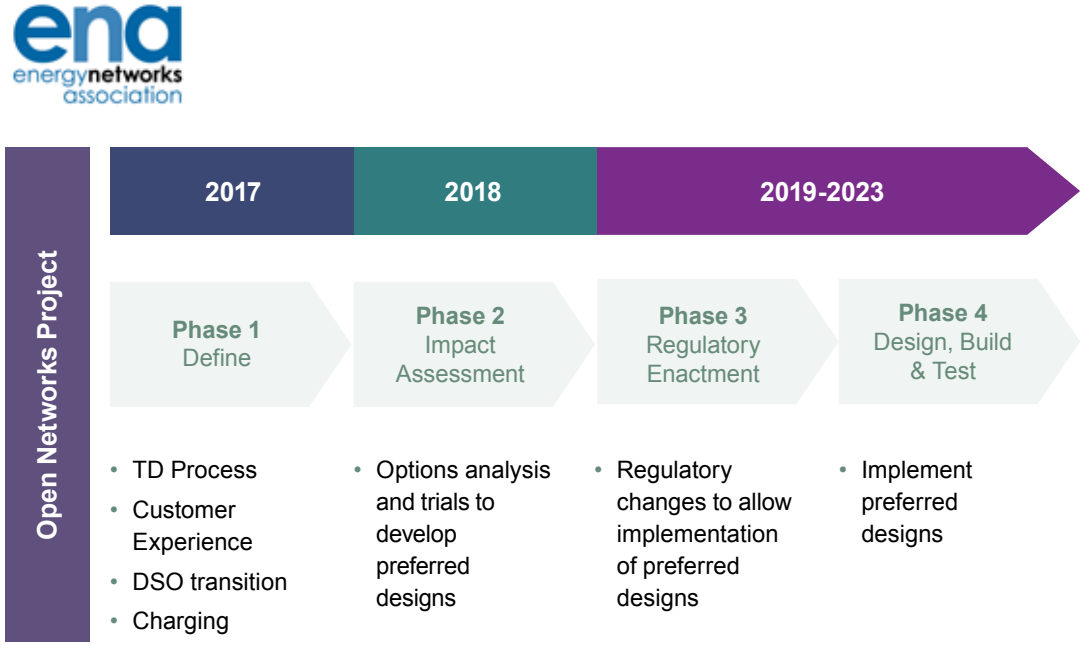
WPD's DSO Strategy highlights the four key areas we will focus on to deliver these benefits:



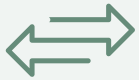
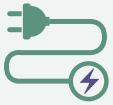
WPD is actively committed to developing the industry transition towards DSO through the Energy Networks Association's Open Networks Project. This project aims to understand the requirements and effects of moving to a more active distribution system. It also aims to design, test and implement the whole system elements which will bring benefits to all energy system participants.

The objectives of the overall Open Networks Project are to:

- Put ENA members on the front-foot to drive change that aligns with their strategic objectives for DSO, rather than being driven by other initiatives
- Provide a consolidated and agreed position across all ENA members as to what DSO is and how it might operate with TSO
- Inform all ENA members of the potential impact of DSO and to propose potential actions to facilitate and make the most of this transition for ENA members
- Set out a strategy and plan for delivery of DSO and to take action to prepare for delivery
- Share non-sensitive information across ENA members to ensure that they are at the forefront of learning on the DSO transition and understand the key messaging of the project
- Inform the regulatory debate around funding (including ET2 & ED2).



DSO Forward Plan Roadmap

	Looking Backwards			Looking Forwards		
Neutral Supply Market Facilitation 	Published data on 32 zones	Consultation on Signposting of distribution system needs, including visualisation and data provision	Data on Signposting publically available for download	Commitment to publish more data on system needs	Working with stakeholders to further develop market information	Development of a Flexibility Register for those offering services
Enabling Decarbonisation 	Suite of four different Alternative Connection types developed	Alternative Connections rolled out as business as usual	Connection of 9.5GW of distribution connected generation	Strategic Investment Options developed for future generation scenarios	Active Network Management available in all areas by 2021	Roll out of flexibility will enable additional connection options
Enhancing Security of Supply 	Consistent improvement in reduction of network unavailability	Widescale deployment of automation	Industry learning gained on resilience through Regional Development Programme	Ongoing ED1 commitment to reduce customer minutes lost and number of customer interruptions	Development of RESTORE flexibility product	Our Control Room will be able to dispatch distributed energy resources to help support the network
Flexibility Services 	Flexible Power brand procuring flexibility services under business as usual	Flexible Power products published	Over 380MW of flexibility responded to expressions of interest. 28 out of 32 zones taken forward.	ENTIRE project proving benefits of flexibility	Flexible seeking further summer and winter flexibility services in 2019	Openly testing the market to compare flexibility against conventional reinforcement
Electric Vehicle Readiness 	Over 7,100 EV domestic chargepoints connected without reinforcement	Our innovative EV trial, Electric Nation successfully installed 673 domestic smart chargers	We have exhibited at the low carbon vehicle and energy infrastructure event LCV since 2013	Results from Electric Nation on smart charging behaviour	Building on learning from Electric Nation on using EV flexibility to defer reinforcement	Continued selective uprating of assets in LCT hotspots
Enabling Economic Growth 	Strategic Investment Options reports published for all four license areas	Stakeholder engagement completed in all regions	Publication of four Distribution Future Energy Scenario reports	Refresh DFES and Strategic Investment Options reports on a two year cycle	Engagement with Government on Local Energy Strategies	Continue to share forecast data with local and regional Government and other stakeholders
Whole System Planning 	Installation of FREEDOM test sites	Completion of WPD & NG Regional Development Programme for South West	Development of industry under ENA's Open Networks	Collaborative Strategic Investment Options reports with other DNOs	Joint SO and DSO articles published under WPD DSOF	Implementation of RDP recommendations, including enabling Deep Connect & Manage for customers
Communities and Localism 	Wide range of innovation projects centred around local communities	Community energy events held in major locations within WPD area	DNO to DSO community consultation published	Continued engagement with local communities enabling them to participate in future energy markets	Outputs and actions from the DNO to DSO community consultation	Additional commercial opportunities for customers connected at LV

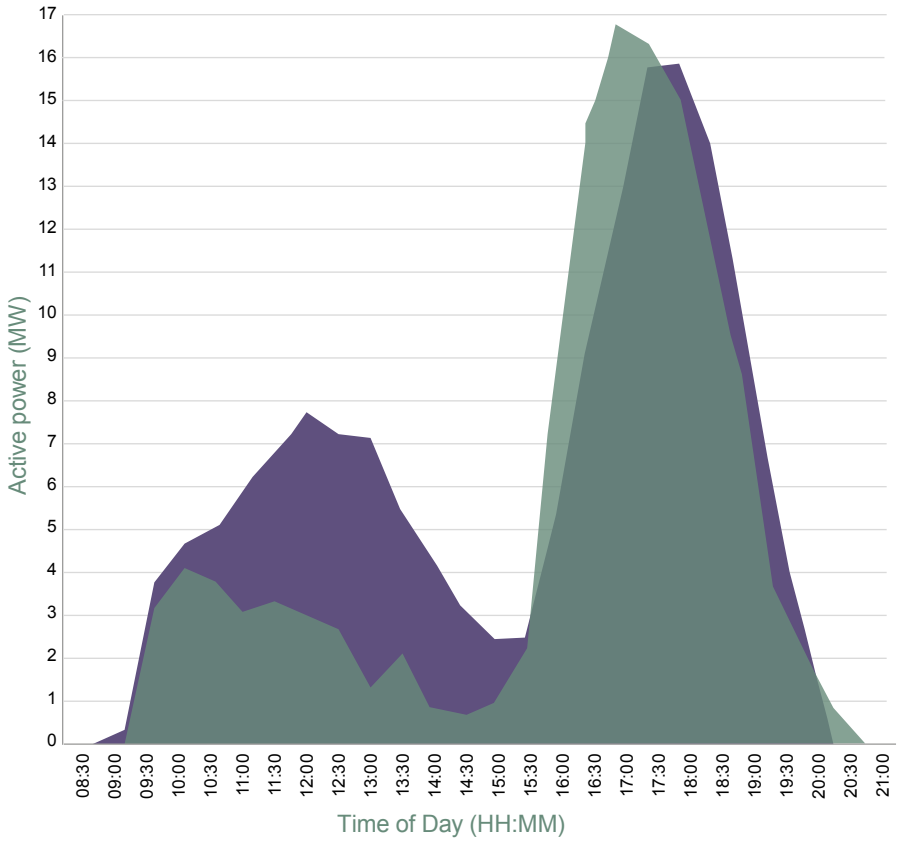
Neutral Supply Market Facilitation

Facilitating new neutral markets around flexibility is a key objective in WPD's DSO Strategy. As the energy system becomes more active, an important role for WPD will be to provide the right information to signal the needs of the electricity distribution network to the markets.

This will require us to provide a greater level of information on the performance characteristics of our network than ever before and in a format which is understandable and transparent. The information we present will inform the market ahead of us requesting tenders for flexibility and allow flexibility providers to understand our potential requirements for demand side response.

> "BY PROVIDING MORE INFORMATION ON ITS SYSTEM NEEDS, WPD CAN BECOME A FACILITATOR OF NEUTRAL MARKETS.

Adelaide Road – 330014 – MW Service availability windows



Legend/MWh availability

- May 222.61 MWh
- June 139.1 MWh

Areas of our network with flexibility requirements that are currently being procured will be published on our main website and expressions of interest will be handled through our Flexible Power brand.

WPD's network flexibility map shows information on flexibility zones under 'Live Procurement' and 'Signposting'. Zones in 'Live Procurement' detail the actual requirements for the flexibility WPD is seeking expressions of interest for.

'Signposting' provides data on WPD's distribution system needs in areas that we expect to become constrained for demand in the near future, under a number of future energy scenarios. Through this signposting work WPD is aiming to describe what generation turn up/demand turn down behaviour we may need (the months required, the MWs needed and predicted availability windows). It is also trying to quantify a likely market volume of energy (MWhs per month). However, it is not a here and now requirement nor does it indicate that flexibility is the only or best solution.

www.westernpower.co.uk/signposting

Flexibility Services

Enabling flexibility in the electricity system is core to the UK's Smart Systems and Flexibility Plan and WPD is responding through the wide-scale roll out of demand side response and alternative connections.

The development and wide-scale adoption of these technologies will embed flexibility throughout the whole electricity system.

Demand Side Response

Our NIA project Entire is seeking to prove the effectiveness of these solutions and develop the mechanisms used by network and system operators to realise the benefits provided by flexibility. We are taking forward 11 zones in the original East Midlands trial area, following a successful round of expressions of interest.

The need for network and system operators to publish information on system needs will continue to grow in importance. Our Signposting information will begin to provide current and forecast data on what would most benefit our system. Active participants within flexibility markets will be able to alter their behaviour to minimise conflicts on the network and maximise their potential revenues. As well as requiring information on network congestion and its impact on charging, participants will also want to see what capacity might be available so they can offer services to other energy system operators without the risk of curtailment.

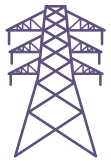
Areas of our network with flexibility requirements that are currently being procured will be published on our main website and expressions of interest will be handled through our Flexible Power brand.

www.flexiblepower.co.uk

Alternative Connections

As network operations move from passive to a more active model, the range of alternative ways of connecting customers to the network will increase. Customers will have more choice in the contractual terms for accessing network capacity and will be able to select which connection options best suit their requirements.

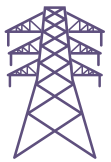
These are particularly useful in areas of constraint, where the connection cannot be accommodated without network reinforcement and where connection of additional flexibility would benefit adjacent network users.



14

Flexibility zones sought in 2017

Flexible Power
By Western Power Distribution



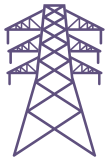
117MW

Flexibility offered into the Entire project in 2017

Flexibility Services

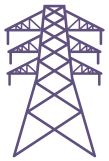
WPD believes that flexibility services will play a key role in delivering an economic and efficient electricity system. As well as ensuring its own network is developed to be as smart and flexible as possible, WPD will be working in partnership with flexibility providers to maximise the benefits they can provide to the whole system.

Demand side response is being rolled out across the business where we anticipate that flexibility can economically provide an alternative to reinforcement. Our business as usual deployment has already sought expressions of interest for flexibility in 18 zones across the WPD region in 2018 and has published requirements for over 60MW of services.



18

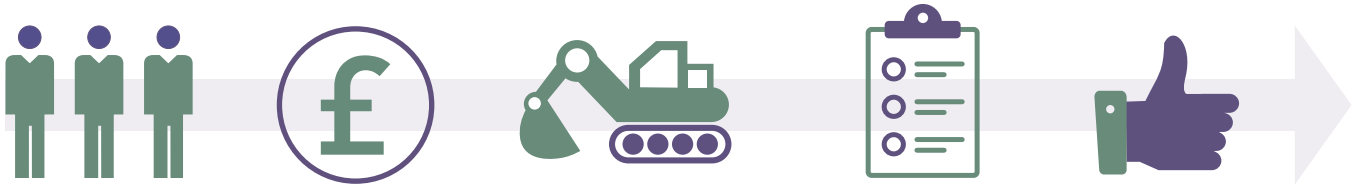
New flexibility zones for 2018



1.3GWH

Maximum flexibility availability required in 2018

Timeline for flexibility in 2018



EXPRESSION OF INTEREST
Mid May to early July

PROCURE
Mid July to mid September

BUILD AND TEST
Mid September to late October

OPERATE
November 2018 to October 2019

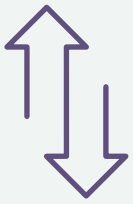
Intentions for 2019

Throughout 2019, flexibility will form an increasingly greater part of our investment strategy for developing our network.

Our signposting work aims to catalyse markets in areas where we are expecting constraints to appear and as we begin to see these manifest, flexibility will be deployed as a primary response to avoid network limits being exceeded. The speed at which flexibility can be mobilised will help us to operate more efficient networks.

WPD has committed to openly test the market to compare relevant reinforcement and market flexibility solutions. We will do this by increasing the transparency and availability of our data and information to the market and by opening up network requirements to market competition on a business-as-usual basis.

Throughout the rest of ED1 we will assess 90% of our load related reinforcement investment for a more economic delivery by flexiblity services.



90%

LRR investment asessed against Flexibility

For the remaining 10%, which is predominately at LV, we will continue to develop, test and evaluate other markets.

Electric Vehicle Readiness

The use of electric vehicles is on the rise and they are expected to play an important role in achieving the UK's targets for improving air quality and reducing carbon emissions.

Just six years ago there were only 2,500 electric vehicles in the UK – now there are over 160,000, and that number is predicted to rise substantially as we move towards the 2040 deadline for zero emission vehicles.

The demand for domestic and on-street charge points is likely to rise, and WPD is pro-actively making its network electric vehicle ready:

OVER 7,100

EV chargepoints have been connected to WPD's network without reinforcement.

Forecasting regional EV demands

- Through our Future Energy Scenario work, we are forecasting regional EV projections across a number of political and economic outlooks. We use this information internally to determine Strategic Investment Options. We also share this information externally to help inform local government strategy.

Selective uprating of assets

- Equipment placed on the network today will still be in service in 2050 so we must plan for this future change in demand
- By refining the regional projections further, we have developed a distribution transformer level forecast, which estimates the likelihood of EV uptake at each one of our 185,000 substations
- Using this data, we will selectively uprate assets on the HV and LV networks, based on a detailed economic assessment.

Electric Nation

- Electric Nation is the UK's largest EV trial, recruiting 700 drivers to better inform our assumptions about EV charging behaviour
- Electric Nation is also trialling smart charging technology, allowing more EVs to be connected to the distribution network without reinforcement
- By working with EV charging aggregators, we are trialling the commercial mechanisms to demonstrate EV flexibility as paid-for-service.

LV Connect and Manage

- LV Connect and Manage is a NIA project which is developing the technology needed to implement Active Network Management on the LV distribution network
- This technology will allow WPD to react quickly to the issue of local clustering behaviour and reduce the time to connect LCTs.

Industry Collaboration

- All DNOs have supported SECMP0046, which will enable DNOs to control Electric Vehicle chargers connected to Smart Meter infrastructure
- This proposal, if approved, would reduce the need for additional equipment to enable managed charging for EVs.

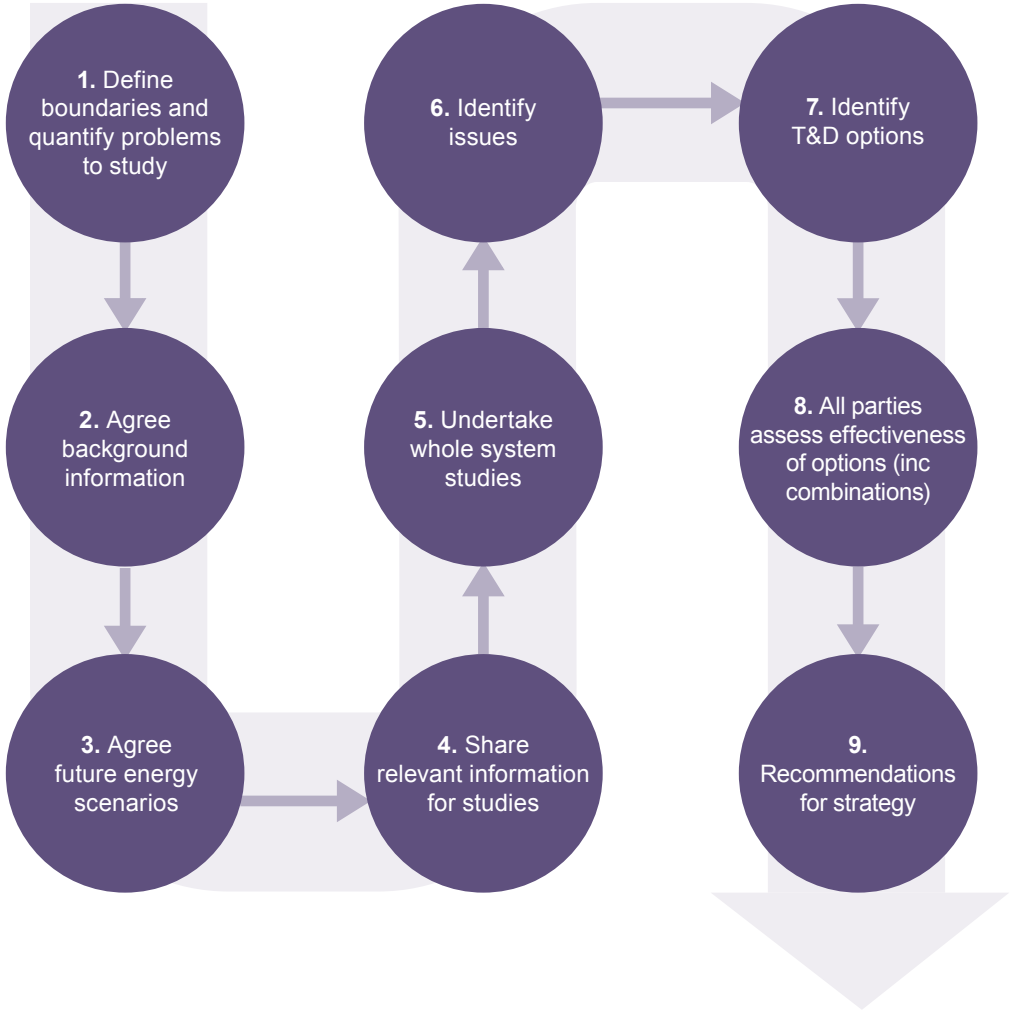
Whole System Planning

The Regional Development Programmes (RDPs) were set up to provide detailed analysis of areas of the network which have large amounts of Distributed Energy Resource (DER) and known transmission/distribution network issues in accommodating that DER.

The idea is to use this analysis to innovate and push the boundaries of current thinking with a "design by doing" approach to resolving the issues, pushing towards Distribution System Operator (DSO) type solutions and informing thinking for the DSO debate.

By solving a specific case study that has a pressing need to improve outcomes for customers in innovative ways, it is possible to make progress faster than the more conventional method of agreeing changes in approach at industry forums before making changes to the way the industry works. While there are risks that working in this way leads to a lack of standardisation across the GB network, this has been successfully managed by close cooperation and using the regional development programmes as case studies for the Energy Networks Association (ENA) Open Networks Project. Techniques and processes used within the RDPs will be replicated across other network areas as appropriate, resulting in innovative approaches being deployed much more rapidly.

Initially the RDPs have been set up on a project basis, but as the techniques and findings of the RDPs move into regular practice, it is envisaged that the RDP approach will continue to develop into a series of Business as Usual (BAU) developments.



> BY SOLVING A SPECIFIC CASE STUDY THAT HAS A PRESSING NEED TO IMPROVE OUTCOMES FOR CUSTOMERS IN INNOVATIVE WAYS, IT IS POSSIBLE TO MAKE PROGRESS FASTER.

Freedom Project

FREEDOM is a £5.2m collaborative project between WPD, Wales & West Utilities, PassivSystems, Imperial College, Delta-ee and City University to evaluate Hybrid Heating Systems.

This technology was installed into 75 homes in 2017 in the Bridgend 'Living Heat Lab' and is demonstrating hybrid gas and electric heat pump systems as a low cost retrofit to existing wet heating systems. It is also testing a unique smart controller which decides whether to provide the heating from gas or electricity.

This project aims to:

- Use the ability of the hybrid heating system to allow smart switching between gas and electric load to provide fuel arbitrage and highly flexible demand response services
- Demonstrate the consumer cost, carbon and energy system security benefits of large-scale deployment of hybrid heating systems
- Gain insights into the means of balancing the interests of the consumer, supplier, and network operators when seeking to derive value from demand flexibility.

Early learning shows this technology offers a solution to the energy trilemma.

Affordability:

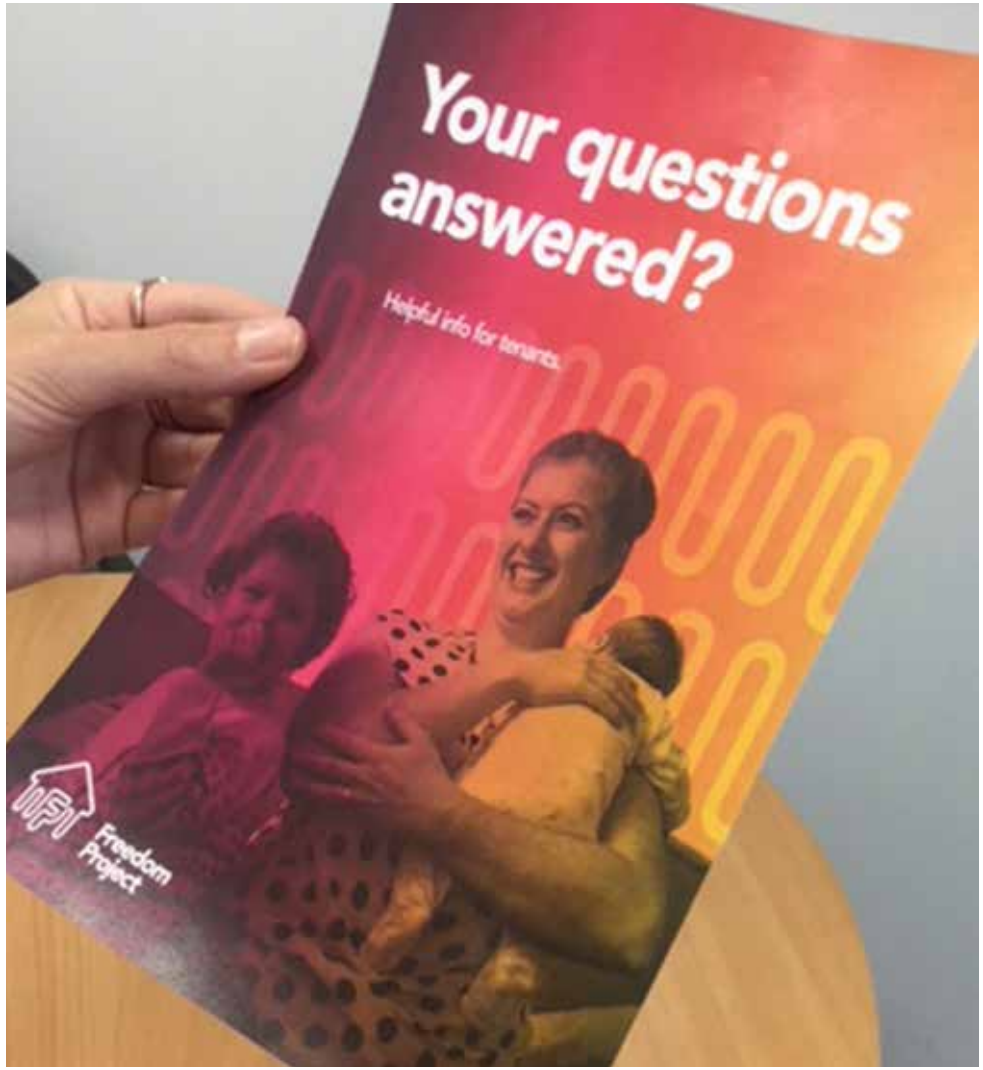
- Provides easy to use lowest cost heat – smart controls with demand aggregation unlock the full value of hybrid heating from fuel arbitrage, DSR and frequency response
- Opens potential for zero capital cost to consumer through a heat service proposition
- Simulated to create value – not reliant on further domestic incentives.

Sustainability:

- Complete load flexibility which favours low carbon electricity, topped up by gas
- Compounds the benefits from a greening gas network.

Security

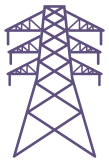
- Uncompromised heat delivered, which avoids DNO peaks and reinforcement
- Storage and flexibility in gas network fills renewable generation intermittency troughs.



Enabling Decarbonisation

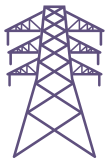
WPD is committed to supporting renewables and other generation technologies by facilitating connections to our network and reducing the time taken to connect.

Our network has seen a significant increase in distribution connected energy resources and to date there are over 178,000 sites providing generation back to the energy system.



3,226MW

Of Alternative Connection offers sent to date



989MW

Installed capacity of renewables connected in 2017

Alternative Connections

Our alternative connections suite has developed four additional options for customers seeking to connect to the grid. Timed and Import/Export limited connections are available across all WPD regions. Soft-intertrip connections are available across all regions as an interim option until we achieve full Active Network Management (ANM) roll out by 2021.

There are four variants:

Active Network Management

This solution is the most complex, but allows for the most optimal network usage. In areas where there are multiple complex constraints affecting a number of customers over a long time period, full active network management systems will be implemented. Distributed control systems continually monitor all the limits on the network and then allocate the maximum amount of capacity to customers in that area, based on the date their connection was accepted.

Soft-intertrip

Some networks are constrained due to a single upstream asset requiring reinforcement, or a single limit being infringed under certain conditions. This solution has an on-site soft-intertrip Remote Terminal Unit which provides two normally open contacts for the customer's control system to monitor; Stage 1 and Stage 2. When both sets are open, the connection will be free of constraints. The levels of curtailment corresponding to the operation of the Stage 1 and Stage 2 contacts are defined at the planning stage.

Timed

This solution is a simple t imer-based device that monitors the connection agreement with the customer, which will include some form of curtailment based on times of day. The customer's connection agreement will include an operating schedule which will define the times and levels of capacity available to them. The solution is supplied by the customer's equipment and does not require any additional investment from WPD to implement.

Export limited

This type of connection enables customers to cap their import from or export to the distribution grid. This often allows customers to connect renewable generation or storage beyond their meter whilst protecting the distribution network. Measurement and control equipment is used to automatically adjust the customer equipment to ensure they comply with their connection agreement.

Enabling Economic Growth

Western Power Distribution has been undertaking analysis on long term strategic studies, to better understand the potential growth in the connection of distributed generation (DG) and energy demand in all its licence areas, and how that future growth may impact on the network.

Every six months we publish a Strategic Investment Options study report on one of our four licence areas: **www.westernpower.co.uk/netstrat**

WPD's Strategic Investment Options reports detail the potential investments required at each GSP and BSP to accommodate the demand and generation forecast under WPD's system operator-aligned future energy scenarios.

Four energy scenarios: Consumer Power, No Progression, Gone Green and Slow Progression are used to identify a range of credible pathways to a decarbonised and decentralised future.

Scenarios requiring investment for West Midlands

GSP	2020				2025			
Bishops Wood			CP	GG	NP	SP	CP	GG
Bushbury							CP	GG
Bustleholm							CP	GG
Cellarhead					NP	SP	CP	GG
Feckenham	NP	SP	CP	GG	NP	SP	CP	GG
Iron Acton								
Ironbridge & Shrewsbury			CP	GG			CP	GG
Kitwell							CP	GG
Lea Marston/Hams Hall			CP	GG	NP	SP	CP	GG
Nechells	NP	SP	CP	GG	NP	SP	CP	GG
Ocker Hill							CP	GG
Oldbury								
Penn						SP	CP	GG
Port Ham/Walham			CP	GG	NP	SP	CP	GG
Rugeley			CP	GG	NP	SP	CP	GG
Willenhall				GG		SP	CP	GG

CP Consumer Power NP No Progression GG Gone Green SP Slow Progression

Enabling Economic Growth

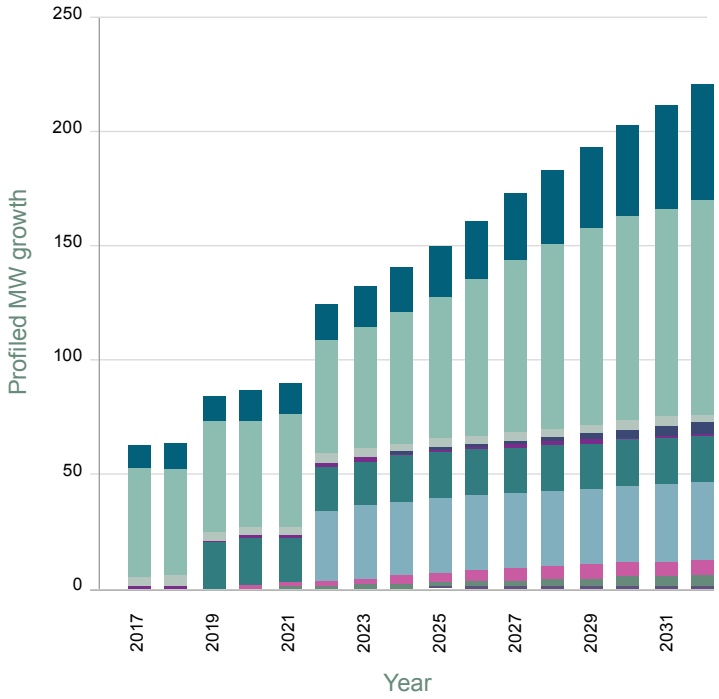
As well as providing a long term view of how we anticipate the network will develop, the data behind these assumptions has been supplied to other key stakeholders to further inform their future planning.

Our Network Strategy team has split the four WPD regions into over 260 smaller electricity supply areas and has generated growth scenario data for these areas until 2032. This includes details on installed capacities per technology type and estimated daily profiles. Already, 30% have been used by third parties to inform their energy strategies.

115

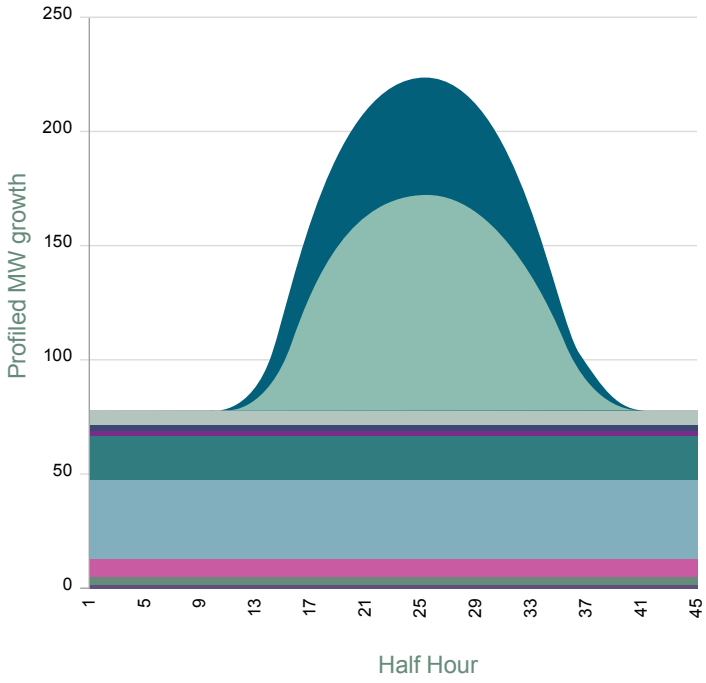
Number of areas WPD has provided future energy scenario data on to stakeholders

Generation Installed Capacity



- Solar PV – Rooftop
- Solar PV – Ground mounted
- Other generation
- Onshore wind
- Hydropower
- Gas
- Battery storage – high energy commercial & industrial
- Battery storage – generation co-location
- Battery storage – Domestic and community own use
- Anaerobic digestion

Maximum Generation Output Profile



- Solar PV – Rooftop
- Solar PV – Ground mounted
- Other generation
- Onshore wind
- Hydropower
- Gas
- Battery storage – high energy commercial & industrial
- Battery storage – generation co-location
- Battery storage – Domestic and community own use
- Anaerobic digestion

Enhancing Security of Supply

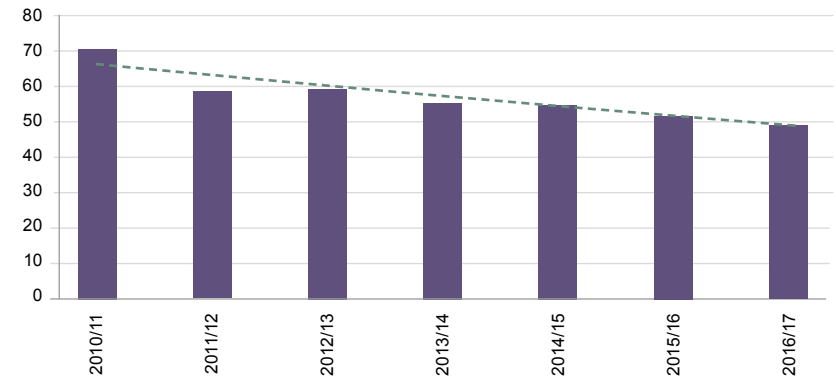
We have a proven track record of improving network reliability for customers.

A number of measures exist for determining how well a distribution business is performing, and WPD continues to demonstrate class leading achievements in all areas.

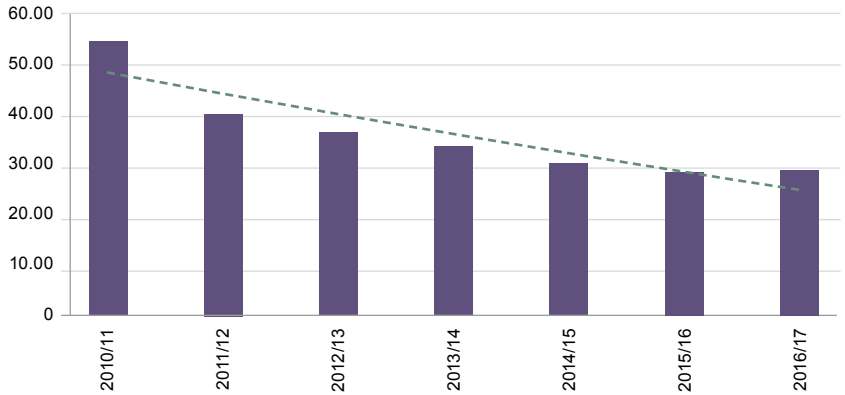
Two annual measures used are Customers Interrupted (CIs), which records how many times customers are without an electricity supply for any duration over three minutes (measured per 100 customers) and Customer Minutes Lost (CMLs), which is the actual number of minutes a customer is off supply on average. For both measures, across all our licence areas, WPD has continued to outperform industry benchmarks by investing in the operational excellence of our regional delivery teams and supporting them through additional network automation.

WPD's Flexible Power initiative seeks to contract with customers in certain parts of the network who have generation and demand flexibility that could help improve network security. By enabling a route for customer investment in flexibility to provide benefits back to the system, WPD can continue to develop its network economically and securely.

WPD all regions – Customers Interrupted per 100 customers (figures include severe weather events)



WPD all regions – Customer Minutes Lost (figures include severe weather events)



25,000

Number of network automation devices installed since 2010

>99.99%

Average network availability provided

Communities and Localism

We believe it is the responsibility of large organisations like ours to play a full and active role in the communities they serve.

We are committed to working pro-actively with community energy groups and recognise that the volunteer led approach and complex nature of their projects means that community energy groups need more time and support to engage in the process of connecting to the network.

We run eight Community Energy Events every year at key locations where community energy groups can come to find out what is happening in the industry and speak to us. We have a dedicated Community Energy page with animations, guides and podcasts on topics that Community Energy groups are interested in.

The following projects demonstrate WPD's commitment to the transparent provision of data on the operation of its network. This will enable communities and other local initiatives to be an integral part of the transition to a smarter and more flexible system.

www.westernpower.co.uk/Community-Energy

OpenLV

OpenLV is an innovation project which will provide community energy groups access to LV data and trigger new ideas.

- Software Platform installed at 80 LV substations
- Opportunities for communities to develop apps that can run on the platform
- Seven Community Energy groups and 17 businesses have been selected and will be implementing their proposals.

Plugs and Sockets – Cornwall Local Energy Market

Plugs and Sockets – Cornwall Local Energy Market will develop a platform that aims to enable the DNO to remove constraints from the distribution network through the flexibility services others can offer.

- Development of a platform (by Centrica) for flexibility services
- Will allow customers to alter generation/ demand to benefit a third party
- First UK DNO flexibility marketplace
- Participants can also access the platform as observers to see the requests for services and transactions.

Western Power Distribution (East Midlands) plc, No2366923
Western Power Distribution (West Midlands) plc, No3600574
Western Power Distribution (South West) plc, No2366894
Western Power Distribution (South Wales) plc No2366985

Registered in England and Wales
Registered Office: Avonbank, Feeder Road, Bristol BS2 0TB

August 2018

www.westernpower.co.uk @wpduk