Everything you need to know about our **Electric Vehicle Strategy**

May 2020

WESTERN POWER DISTRIBUTION

Serving the Midlands, South West and Wales

Foreword

The future is electric and Western Power Distribution is right at the heart of it.

Our latest EV strategy explains how we are preparing our network for the millions of electric vehicle drivers who will want to charge their EVs at a time and place to suit them.

That's why our vision includes EV charging solutions to meet the needs of all kinds of customers.

This document – which builds on the success of our first EV strategy published in 2019 – outlines the steps we're taking in 2020 to make that vision a reality.

It charts the research and development we have been spearheading and the myriad of EV-related activities that have been taking place at WPD (and on driveways and service station forecourts across our region) – even before most people were talking about the EV revolution.

The strategy also shares the rationale behind our current innovation projects and business initiatives – as well as how we are already transforming some of our early-stage charging solutions into 'business as usual' activities.

We've been working closely with our stakeholders to plan and prepare for the needs of individual customer groups (as outlined in Section 4) so we're confident that the commitments we're working on – many to tight schedules (as outlined in Section 6) – will be exactly what drivers want.

By listening to our customers and harnessing our talent for innovation, we have everything in place to meet the growing demands for EV charging in the UK.

We'll be ready when you are.

P. White

Peter White
DSO Development Engineer

What we do

Western Power Distribution is the electricity distribution network operator for the Midlands, the South West and South Wales.

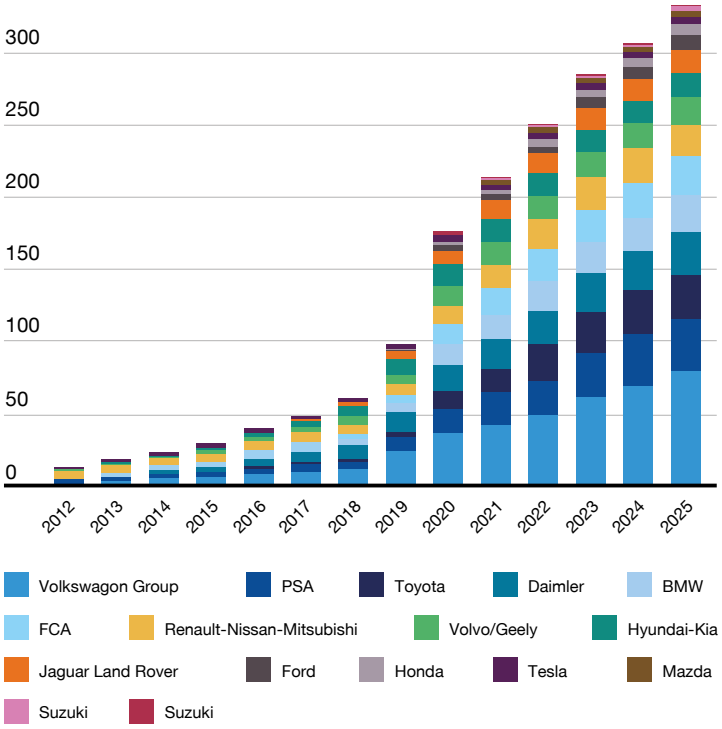
Our job is to deliver a safe, reliable and resilient electricity network to our **7.9 million customers**. We do all this for **less than 30p a day**, investing almost **£900 million** in the network each year and **employing 6,500 highly-trained staff**.

This year, we've:

- Added **2.9GW** of extra capacity by operating the network in a smarter, more efficient way
- Taught **84,000** school children about electrical safety
- Recruited **77** new engineering trainees
- Achieved **91%** average customer satisfaction (the best performing electricity network operator in the UK for the last eight years)
- Handled **two million** customer calls
- Added **200,000** vulnerable customers to our Priority Services Register
- Invested almost **£900 million** in the network
- Served **7.9 million** customers
- Achieved this for less than **30p** a day

Getting EV ready – why now?

We know what steps we need to take to make sure we're EV ready – and that's why we're taking them now.



Almost eight million customers rely on us for their electricity supply – and many of these customers will be making the transition to EVs and to electric vehicle charging.

It's vital we pay close attention to their needs as we work towards a future where EVs are a part of everyday life. Our stakeholders expect us to do this and we're determined not to let them down.

Why we need to act now:

1 The popularity of Electric Vehicles (EVs) is growing. EVs are a key part in the government's target to achieve net zero by 2050.

2 In 2018, the government called for 'at least 50%, and as many as 70%, of new car sales and up to 40% of new light van sales (to be) ultra-low emission by 2030'. Earlier this year, it announced its plan to 'end the sale of all new conventional petrol, diesel cars, vans and hybrids by 2035'.

3 New incentives to reduce vehicle emissions and make electric cars more attractive to company car drivers are expected to accelerate the demand for EVs.

4 The growing number and choice of EV models is likely to stimulate interest from car buyers. The graph opposite shows how the range of EVs is set to increase from 2012 to 2025.

5 And it's not just cars that are going electric. Revised CO_2 emission performance standards for new heavy-duty vehicles including trucks and buses look set to boost EV sales in this area, too. Manufacturers will also have to ensure that at least a 2% market share of the sales of new HGV vehicles is made up of zero and low emission vehicles by 2025.

6 As well as national government, towns and cities across the UK are introducing their own restrictions in a bid to reduce pollution levels.

Among the locations to announce schemes for cutting emissions are the following across our region:

Bath
Clean air zone for commercial vehicles in 2020;

Bristol
Ban on all diesel cars and a clean air zone for commercial vehicles in 2021;

Cardiff
Daily charge for drivers who don't live in Cardiff and a clean air zone for vehicles date to be confirmed;

Derby
Traffic management measures or a clean air zone date to be confirmed.

That's why we're getting ready now.

A network for all

Our job is to make sure the network is ready for all kinds of EV charging.

People's charging needs will vary, depending on the type of vehicle they own and whether they have access to their own charging point or plan to use a public charging facility.

We know only 60% of car users have access to an off-street parking location likely to be suitable for charging.

Wherever and whenever people want to charge, they need to know we will provide an adequate and safe electricity connection to meet their needs.

The principle is simple:

The infrastructure for EV charging requires high volumes of energy – and we need to be able to deliver that energy where it's needed. Our predictions show that the majority of larger local transformers will be able to support the demands of home-connected EV charging.

A large transformer can accommodate one 35kWh charge for cars and vans every five days for every customer connected to it, allowing most EVs to travel up to 150 miles on a single charge. We also expect our 33kV network and primary transformers to be able to deliver this level of charge point activity.

Making the changes

For older homes – particularly those built before 1946 – there is a greater chance of network constraints caused by old-style low voltage (LV) service cables. We've begun replacing these cables as we install EV chargers and we're also identifying areas where proactive uprating of cable networks will be needed.

When it comes to network design, we expect our assets to remain in place for about 50 years. That's why it's so important to plan for EVs now. We've been incorporating extra capacity into our 11kV network since 2013: this will enable us to draw on existing capacity to support the early adoption of EVs and other Low Carbon Technologies (LCTs), particularly in urban areas.

In 2013, we also started installing larger LV main and LV service cables as standard for new build estates to meet the future challenge of LCTs. And, when we've been working at substations or replacing cables, we've increased cable sizes to help future-proof the network further.

150 miles on a single charge.

A large transformer can accommodate one 35kWh charge for cars and vans every five days for every customer connected to it, allowing most EVs to travel up to 150 miles on a single charge.

A network for all

Since 2016, we've been working on a series of future energy scenarios to help predict the likely impact of EVs and other new technologies on our network.

Potential 70% uptake in EVs by 2023 > **3,064,000**

The expected number of chargers connected to the network if EV adoption continues at existing levels.

217,000 by 2023

These are based on National Grid's Future Energy Scenarios (FES) and tailored to specific locations. They enable us to take into account the possible future impact of factors such as distributed generation, an increased demand for electricity and the growing popularity of electricity storage. We can then identify possible constraints on the network and develop investment strategies for dealing with these, using flexible solutions where these offer better value than conventional reinforcement.

We've come up with our own scenarios – known as Distribution Future Energy Scenarios (DFES) – based on the four below drawn up by National Grid: Our own version of the Two Degrees scenario sees growth accelerating more rapidly ahead of FES 2019 and levelling off by 2050. Across our licence areas, we expect to see an above average take-up of EVs initially, taking into account factors such as affluence, the availability of off-street parking and second car ownership, along with emission reduction incentives in and around urban centres.

Along with our work on DFES, we've been working with EA Technology to create a tool which will assess the impact on local LV networks. This tool, which was developed as part of the Electric Nation project, shows where networks are becoming constrained as a result of local clusters of EVs and will help to highlight where proactive reinforcement can help prepare local networks for LCT connections, in particular EV connections.

Our 'Who's on our Wires' report, in partnership with the Centre for Sustainable Energy, added socio-economic factors to the national growth forecasts for all LCTs – and predicted a similar clustering effect where the number of EVs is likely to grow fastest.

In preparation for this, we're uprating assets at the same time as carrying out other works, in areas where we're confident of load growth. This has already taken place across 7% of our network.

The number of EVs across our four licence areas so far matches the predictions in our ED1 business plan.

✕✕2050 carbon reduction target is not met

✓✓2050 carbon reduction target is met

Level of decentralisation

Consumers Evolution	
Electricity demand	Moderate-high demand: high for electric vehicles (EVs) and moderate efficiency gains
Transport	Most cars are EVs by 2040; some gas used in commercial vehicles
Heat	Gas boilers dominate; moderate levels of thermal efficiency
Electricity supply	Small scale renewables and gas: small modular reactors from 2030s
Gas supply	Highest shale gas, developing strongly from 2020s

Community Renewables	
Electricity demand	Highest demand: high for EVs, high for heating and good efficiency gains
Transport	Most cars are EVs by 2033: greatest use of gas in commercial vehicles but superseded from mid 2040s by hydrogen (from electrolysis)
Heat	Heat pumps dominate; high levels of thermal efficiency
Electricity supply	Highest solar and onshore wind
Gas supply	Highest green gas development from 2030s

Steady Progression	
Electricity demand	Moderate-high demand: high for EVs and moderate efficiency gains
Transport	Most cars are EVs by 2040; some gas used in commercial vehicles
Heat	Gas boilers dominate; moderate levels of thermal efficiency
Electricity supply	Offshore wind, nuclear and gas; carbon capture utilisation and storage (CCUS) gas generation from late 2030s
Gas supply	UK Continental Shelf still producing in 2050; some shale gas

Two Degrees	
Electricity demand	Lowest demand: high for EVs, low for heating and good efficiency gains
Transport	Most cars are EVs by 2033; high level of gas used for commercial vehicles but superseded from mid 2040s by hydrogen
Heat	Hydrogen from steam methane reforming from 2030s, and some distinct heat; high levels of thermal efficiency
Electricity supply	Offshore wind, nuclear, large scale storage and interconnectors; CCUS gas generation from 2030
Gas supply	Some green gas, including biomethane and BioSNG; highest import dependency

Speed of decarbonisation

If EV adoption continues to increase at the current rate, we expect up to 217,000 chargers to be connected to the network by 2023.

However, the government's target to ban the sale of all new non-zero emission cars and vans by 2035 could mean an extremely high, 70% uptake in EV adoption resulting in a possible 3,064,000 EVs by 2023.

What will EV charging look like?

There are four main types of EV charging – super, rapid, fast and slow.

These represent the power outputs – and therefore the charging speeds – available to charge an EV. (Power is measured in kilowatts or kW).

Smaller size chargers are set to become a common sight on driveways and for on-street parking, to enable overnight charging. The government is consulting on plans to ensure that all new buildings are fitted with a 7kW type 2 EV charger.

Some households may opt for a slow 3kW charger. For any vehicle which is stationary for a longer period, such as at a 'park and ride' site or office car park, slow charging may be the most efficient solution. Charging times will vary depending on the charging unit, the LV supply capacity and the EV being charged, but a full charge on a 3kW unit typically takes 6-12 hours.

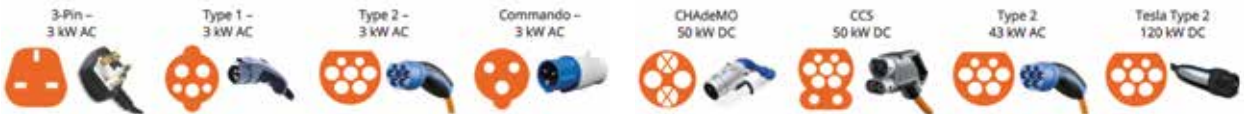
Slow charging can be carried out using a standard three-pin socket but the higher current demands of EVs and the length of time spent charging means that those who need to charge regularly are strongly advised to get a dedicated EV charging unit.

Larger rapid chargers will be installed at public locations such as service stations, motorway services areas and car parks, where drivers need a faster charge. These will also be most suitable for vehicle charging hubs, such as those used to charge taxis.

Chargers of 7kW can be accommodated by most existing homes. Larger chargers will usually require a network upgrade.

Charge Point type and power output	Likely installation location	Specific connection requirements	Network considerations	Likely charge time for a 35kWh charge
Slow up to 3kW	Domestic	None – connects via household plug/socket	None	12 hours
Slow 3.7kW	Domestic or street side	Dedicated household circuit or on street equivalent	In some cases limited local reinforcement is required	9 hours
Fast 7kW	Domestic or street side	Dedicated household circuit or on street equivalent	Likely upgrade to service cable and local mains	5 hours
Fast 22kW	Street side or public charging location	Three phase dedicated supply point	Requirement for three phase connection and likely local mains upgrade	1.5 hours
Rapid 43kW	Public charging location	Three phase dedicated supply point	Requirement for three phase connection and likely local mains and transformer upgrade	45 minutes
Super 130kW or multiple rapid chargers	Public charging location	Supply point from dedicated transformer	In most cases a new transformer will be established	15 minutes

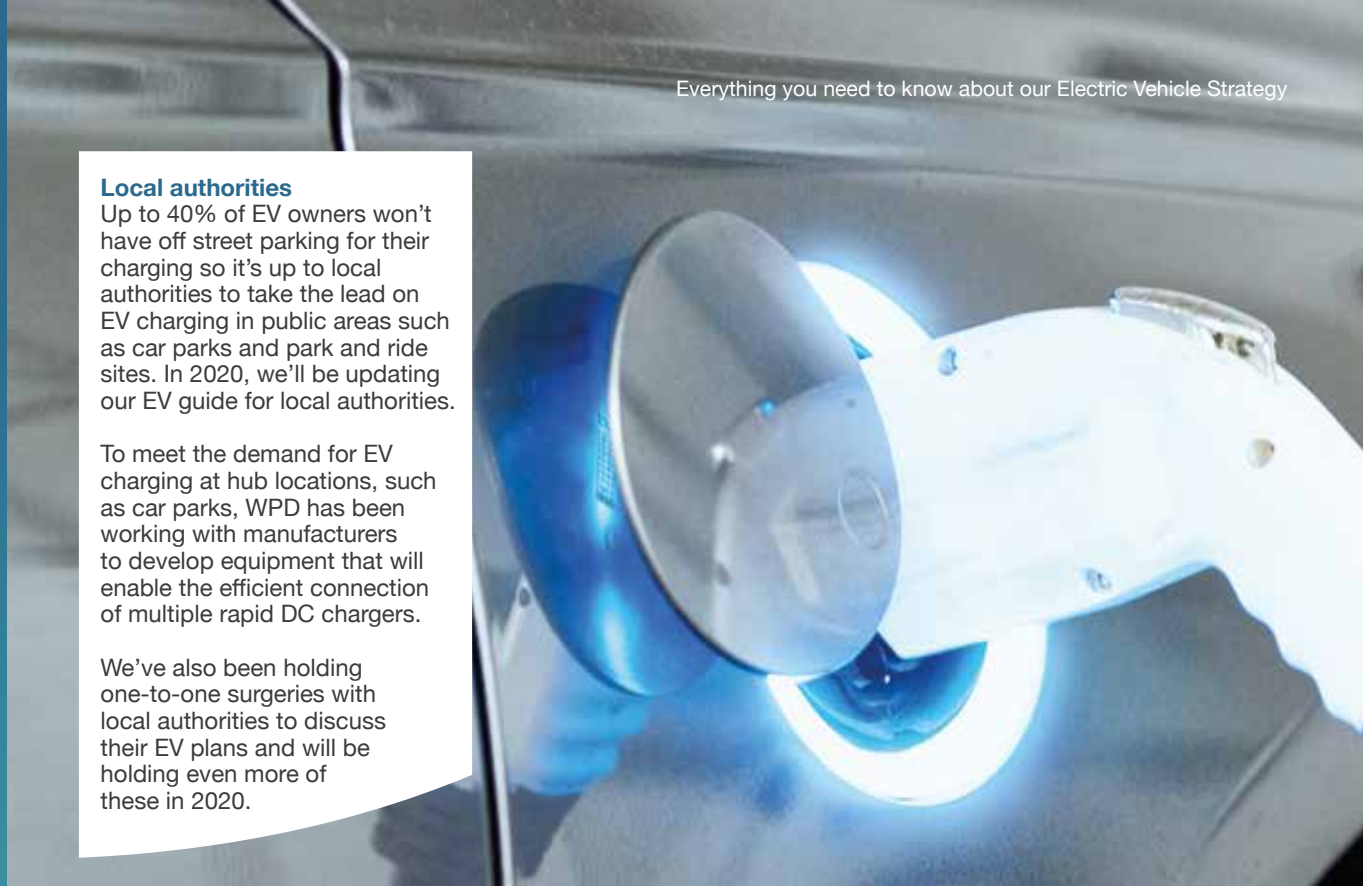
Charge Point type and power output	Likely installation location	Typical approximate connection lead-times	Network and Third Party considerations	Approximate connection cost
Slow up to 3kW	Domestic	Immediate	None	None
Slow 3.7kW	Domestic or street side	Immediate in most cases	Usually none	Usually none
Fast 7kW	Domestic or street side	4 to 8 weeks	Likely upgrade to service cable and local mains	£1,000 to £3,000
Fast 22kW	Street side or public charging location	8 to 12 weeks	Streetworks and permissions	£3,500 to £12,000
Rapid 43kW	Public charging location	8 to 12 weeks	Streetworks and permissions	£3,500 to £12,000
Super 130kW or multiple rapid chargers	Public charging location	16 weeks	Streetworks, permissions and cost of land for transformer	£70,000 to £120,000



Charging points – and talking points

We've been talking – and listening – to our stakeholders since 2010 about our plans for electric vehicles. These conversations have helped to shape what happens next.

In the last 12 months, we've been talking to:



Local authorities

Up to 40% of EV owners won't have off street parking for their charging so it's up to local authorities to take the lead on EV charging in public areas such as car parks and park and ride sites. In 2020, we'll be updating our EV guide for local authorities.

To meet the demand for EV charging at hub locations, such as car parks, WPD has been working with manufacturers to develop equipment that will enable the efficient connection of multiple rapid DC chargers.

We've also been holding one-to-one surgeries with local authorities to discuss their EV plans and will be holding even more of these in 2020.

Vehicle manufacturers and transport operators

We've been talking to HGV manufacturers about how they can make the transition from diesel to electric, helping them to plan for new emission targets, as well as talking to Nissan about their EV charging, home generation and battery storage plans.

We're also helping transport trade bodies to prepare for the changes to road transport as a result of a growth in EVs.

EV charge point operators

We're making the connection process easier for EV charge point operators to speed up the connection process and get more EV charge points installed in the UK.

House builders

We've launched the Superfast Electricity project in Wales as part of our plans to increase the house service cable design (read more about this on p13).

Fuel station operators

We're part of OLEV's Project Rapid Phase 1 which is rolling out 130 rapid motorway service area sites in England, 48 of which are in our licence areas.

As part of Phase 2, another 14 sites will be nominated across Wales and Scotland.

We're already working with Moto Services on plans for a demonstration project at one of their motorway service areas.

It's good to talk!

Depot-based fleet operators
We've been working with bus operators like Arriva as part of the Electric Boulevard project to explore the benefits of wireless charging.

We've also been supporting Cardiff Bus who will be using 40kW rapid chargers in a depot charging hub for their 32 BYD electric buses. As the buses are generally at the depot overnight, a flexible connection may allow this capacity to quickly connect.

Government
Working with OLEV and BEIS, we've been calling for changes to building regulations so that EV chargers in new buildings can incorporate other LCTs for a more holistic approach.

We're part of the UK's Electric Vehicle Energy Taskforce which was formed at the request of the government to ensure the UK energy system is ready for the mass take-up of electric vehicles.

Welsh government
Our projects to demonstrate Superfast Electricity and On Street Charging have all been developed with the help of the Welsh Government.

Local enterprise partnerships
Our network investment plans need to be aligned with developments at a local level. That's why we regularly meet local stakeholders to learn more about their planned projects and ensure we're capturing the correct data to feed into the right investment strategies.

We then build a bottom-up vision of demand, generation and storage growth by absorbing locally published plans and other market intelligence so that we can study the network under future growth scenarios.

This data is also shared with local enterprise partnerships, local authorities and other stakeholders and has been used to inform local energy plans.

Go Ultra Low cities
Three of the four Go Ultra Low projects – Nottinghamshire/ Derby, Milton Keynes and Bristol – are in our operating area. Between them, they have plans to install 410 charge points, many of which will be high capacity rapid chargers. They are all supporting free or discounted parking for EVs which is likely to increase early adoption. We're working with each of the cities to help them deliver these ambitious targets, workshops, online panels and customer groups.

You!
Many of our forthcoming stakeholder engagement sessions this year will have an EV theme. These will include workshops, online panels and customer groups.

What happens next?

Because we have years of experience designing electricity networks, we're used to adapting to the changing needs of customers.

Our engineers are already working hard to incorporate EV charging into the network in the most efficient and economical way.

In some cases, this will mean upgrading the network; in others, it will involve innovative solutions to create faster and more efficient connections.

Here are just some of the ways we're using innovation to make our network EV-ready:

We've allocated

£58million

for investment in our EV charging infrastructure (as outlined in our ED1 submission).

Releasing existing network capacity

Our network capacity map shows where our existing transformers can offer capacity and where constraints are likely. These early constraint signals will help us to introduce appropriate flexibility solutions such as smart meters or 'time of use' tariffs.

Innovative solutions for:

Motorway service stations and filling stations

Large fuel retailers and service area operators will have to provide public charging points. Some of this demand will be met by uprating LV mains. But we're also looking at innovative ways of creating network capacity for EV charging through initiatives such as our Hub Charging and EV Filling Stations projects.

New homes

Every new home in the UK will be fitted with a 7kW EV charger from April 2020. But we're ahead of the game: we've been fitting larger capacity service cables – to meet the demands of EVs and LCT generation – since 2013. That's a lot of homes that won't need a service upgrade because we planned ahead.

We're also excited to see the results of our Superfast Electricity project, in conjunction with energy efficient house builders in Wales, which is trialling new ways of meeting the energy demands of the modern household.

Existing homes

Most homes built since the mid-1990s will be able to accommodate the added demands of a small car charger. But, where an existing service cable is inadequate to meet the requirements of an EV charger – as in many older properties – our Superfast Electricity project in Swansea will demonstrate how this can be achieved with minimum customer disruption.

On-street charging

We're helping local councils to provide new street lighting installations or bespoke EV charging installations in their streets. This will change the way we design connections for streetlights, which have historically been sized and connected for the relatively low demand of a single lamp! In some cases, we'll be able to uprate services to streetlights; in others, we'll need a wider scheme to uprate the mains. In new streets, we're expecting to install bespoke street lighting mains cables, as part of our On Street Charging Solutions initiatives.

Depot-based fleet users

Fleet users who are charging vehicles overnight in a depot are going to need a relatively large electricity supply to meet their needs. But, as the majority of charging will take place overnight at times of low demand for the network, we'll be able to offer flexible solutions such as Alternative Connections to these customers to make the most efficient use of the network.

Workplace and off-street charging

The charging points of the future will never be far away, from park and ride sites and supermarkets to retail parks and other leisure locations. It is expected that third party EV charging sites will be developed at car parking locations. The EV Hub Charging project that we're leading will look at how this demand with bespoke load centres can be established directly in car parking areas.

What happens next?

Innovative solutions for:

Vehicle to Grid (V2G)

As part of our Electric Nation project, we conducted a mini V2G trial. The flexibility offered here is restricted to specific models of car and limited to the CHAdeMO connected EV charger at present – but delivered an invaluable insight into future EV charging habits. We were also involved in the V2GB Innovate UK project and worked with Ovo to help connect the first domestic V2G charger in 2019. We have now launched the Electric Nation – PoweredUp project as a follow-up to Electric Nation and will be monitoring up to 100 V2G chargers during 2020.

Smart charging

We've been working with Pobl, a Welsh Housing Association, and Sero Homes on the Tonyrefail project, where all new homes are being fitted with a complete suite of LCTs managed by a Program Logic Controller (PLC) enabling residents to 'live within the generation of the house'. It is hoped that a fully LCT-connected house will make it possible to manage fuel consumption more effectively and minimise the risk of fuel poverty. This smart system means EV charging can be carried out when demand is low to reduce strain on the network.

Schemes like this could help DNOs manage the electricity network more efficiently and reduce the need for reinforcement. We know from the Electric Nation project that price can affect charging patterns. We've since held workshops with other industry participants to explore how this knowledge can be incorporated into other products and services.

EV clustering

It's important that not all EV charging takes place at the same time – to avoid 'clustering'. We learnt from Electric Nation that the natural spread of charging behaviour means all EVs rarely connect every night. But it's still vital we find out where the demand for charging is likely to be highest which is why we've been busy identifying hotspots and clusters of EVs and other LCTs, as part of our commitment to be EV ready.

The LCT Detection project revealed as many as 20,000 connections that we had not been notified of by installers. As a result, we are now embarking on a second round of LCT detection with IBM and Electralink to add further locations.

And we're constantly using this clustering information to inform the proactive reinforcement of our network.

Avoiding local network constraints

We're using new technology to help us respond to the added demands of LCTs while upholding our high levels of customer service – confirming our place as an industry leader when it comes to supply interruptions.

While most EV clusters will be identified as part of our cluster modelling, there may be isolated locations where a cluster of new EVs will exceed the capacity of the local network.

To reduce the risk of interruptions while we uprate the network, we have devised new ways of managing load in response to local overload situations and developed these through the WPD Innovation Connect and Manage project.

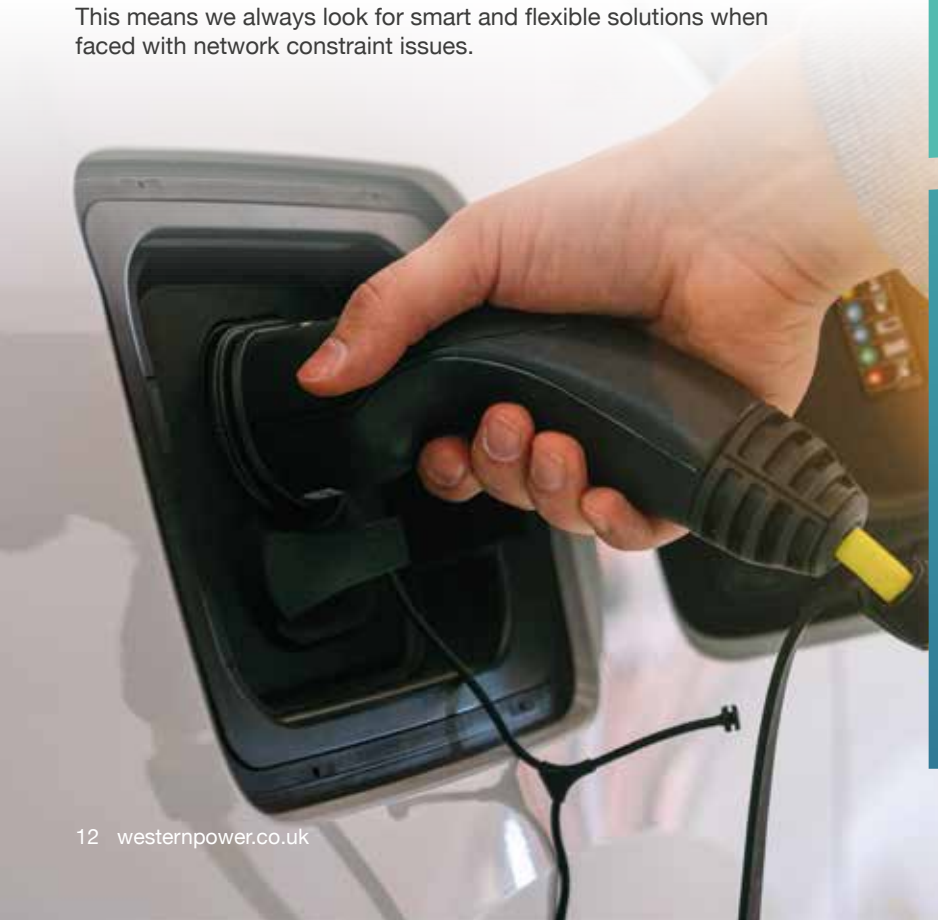
This solution is now part of our BAU response where LCTs have created a specific problem but will only be used while the network is being upgraded.

Smart and flexible

We know flexibility will be key to delivering EV charging for all kinds of customers, from domestic users to fleet drivers who return their vehicles to the depot overnight.

In fact, flexibility is already an established network management tool, developed as part of our Flexible Power initiative.

This means we always look for smart and flexible solutions when faced with network constraint issues.



Domestic flexibility

The growth in Smart Meters is one way in which domestic users will be able to take advantage of smart solutions, thanks to 'time of use' tariffs expected to be offered by electricity suppliers. Customers with home charging will be able to plug in their vehicles and leave them to charge when the cost is lowest – helping to take the strain off the electricity network at peak times.

Our work with larger customers is now helping to inform our approach to EVs and the domestic market. V2G technology and deferred charging offers networks a greater opportunity for flexibility, for example where EVs are plugged in for an extended period, including longer spells at park and ride sites or long stay car parks.

We expect domestic flexibility will be delivered in stages, starting with simple 'time of use' demand, shifting through supplier signals, moving on to Flexible Power products where aggregators will manage multiple EV chargers and offer us a higher capacity response.

Where short term flexibility is needed to overcome local constraints, we will use active network management tools such as Connect and Manage while network reinforcement is taking place.

Commercial flexibility

Fleet users are more likely to make use of overnight charging to power their vehicles for the next working day, making the electricity demands of a depot charging facility similar to that of an extra factory.

This could cause potential constraints on the network if everyone plugs in at the same time. However, most businesses are expected to take advantage of flexible connection solutions to allow charging at off-peak times, making connections quicker and cheaper for customers.

Where there are larger clusters of EV charging, such as depots and long stay car parks, operators may be able to play a part in our flexibility markets. A customer who makes use of local generation, storage and EV charging can not only reduce their impact on the network but help to avoid conventional reinforcement.

Through Flexible Power, operators can do this by reacting to constraints and reducing demand at peak times. This full Active Network Management solution has already been delivered by a car showroom in Lincolnshire to restrict charging at times of peak demand.

Innovative solutions like this will allow EV charging to coexist with other conventional demands. For example where a depot facility requires charge capacity at night, it may be possible to provide this without reinforcement by sharing network capacity which is already available for daytime industrial use.

Taking charge – current projects

All of our current projects build on the research and knowledge we already have under our belt.

Reinforcement planning – forecasting and planning interface tool (2020)

This project builds on the success of Electric Nation by focusing on smart meter data, consumption data and network conditions – and looking at how this information can be imported into design software to allow planners to undertake network assessments.

Once this work is completed, we will assess how the tool can be developed further to help our local planners identify local constraints and design solutions.

We hope to make this information available to customers on our website, so they can quickly assess the impact of their additional demand on our network.

Smart homes – EVs and storage

The Tonyrefail Superfast Electricity project will see all homes in the development fitted with a complete suite of LCTs managed by a PLC enabling residents to 'live within the generation of the house'. A fully LCT-connected house should help to manage fuel consumption more effectively and minimise the risk of fuel poverty.

To achieve this, Sero Homes will create an 'electricity co-op' – this will enable the battery storage of all houses on the estate to be offered to National Grid in the event of a frequency response issue on the wider electricity network. Any money generated would be ploughed back into the electricity co-op to reduce fuel bills. By using this data, it will be possible to show how a domestic installation can make use of locally generated power and storage to provide the energy required to run a house and charge an electric vehicle. Ultimately, the equipment could also be used to mitigate peak demands.

Self assessment

When a customer chooses an EV, the next step is to consider their charging options.

The ENA LCT group is working to create a centralised system which will provide DNOs with the information they need to assess quickly if a home can accommodate an EV charger and ensure an easy, smooth and trouble-free experience for the customer.

Charging hubs

Local authorities are likely to establish charging hubs in car parks, supermarkets and other off street locations. These provide a large single point load connection to our network using a bespoke transformer. However it is likely that these locations will not be in continual use and there will be times of the day when no charging occurs.

We are working with a transformer manufacturer to develop a low loss version of our standard units which will reduce the network running costs of these locations.

We have already designated sites for the proposed installation of charging hubs. These will be used to charge passing vehicles and also to provide a charging facility for the EVs of people living nearby who do not have off-street parking. We expect that similar hub facilities will be used by commercial and public transport operators and are exploring ways in which we can apply our technology to these locations.

Leading the charge – future projects

EV filling stations

This project will explore a number of innovative solutions to provide network capacity for EV charging stations, particularly for people who do not have a driveway or designated parking.

This will include locations close to major trunk routes as well as locations like supermarkets and city ring-roads.

Options include increasing the voltage level at the point of connection, DC rather than AC connections, inclusion of co-located batteries and poly-phase options.

This project is still at the development stage and we would welcome expressions of interest from partners wishing to work with us in this field.

On-street charging solutions

This project will look at solutions for charging vehicles in residential locations on the street or at communal parking areas. We plan to work with local authorities and other regional bodies to design and demonstrate dedicated infrastructure for electric vehicle charging.

Where local authorities deploy on-street charging, we will need to change the way we provide electricity supplies to street furniture such as streetlights. Conventional networks are built to provide low wattage connections to lamps only. Earthing and technical issues will also call for changes to the type of connection we can use.

Our project will show how a bespoke low voltage mains cable can be used to provide supplies to charge points and other street furniture.

We will also establish triggers which will allow for mains cables to be uprated ready for future demands.

Ready charged – completed projects

We've been leading the way in EV thinking and planning since 2009. So much has happened in the last 10 years – take a look at some of our projects to see how far we've come.

Imagine where we'll be in another 10!

Cabled (2009)

This was the UK's first ever at-scale project to engage the public with EVs and gauge their attitudes to recharging, as well as assessing the impact of EV charging on the local electricity network.

By installing 35 charging points in city centre locations, and using smart meters to measure customer behaviour, we identified charging habits and challenges that have informed our design policies ever since.

V2G Taxi (2011)

This project gave an early and valuable insight into how vehicle to grid (V2G) technology could be embraced by the energy and automotive sectors as a way of cutting bills and ensuring a safe and stable electricity supply.

It directly informed industry design standards and has led to numerous government-funded V2G projects.

Electric Boulevards (2014)

Our Electric Boulevards project set out to demonstrate the UK's first ever use of inductive charging infrastructure and to explore ways of recharging larger commercial vehicles, in this case, buses.

This included installing inductive charging solutions across Milton Keynes and converting one Arriva bus route in the city to a fully electric solution. The project proved that inductive charging is a viable and efficient way of recharging large vehicles and that large inductive charging units can be connected to the low voltage network.

Smart Charging and Vehicle Telematics (2015)

This project used data from the vehicle telematics system of buses to understand the state of charge of the battery system and to estimate the recharging requirements at each charging location. By assessing local grid capacity at the times the buses were forecast to arrive at the depot, we were able to ensure that all vehicles had no less than 20% charge by the end of the day.

Additional smart charging solution algorithms were used at the depot overnight to ensure all buses left for their first journey with 100% charge. Learning from this project has informed smart charging solutions which have since been tested at scale in our Electric Nation project.

Ready charged – completed projects

EV Emissions (2016)

All makes of electric passenger vehicle sold in the UK were tested for their compliance with set emissions standards. This insight is still helping to refine engineering standards.

Alternative Connections for EV Charging (2017)

The range of alternative connection solutions – originally designed for customers wanting to connect new distributed generation such as solar, biomass and wind – was adapted to cater for flexible demand, including EV recharging.

This enabled us to offer alternative connections to customers who wanted to install EV chargers but were faced with prohibitive costs.

IET Code of Practice Ed 4 (2019)

We were asked by the Institution of Engineering and Technology (IET) to help produce a code of practice for electrical equipment installers. This code of practice sets out safety standards for the electrical earthing of equipment and means of connecting to household and business electrical wiring.

LCT Detection (2019)

We're working with the Energy Networks Association to make it simpler for electrical installers to notify us where charge points have been fitted. This project will provide us with the most up to date information on LCT take-up within the licence areas.

Electric Nation (2019)

At the time of its launch, Electric Nation was Europe's largest domestic EV charging trial with 673 participants.

The project delivered a better understanding of EV home charging patterns (typically less than two charges per week per EV) and customers' willingness to embrace smart charging. Most importantly, it produced a longer term, strategic view of the overall implications for the electricity network of EVs becoming mainstream.

We also proved we have the technology to support a smart charging solution and established how this solution could be used in our network management. Many of the findings from Electric Nation underpin our Electric Vehicle Strategy.

LV Connect and Manage (2019)

The LV Connect and Manage project is developing a solution to provide emergency overload protection in areas with high numbers of EVs. This is a form of Active Network Management.

Customers will be notified when their local distribution network is at capacity and will be given a choice: to wait for conventional network reinforcement or to install an LV Connect and Manage domestic load controller.

This device will communicate with the charge point or vehicle and reduce the charging level for a short period when an overload is predicted.

This solution is a last resort and will only be implemented when all other options have been exhausted.

Superfast Electricity – feasibility of three phase services (2019)

Working with Innovate UK, Monmouthshire County Council, Wales and West Utilities, Cenex and the Welsh Government, the group looked at the feasibility of fitting LCTs to 20,000 properties, a combination of new build and retro-fit properties.

As part of the project, three phase service cables will also be installed at all properties in the development.

From WIP to BAU

Our Work in Progress is becoming Business as Usual.

We've already made lots of changes to our technical designs and ways of working based on the knowledge we've gained from our earlier EV projects. And we're expecting to use our knowledge to make more changes as more projects come to fruition in 2020/21.

Superfast Electricity

We're expecting this project in Tonyrefail to show that three phase service cables are the best solution for new housing estates.

Following the Swansea retrofit project, we will also have learned how to retro fit three phase service cables effectively into an existing domestic environment.

Using this knowledge we plan to amend our design policies to install three phase service cables as standard.

Design capacity

For many years, we've used a set of After Diversity Maximum Demand (ADMD) figures to design the network that supports housing developments. This has allowed for the efficient and economical connection of traditional gas and electrically heated homes. The impact of LCTs will change this design model.

Using data from Electric Nation, we've been able to calculate a new ADMD which makes allowances for EV charging and other LCTs. The new ADMD assumptions are now part of our standard low voltage network design tool used by WPD planners. We have also shared this detail with planners who work for Independent Connection Providers designing networks that we will adopt.

Public charging hubs

We've devised a hub charging solution to help develop charging infrastructure in car parks and other public locations.

Following the completion of our hub charging project, we will create a design specification for bespoke charging transformer locations.

(A wayleave/lease issue relating to EV charging locations is currently being addressed by WPD along with Ofgem and the other DNOs. This will mean a far quicker turn around in supplying connection agreements.)

Connect and Manage

We'll be using equipment successfully trialled in our LV Connect and Manage project to enable EVs to overcome the possible constraints of EV clustering by using Connect and Manage equipment.

This short term solution allows us to respond rapidly to clustering scenarios until a more enduring solution is developed.

Procedures are already in place to allow Connect and Manage solutions to be used by local teams.

Keeping you informed – and in the driving seat

We care about electric vehicles because you do.

That's why the views of our customers and stakeholders – from domestic and business users to local authorities and motorway service stations – are central to our EV strategy. Your feedback is crucial to ensure our strategy continues to reflect your needs – so it's vital we keep you informed on how it's going.

We've put together **'The Getting Electric Vehicles Moving'** guide for local authorities which are considering public and street side charging connections. This provides information on the different kinds of chargers available and how charging points can be connected quickly and efficiently to the network.

The 'DNO Engagement for Local Authorities' guide provides information specifically tailored to local authority customers delivering public charging points. The guide covers some of the technical considerations related to public connections as well as offering advice on how to make applications and discuss plans with WPD. We're also working on a range of guides for fuel station operations and fleet users with depot facilities.

Our capacity map is available for all customers to check the level of generation capacity at their local substation and the scope for EV connections. And we help customers to understand how charging works. For instance, charging rates when using a fast charger will depend on factors such as the car's on-board charger and the cable used.

We also hold one-to-one connection surgeries to discuss customers' plans for EV charging and how the electricity network can be adapted or uprated to accommodate future plans.

Building an EV future

We want to build an EV future that works for you and that's why we'll go on seeking your views as our strategy evolves.

By taking into account the needs and ambitions of all EV users, we can continue to provide a safe, resilient and reliable network for everyone – and for every electric vehicle.

Like we said, we'll be ready when you are.

For lots more information on our EV planning, go to

www.westernpower.co.uk/smarter-networks/electric-vehicles

WESTERN POWER DISTRIBUTION

Serving the Midlands, South West and Wales

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

www.westernpower.co.uk

@wpduk