

Electric Vehicle Strategy



Foreword

We are entering the age of the electric vehicle. By being proactive, companies that were once start-ups working with us in small-scale trials, are now established nationwide charge point operators. New vehicle manufacturers are revolutionising the customer proposition of mobility. Big oil companies are getting involved in the EV charging industry as fuel stations begin their transformation.

Data companies are future proofing solutions for challenges many have not even identified yet. Energy suppliers offer EV specific tariffs as standard. At the same time emerging sectors such as aggregation have started to flourish and London's iconic black cabs are leading the charge as drivers see the value proposition.

UK Power Networks is a customer-centric, market led, data-driven organisation with a clear strategy to deliver the electrification of heat and transport in support of net zero agenda. We aim to achieve this while maintaining our position as the lowest-cost Distribution Network Operator in the UK.

We want customers to be able to easily connect to our network when they need to. Put simply, we want everyone to be able to charge where they want, when they want, at an affordable cost, whether this is at home, on the street, en-route or at work.

How are we achieving this?

- Through a comprehensive programme of engagement with all of our stakeholders to understand their needs and tailor our services
- By working in partnership to develop, test and deliver technical and commercial solutions that facilitate the uptake of electric vehicles for each customer segment
- By taking a market led, whole systems approach to maximise the utilisation of our existing electrical infrastructure, only investing in new infrastructure where we have exhausted the smart alternative

This approach to support the electrification of transport is not new to us; we are building on the evidence and experience we gathered through our EV innovation portfolio and ground breaking projects such as Low Carbon London, Smart CAR, Black Cab Green, Shift and Optimise Prime. These projects have helped inform our approach to facilitating EV uptake culminating in the Industry's first EV strategy in 2017 backed up by a suite of technical and customer guidance.

In May this year, the Committee on Climate Change published its 'Net Zero' report detailing the UK's progress so far to reduce greenhouse gas emissions.

It seemed an appropriate time to review our strategy, in collaboration with you, our stakeholders, to ensure we continue to deliver on your priorities for us to ensure the electrical infrastructure you need is ready. Most importantly this document seeks input from all of our stakeholders on what you think our priorities should be.

To achieve this will require strong collaboration as well as a joined up approach to policy and regulation. The early signs are that this is possible, however, to meet carbon targets it is now time to put talk into action and we stand ready to work as closely as possible with Government at all levels to support their ambitions. The potential rewards are there for us all if we get it right – a low carbon economy and clean air for all generations to come.

We are excited to be at the centre of this transition. In this document we have set out various questions about our EV strategy that would be great to get input on. We would also welcome any general feedback, which can be sent to electricvehicles@ukpowernetworks.co.uk. Finally, please email us if you wish to sign up to our EV newsletter and any future updates.

Suleman Alli
Director of Strategy



Situation

Recent technological developments in the electric vehicle (EV) space, alongside policy support, such as the Road to Zero Strategy, has helped accelerate the uptake of EVs in the UK. Our latest forecast projects 1.9 (low case scenario) to 4.1 (high case scenario) million EVs on our three networks by 2030. The Net Zero report further extends the ambition of carbon reduction which could accelerate the uptake of EVs.

UK public charge point installations continue to increase. As of October 2019, there are over 27,000 public charge points across almost 10,000 locations in the UK, including 7,000 in Greater London. As of May 2019, there were 20,000 residential charge points in UKPN licence areas, totalling 135MW of additional load to our networks. As shown in Figure 1, London has seen the largest uptake.

However, as shown in Figure 2, based on our projections of required uptake in the next six years, to ultimately meet Net Zero by 2050, we estimate that we are 40% behind target on EV uptake to date. This is based on the number of vehicles needed on the road to achieve these ambitious targets. According to our forecasts, by 2019 in the high uptake scenario there would be 370,000 vehicles on the road across the UK, where actually there are only 223,000.



Figure 1. Existing charge points by area (October 2019), Source: Zap-map www.zap-map.com/statistics/

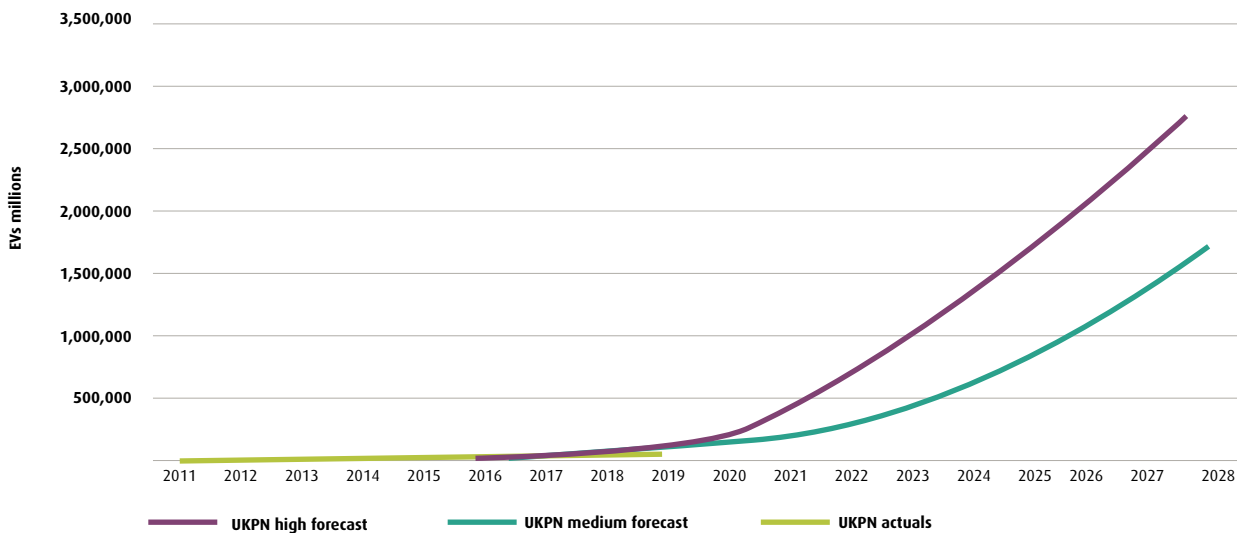


Figure 2. Expected EV uptake in UK Power Networks license areas, medium and high uptake versus 2019 actuals

Therefore, as an industry, there is still a lot to do. Throughout our current regulatory period, R110-ED1, which started in 2015, our focus has been on understanding the actual uptake of EVs and impact it presents on the network, identifying opportunities to provide the best service to our customers converting to electric and assessing smart solutions for avoiding unnecessary reinforcement.

We are on track to deliver our Flexibility Roadmap being the first DNO to carry out flexibility tendering and widely deploy Active Network Management (ANM). Additionally our DSO strategy is aligned with our Forecast – Monitor – Deploy Smart approach to EV facilitation.

In the wider context we are entering a world where we need to react to an incredibly dynamic and agile system to facilitate clean growth. As discussions begins on how R110-ED2 will be set out, we are working closely with government, our regulator and across the industry to define a framework that will focus on critical strategic areas that will help reach emission targets.

We must also collaborate to align with government's ambitions as laid out in the Clean Growth Strategy, Industrial Strategy and National Infrastructure Commission roadmaps, as well as the Mayor of London's EV Infrastructure Plan. Similarly there are key parallel discussions such as the Network Access and Charging Reforms and the consultations on EV infrastructure within the Building Requirements and Smart Charging that will set expectations and inform our future investment plans.

Ultimately we need to get back on track for Net Zero while not investing unnecessarily, i.e. keeping bills low, whilst ensuring everyone has access to charging infrastructure. Our extensive stakeholder engagement over the last three years in this fast moving sector has driven us to refresh our strategy to ensure it remains fit for purpose. Our vision is to be an enabler of EV uptake, and as we prepare for the future we must focus on what strategic investment is required once smart alternatives have been considered.

The purpose of this document is to familiarise you with the work we are currently doing and gather your views on how we can improve.

The Challenge

There are several identified barriers to EV uptake¹. Some of these include:

AVAILABILITY OF VEHICLES AND THEIR COST

RANGE OF THE VEHICLE BATTERIES AND THE PERCEPTION OF NOT HAVING ENOUGH CHARGING INFRASTRUCTURE CREATING RANGE ANXIETY

POOR PROVISION OF CHARGING INFRASTRUCTURE AND HIGH CONNECTION COSTS SPECIALLY FOR RURAL AREAS

INTEROPERABILITY BETWEEN DIFFERENT CHARGING SERVICE PROVIDERS AND ULTIMATELY HAVING OPTIONS OF WHERE TO CHARGE

All of these barriers have been analysed and are starting to be addressed by government and industry.

Having publicly accessible charge points installed, can give confidence to potential EV buyers. Knowing that when they have the vehicle they will be able to charge is one way to address uncertainty.

In recent years we have focused on understanding various charging segments and infrastructure requirements across the whole transport space. As shown in Figure 3, over 80% of charging currently happens at home and therefore at the distribution network.

When we think of EVs, the impact on the network needs to be considered from several perspectives:

- Where will charging infrastructure be needed and installed?
- How many EVs per charge point will be required to make them accessible to everyone?
- How much power and how many EVs will be connected at this point?
- Who will pay for the installation?
- When will the charger be expected to be fully utilised?
- Is there enough capacity to supply that need?
- Will there be voltage and thermal issues caused by the new loads?
- How can we collaborate with other parties such as suppliers and generators to ensure that we are designing whole system solutions?

As part of our strategy work, we established three main categories of EV charge points/ customers: residential ('at home'), public ('en route') and destination. However, following vast engagement with stakeholders we understand that it is worth differentiating 'destination' charging (e.g. supermarket parking) from public 'en route' charging in general.

Therefore the charging segments we will consider going forward are '**at home**' (off street and on street), '**at work**', '**en-route**' and '**destination**'. We have divided 'at home' into off-street and on-street to differentiate the publicly accessible infrastructure. We have also conducted detailed modeling to understand the split of infrastructure requirements across segment and how they will change going forward.

For example:

- We estimate that work place charging will increase significantly because it includes fleets charging at their depot.
- 90% of the new van sales are company-registered so we expect a much quicker turnover in fleet vans than fleet cars
- On-street residential and work charging will increase as more people (without off-street parking) transition to electric
- Taxis and private hire vehicles charge the same today and in 2025 but the volumes are forecast to increase
- Based on survey research we expect there will always be some demand for rapid top-ups, from both local rapid charging hubs and motorway service charging

¹ In 2018 House of Commons (2018). Electric vehicles: driving the transition. Business, Energy and Industrial Strategy Committee, Fourteenth Report of Session 2017-19, published 19 October 2018. Available from: <https://publications.parliament.uk/pa/cm201719/cmselect/cmbeis/383/383.pdf>

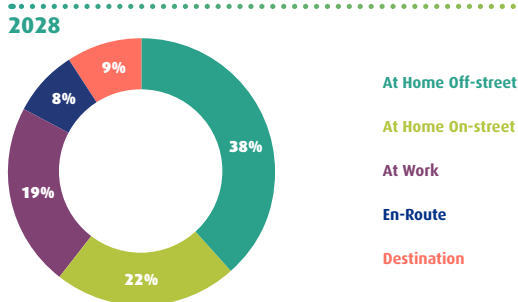
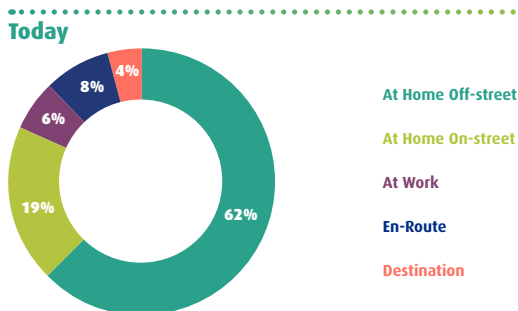


Figure 3. Charging segments in 2019 vs charging segments in 2028

As a local electricity network operator we are at the centre of the low carbon transition. Understanding the challenges from a specific network operator perspective, for example the capital hurdle, and the opportunities for each sector is important when guiding our next steps in continuing to enable the low carbon transition. It is our responsibility to ensure our distribution network is available at the most appropriate time and managed efficiently.

Our EV strategy aims to answer the following questions:

- How can we collaborate with industry to overcome the barriers for each segment and kick start the transition?
- How can we best support our customers in transitioning to electric transport?
- How many EVs should we facilitate by using smart solutions before we consider investing in more infrastructure?
- How do we market test commercial solutions ahead of deploying network reinforcement?
- Should we provide more support to enable capacity at the point of use?
- What are the market failures for EV infrastructure and how could these be overcome?
- If we are to support, how can we identify when uptake has reached a point that it no longer requires input from the DNO?
- How do we make any intervention fair for all customers?

Questions for our stakeholders

1. Do you agree with how we have characterised the different charging segments?
2. Do you agree that of all segments workplace charging will undergo the most change between now and 2028?

Our Approach

Areas of Focus

UK Power Networks ensures that millions of households and businesses have access to reliable, safe and affordable electricity supply. It is our responsibility to ensure that the electricity network we own and operate is EV ready. To achieve this we are participating and leading a wide range of EV projects that are pushing the boundaries of innovation in electric transport.

Our EV Strategy remains simple. Keep the lights on while enabling decarbonisation of transport and improving air quality by preparing the network for changes in how customers use their electricity supply as they convert to EVs.

We should facilitate the uptake of EVs by preparing the network, engaging with stakeholders and ensuring the customer journey is at the centre of our strategy.

Our 2018 EVolution strategic EV Readiness project provided a great foundation to establish our key areas of focus. We identified the processes that need to change to deliver the required outcomes to facilitate EV uptake. One of the key outcomes of this project has been better information on EV charging locations and charging behaviours as well as adequate forecast and modelling tools to quantify the impact EVs will have on the network. Initiatives undertaken as part of EVolution cemented our position as the leader amongst all networks in preparing for EV uptake.

Our strategy has three key objectives:

- A. INFORM INVESTMENT AND INDUSTRY LEADING POLICIES AND STANDARDS**
this means informing policy development and ensuring technical standards are up to date
- B. DELIVER GREAT CUSTOMER EXPERIENCE**
this means focusing on the customer experience and educating the market on the role of the network infrastructure to enable their connections
- C. DEVELOP A NETWORK THAT IS PREPARED FOR EV UPTAKE THROUGH THE USE OF SMART SOLUTIONS AND STRATEGIC INVESTMENT**
this means having our network technically ready by using our smart solutions and required capacity

Questions for our stakeholders

3. Are these the right objectives for us to focus on? If not, what would you add or remove?

Our Electric Vehicle Strategy

OBJECTIVE
Informing investment and industry leading policies and standards
ACTIVITY
Achieve the best forecasting tools to support planning
Clear and accessible policies and standards

OBJECTIVE
Deliver great customer experience
ACTIVITY
Most choice available and customer convenience
Continue to engage and provide transparency of required data

OBJECTIVE
Network prepared for EV uptake
ACTIVITY
Smart toolbox
Deploy efficient investment: right sized and timed

A. Informing investment and industry leading policies and standards

As a regulated business we have regulatory periods that define our investment. EVs will have a significant impact on what and where we invest going forward. To inform this investment we must accurately forecast the amount of EV uptake. Our focus now, ahead of vast volumes of EVs materialising is to have the best data to inform our forecast. Ultimately we have a social obligation to deliver the best environmental outcomes at the lowest cost possible by investing in the right locations just in time while avoiding stranded assets.

The transport and energy sectors are merging, new customers are approaching us and new technologies are connecting to our network. This means that our standards require updating and adapting to EV connections. Already UK Power Networks has published version 3 of EDS 08-5050, the Engineering Design Standard for Electric Vehicle Connections. Also, the introduction of Vehicle to Grid (V2G) chargers has initiated discussion on what is a reasonable connection procedure for this type of technology.

B. Deliver great customer experience

Customers are at the centre of our EV strategy. Delivering choice and transparency is critical in facilitating the transition for customers. Choice includes providing our evolving customers new innovative and alternative connection products such as timed and flexible connections alongside our traditional offerings.

For each of the customer segments, we are working on how we can best support them and offer choice. At this early stage of infrastructure deployment we have focused on charge point installers, domestic customers looking to install a charge point at home and local authorities that want to install charge points in public locations. For example, in the rollout of EV infrastructure, local authorities play a key role in determining their strategies to publicly accessible charge points. We are working across our three licence areas with these organisational bodies to understand how we can best serve their needs. To that effect we understand that collaboration is key to having strategic investment plans that ensure our communities have the network they need for their electrification of transport needs.



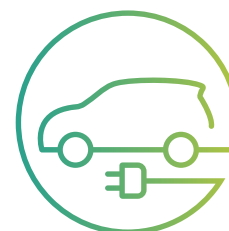
Working in partnership with TfL and Local Authorities

- Established a Local Government Forum to increase councils' understanding of our role in connecting EV charge points and new developments
- Supporting the Mayor's EV Taskforce
- Providing 'Ask the Experts' sessions to discuss energy requirements
- Produce EV charging guides for Councils, fleet and taxi operators



Supporting TfL in attaining a zero emission bus fleet by 2037

- Detailed assessment undertaken of the requirements to electrify all 66 garages in our network area
- Optimised power requirements from 800MW to 232MW by working proactively with TfL – reducing costs for customers
- Developed network investment plans to support the transformation of the bus fleet



Supporting the GLA to make 300 rapid chargers available by 2020

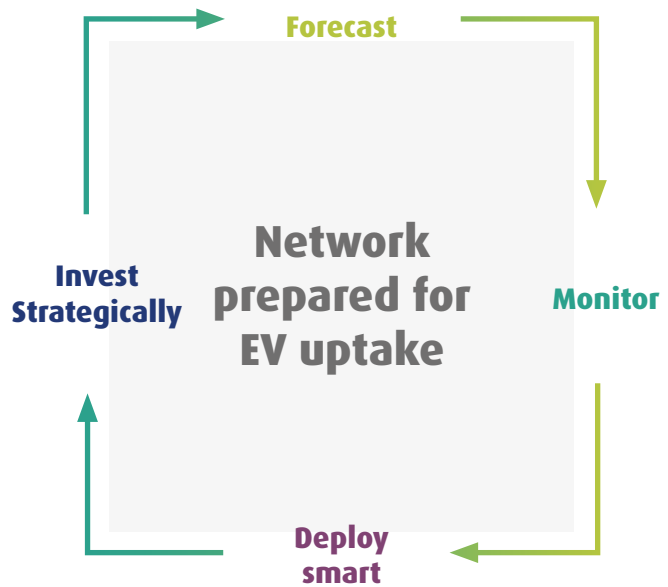
- Appointed a single point of contact for TfL
- Successfully supported the delivery of the first 75 chargers by the end of 2017
- Coordinated the charge point installers and TfL Civil Contractors to ensure timely delivery of charging infrastructure
- Leading the facilitation of competition by enabling Independent Connection Providers to: self determine point of connection, self design and self connect any 24kW supply

Our Approach
Areas of Focus

We also recognise that there is a need to educate and inform our customers about the wider energy industry, while learning from the transport industry on the challenges and solutions of the electric transition. In 2018 we actively participated in over 100 EV related stakeholder engagement events. We see true value and receive very positive feedback from stakeholders on our role in leading the EV discussion, so we plan to continue at this pace.

Questions for our stakeholders

- 4. Have we prioritised the right customer groups to support? Who else should we consider?
- 5. What mechanisms and media are best suited to ensure EV stakeholders are informed and educated on network aspects for the EV transition?



C. Develop a network that is prepared for EV uptake

Our EV project portfolio consists of over 18 initiatives filling a toolbox of smart options to respond to rapid EV uptake. These tools will help us maximise the use of the existing assets, manage uncertainty of uptake and provide cover whilst we consider longer term network impacts. Under certain scenarios where smart solutions cannot provide suitable cover, we will develop a framework to transparently deploy infrastructure. This includes favouring a market led approach before building more infrastructure.

In our 2017 EV Strategy, we defined three pillars to prepare for EVs: Forecast, Monitor and Deploy Smart. However, by engaging with our stakeholders we understand that we need to include a new pillar covering strategic investment.

1 Forecast

In 2018 we undertook a project called Recharge the Future to deliver the most sophisticated forecasting tool in the industry. The objective of the tool was to reduce uncertainties associated with electric vehicle load growth, enabling efficient planning of interventions, inform reinforcement spending, and reduced risk of firm capacity shortfalls.

This data now offers us a baseline for observing uptake. Additionally, it provides our stakeholders, like local authorities, useful information on EV uptake in their geographical areas, as show in Figure 4.

East Sussex EV uptake in 2030

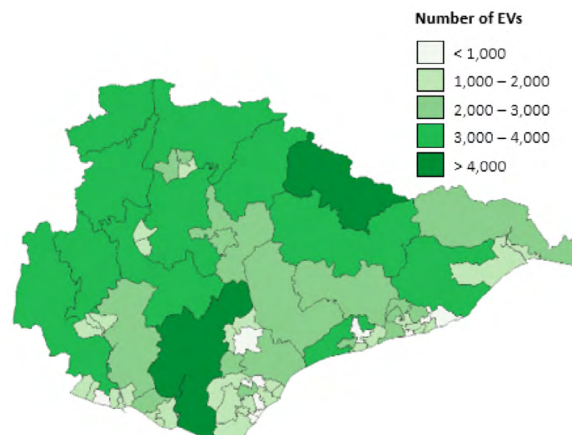


Figure 4. Example of data extract from Recharge the Future

This project has enhanced UK Power Networks’ current electric vehicle load forecasting capabilities, by adding the ability to map the variance in residential on-street, off-street, at work, destination and en-route roll-out. It has been used with the model’s existing charger cluster mapping capabilities, to map electric vehicle load growth on the different voltage level networks.

What data informs our forecast?

There are several sources that feed into this forecasting tool. This includes datasets from Driver and Vehicle Licensing Agency (DVLA), Office for Low Emission Vehicles (OLEV) grants, socio economic factors, all the way down to granular user groups such as taxis amongst others.

This tool enables us to map where uptake is happening and predict where EV uptake will occur to inform our decisions of where and when to take action.

We have categorised our key sources of data and evaluated the status on our access to such data. We are working closely with OLEV, with the other DNOs through the ENA and with our stakeholder communities to improve and consistently obtain the best data available.

This detailed forecast helps us understand better location and timing of possible charging infrastructure in support of our Local Authorities and Transport for London infrastructure plans.

Questions for our stakeholders

6. To ensure that DNOs can prepare and adapt efficiently, do you think it should be mandatory for the DNO to be made aware when EVs are purchased or charging infrastructure installed?

7. Can you think of valuable data sources we should be additionally including in our forecast modelling?

2 Monitor

Our EV forecast informs where we deploy monitoring. In 2018 we started an LV monitoring and control programme valued at £41m over the next 5 years. The purpose of this equipment is to allow us to verify the impact and constraints on the network ahead of any intervention. This information will also inform where we deploy our smart toolbox of solutions. Part of this programme is to develop our Distribution Management System to cover the whole LV network. This will unlock next level performance at LV and facilitate smart solutions.

Benefits of LV visibility

Today	2020
Limited functionality	LV Connectivity & monitoring
No connectivity	LV Smart Solutions, automation
Just a Picture	Network data by feeder and phase
Unable to trace	Customer Service improvement through link to phase - smart meter loop

This programme will also deliver strategically targeted LV network monitoring, defined by constraints driven by low carbon technology uptake, providing visibility of over 5,500 distribution substations across our three networks by 2023. As our network contains over 120,000 distribution sites, we are aware that a mix of LV monitoring will consist of network deployed LV monitoring and grid edge monitoring from devices such as smart meters and smart EV chargers.

Questions for our stakeholders

8. Do you think network companies should have access to third party data - such as from Smart Meters and EV chargers – to reduce the cost of investment in network monitoring?

Our Approach
Areas of Focus

3 Deploy Smart

Our third pillar focuses on deploying smart solutions to optimise network use and prepare for the future EV uptake. We have a vast innovative portfolio that covers a range of commercial and technical solutions. We have categorised our projects into three groups.

The first is the enablers. These projects are focused on understanding the potential impact of EVs and setting up the tools to help us prepare for the uptake. The other two groups are focused on finding solutions to address the network impact. Innovation solutions are not necessarily technical, and although many of our projects are exploring data driven software and hardware developments, some of the problems can be addressed by commercial solutions.

Our solutions consist of commercial and technical solutions, and will be selected based upon a lowest cost approach. Figure 5 highlights some of the initiatives and EV innovation projects as per our categorisation.

Questions for our stakeholders

9. We have worked hard on our smart toolbox, are there any additional technical or commercial solutions we should be considering?



Commercial Solutions

Timed Connections
PicloFlex
Smart Charging flexibility
V2G Flexibility
Beyond the meter Smart
Optimise Prime

Enablers

UKPN EV Readiness Program
Black Cab Green
Recharge the Future
LV Diagram - Full LV Control
LV Monitoring
Smart Charging Architecture Roadmap

Technical Solutions

Baseline- Existing technical solutions
FUN-LV- LV CB and SOPs
LV Phase Switching
LV Engine- SPEN
Active Response- Network Meshing & proactive reconfiguration

Figure 5. UK Power Networks' EV portfolio

4 strategic investment

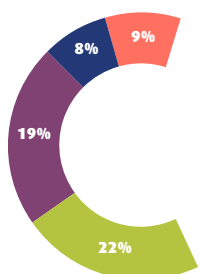
The current access and charging regulations define how connection offers are issued. Customers requiring a connection want to couple to the electricity network and obtain connections at the lowest possible cost and as quickly as possible. However, these costs vary by location and time.

For us, one of the key areas of focus to address this challenge has been on providing more visibility of where capacity is available. Having visibility both of capacity and infrastructure investment plans can give customers better understanding of when and where to connect. In locations where headroom capacity has been eroded, DNOs can facilitate a connection either by procuring flexibility or building new infrastructure.

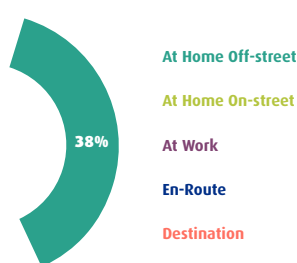
In a fast pace world, where technology advances quickly and government policy and targets can drive technology uptake, long term investment plans are characterised by uncertainty. Simultaneously, there is an argument for requiring the charging infrastructure in place for EV uptake to succeed. Having visibility of where infrastructure is required can inform DNOs on our investment programmes. However, to avoid stranded assets, it's important to coordinate and collaborate in defining where the infrastructure is required.

We have identified several key barriers for the different charging segments and have already started to work across them:

Typically a Capital Hurdle
Connecting customer pays (Sole use and proportionality rules apply)



Typically no Capital Hurdle
Socialised costs across customers



We understand that there is also a utilisation risk that limits investment in this type of infrastructure. As shown in Figure 6, the interaction between these two hurdles will determine how the private sector invests as the uptake of EVs matures.

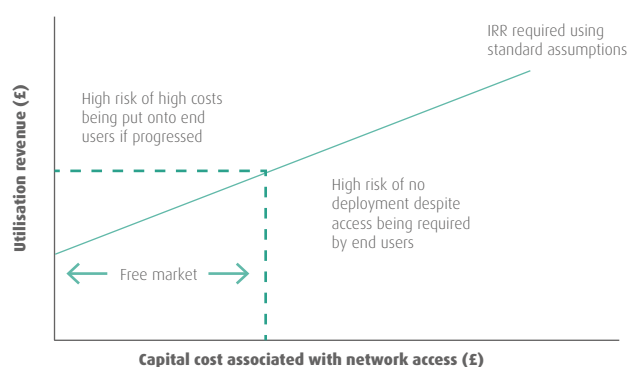


Figure 6. Interaction between capital cost and utilisation risk that lead to private investment

We are exploring what our role as Distribution Network Operators is to help kick start the EV market to help reach the net zero targets.

Questions for our stakeholders

10. Do you agree that the cost of the electrical connection is a barrier to the roll-out of EV infrastructure to the four segments above?
11. If connection costs are a barrier to rolling out EV infrastructure, should government and the regulator develop mechanisms to address this barrier?
12. To what extent should DNOs have a responsibility in addressing the connection cost barrier?
13. What could a framework look like to help us best identify segments of market failure?

Best Practice

What we've achieved

Since 2010 we have been working on the EV agenda. The foundation is set, and we have great examples of collaboration and innovation across the sector. This section focuses on giving insight to what we have learned and where we think more work is required. However, we are concerned that this alone will not deliver our customers' expectations - as such we have developed this consultation to understand how networks can do more for our customers.

Planning collaboratively - Mayor of London's EV taskforce

In 2018 we were invited to join the Mayor of London's EV Taskforce. After working on the Mayor's Taskforce for over 12 months we realise the importance of supporting local communities in the interest of greater air quality and decarbonisation of transport policy objectives. One of the key challenges highlighted by the Taskforce is the low utilisation of some public charge points and the associated weak commercial case for investing in such infrastructure.

Already we know that, for example, 44% of public accessible charge points in London, including rapid, fast and slow chargers across our three networks are used less than once a day. A possible framework for investment could define selection criteria to target poor air quality areas, based on vulnerability and locations where market fails to deliver the infrastructure needed to kick start EV uptake.

Questions for our stakeholders

14. How can we ensure collaboration in defining where the infrastructure is required?
15. If connection costs are socialised to support new EV charge point infrastructure, what is an acceptable forecast level of utilisation of these charge points?
16. Do you think that utilisation will be relatively low in the first few years of operation as consumer confidence grows? If so how should utilisation risk be spread across different parties fairly?



Figure 7. The Mayor of London's EV Taskforce is a great example of how communities can come together to inform where investment should occur.

Best Practice

What we've achieved

Sharing data – Supporting our customer needs

A key element of our EV strategy is to inform and educate our customers and stakeholders about our network. We achieve this through several channels.

EV Newsletter – Due to the high level of activity in this sector, and the need to ensure our business is continually suitably aware of this transitioning sector, we developed an internal newsletter called 'EV-e-shot' to ensure that our employees are aware of all of our EV readiness activities. Realising that this is a great communication tool, we subsequently created an external version that we send to our stakeholders covering government, charge point manufacturers and energy suppliers amongst others. So far over 500 stakeholders read our EV updates and although it has been received positively, we welcome any further feedback on how to improve it. If you are interested in receiving this newsletter, please email us at:

electricvehicles@ukpowernetworks.co.uk

EV Website – Our website is one of the key ports of call for our customers. That's why in 2017 we redesigned the section on EV information. To date the website provides step by step guidance on how to ask for a connection and gives orientation to our different type of EV customers. This includes charge point installers, end consumers, local authorities that want to install charge points in different locations. We believe that enabling a simple connection process for our customers through our online platform is the best customer service, we aim to develop our EV information on this channel.

<https://www.ukpowernetworks.co.uk/electricity/electric-vehicle-charging-point>

Heat maps – Through vast engagement, we understand that our customers need access to more information that we have. We have created heat maps with the purpose of helping customers make more informed decisions. Heat maps of the electricity distribution network, indicating available capacity, are useful tools for customers who want to know where the best location for their charging infrastructure may be. Our DG Mapping tool has most of this information:

https://dgmap.ukpowernetworks.co.uk/site/?q=ev_ext

Such geographic information can indicate areas of constraint, and therefore locations where connections could be more costly. This information is based on forecasts and should be treated as such. However, constrained areas do not prevent a connection – but involve the opportunity to use smart and flexible connections before reinforcing the network for the increased load.

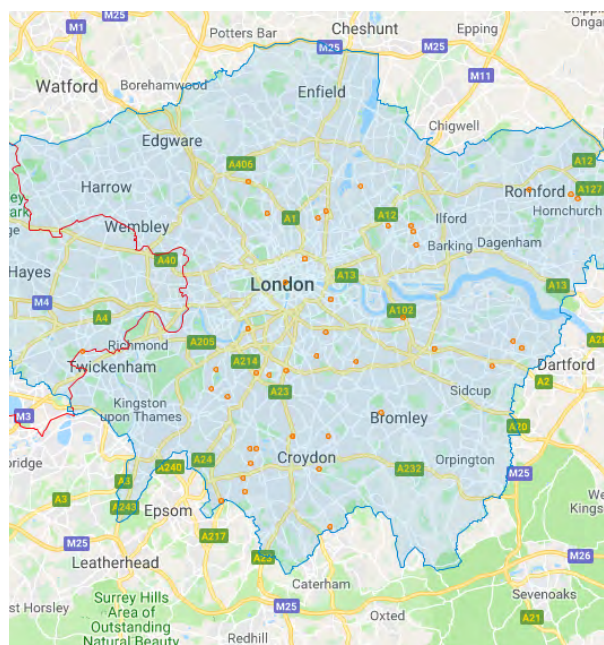


Figure 8. Future constraint map for London

Best Practice

What we've achieved

UKPN has also released a future EV-driven LV constraint map trial covering the London network as shown in Figure 7. This map identified LV transformer sites and network areas which are likely to be constrained without deployment of any smart charging.

<https://innovation.ukpowernetworks.co.uk/2019/06/10/ev-network-impact/>

EV Guides – In 2017 we published an EV charging guide for Local authorities, fleets and taxis. These guides have been called out as best practice, including by Citizens Advice and have been replicated by our DNO colleagues. Our guides are available at

<https://www.ukpowernetworks.co.uk/electricity/electric-vehicle-charging-point>

Connection Forums – We regularly have connection forums where we invite a wide range of customers from the development and generation industries. We have for a long time included EV specific sessions within them. However, in 2018 we held three EV specific technical workshops with over 200 stakeholders. Based on the positive feedback from our connection events, this is now part of our annual business activities. In 2019 we held our first EV Forum for Local Authorities. Having events for such audiences, which could also include fleet operators and housing developers will hopefully address specific customer group needs and allow us a venue to target specific information.

Connection Standards – We also provide technical information for customers looking to connect to our network.

- **How to connect: EDS-08-5050** – We are very proud to have delivered the first Engineering Standard for EV connections. This standard outlines our procedure for processing applications for the installation of dedicated electric vehicle charging equipment.

<https://g81.ukpowernetworks.co.uk/library/design-and-planning/smart-grid/eds-08-5050-electric-vehicle-connections>

- **Connecting to streetlamps: EDS 08-2102** – We worked very closely with many local authorities to understand that lamppost charging is an attractive technical solution for them. We delivered the first engineering standard for unmetered supplies that considers lamppost charging.

<https://g81.ukpowernetworks.co.uk/library/design-and-planning/lv/eds-08-2102-lv-customer-unmetered-supplies>

- **Power quality assessment: EDS-08-5055** – We are currently working on the guidance for assessing EV chargers from the impact on the network point of view and will be published soon. We have assisted the TfL Engineering Directorate with our design standards information for the Go Ultra Low City Scheme (GULCS) Guidance for London Boroughs for Residential Electric Vehicle Charging Infrastructure. By sharing our expertise and clarifying technical queries we are helping TfL enable the charging infrastructure our local community requires. The GULCS Electrical Guidance document is available on the London Councils website.

https://www.londoncouncils.gov.uk/sites/default/files/Electrical%20Guidance_Final_v1.pdf

Collaboration in providing information – We are also working with the GLA and London Councils to collaborate on a central source of information and guidance on implementing EV infrastructure in London. For example our long term development statement documentation indicates where we are investing in capacity, which could be valuable information for connecting customers. This means we are making existing information easier to find for customers that will benefit from having it.

QUESTIONS FOR OUR STAKEHOLDERS

17. Did you know this information was available?

18. Which information is most relevant to you?

19. How can our heat maps be improved?

20. Are you familiar with our EV Connection Engineering Standard? Is there any way we can improve it?

21. At the moment, generation and demand connections are treated differently, do you think discharging of an electric vehicle (i.e. V2G) should be treated differently to charging the same vehicle from a connections point of view?

22. We recognise that assessing harmonics is a gap in this segment. Would it be useful for us to develop a harmonics standard?

Improving air quality - Simplifying the connections process

We have reviewed all of our customer journeys from initial engagement to connection offer through an EV lens and have changed the way we do business accordingly. For example, we have trained our gateway and general enquiries teams to be able to offer useful EV information and guide customers to the right business area. Our general enquiries schedulers developed a way to track EV enquiries, helping us improve our data in-house. We achieve a 97% customer satisfaction for fuse-service upgrades due to our proactive service and continue to develop our service in this space. We have also simplified the information on our website to ensure our EV customers can find the right process for them.

Cost of connection– A great example of connection cost reduction is the work we are doing with London's TfL bus team. This six month project saw us work side by side, assessing the best options to electrify 54 of their 79 bus garages that connect to our network in London. We reduced the original capacity requirement by 67% and avoiding millions of pounds in network investment and costs to our customer.

Adapting our business to serve our EV customers –

The number of inquiries from domestic customers looking to upgrade their electrical supply to enable them to charge their EV increased by 243% in the first three months of 2019.

We responded by training more than 300 staff to ensure we could deliver the customer service our customers expect. Additionally, we have restructured our asset management team to have infrastructure planners and distribution planners, who traditionally were separated by voltage levels, working together across the distribution system. This has enabled us to plan the network in a more holistic way. Reverse power flows and changing energy profiles have made network design at the LV level increasingly more complex. This structural change addresses our customers' evolving needs as they increasingly requiring large loads in the LV and HV networks.

Understanding customers' changing needs: First EV – LV Flexibility smart charging trials

To explore the value of flexibility, in 2017 we started a project called Smart Charging Architecture Roadmap (SmartCAR). This project engaged with over 30 organisations across the industry to identify the solutions to smart charging that put the customers at the centre. There are different ranges of smart charging, from network control and reconfiguration to full market solutions.

From that project we developed our position to smart charging based on five key standpoints:

- Allow transparency of network constraints and customer needs
- Maximise available capacity through reconfiguration
- Facilitate the market to manage constraints
- Unilateral load management between 3rd party and the DNO (compensated, opt-in basis, enacted by 3rd party infrastructure)
- Where economic to do so, reinforce the network

We will support maximum market freedom, pursuing a market based 'interim pricing solution'. This means that we will also test the market ahead of reinforcing the network. To achieve this, we have kicked-off the project Shift. This is the first true smart charging trial which is focusing on designing the customer proposition to unlock more than £250m for customers, while providing them choice of when to charge.

QUESTIONS FOR OUR STAKEHOLDERS

23. To what extent do you believe Smart Charging will resolve network constraints for EV uptake?

24. To what extent do you believe the network will need to be upgraded to resolve network constraints for EV uptake?

25. How do you think that DNOs should best support smart charging?

Stakeholders and Collaboration

There is no way we can deliver this transition alone. In everything we do, we surround ourselves with key individuals, companies and organisations that inform our objectives and support our endeavours.

The transport and energy industries are going through a massive transition and albeit we have great ideas and are committed to support our customers through the transition, we cannot do it alone. We work in teams and collaborate across all of our activities. From charities, consumer groups to public sector organisations we have many examples of how working together delivers greater outputs.

Collaborating with other Networks

We recognise that our three networks are seeing EV uptake and fleet conversions in greater volumes than other networks. As such, we have already gathered great examples and lessons learned that we continuously share with our fellow networks. We know the importance of knowledge sharing and have successfully worked with all networks in various areas of the transport transition:

- We assume our role is to lead by example, so we assigned our Head of Innovation to represent our readiness and support the ENA LCT working group to drive readiness
- Collaborated to develop a common networks EV notification form and made a commitment to develop an electronic version to increase notification rates
- We collaborated with Western Power Distribution by using the data from their Electric Nation trial and helping them in developing the diversity curves.
- In our Optimise Prime project, we are working with Scottish and Southern Electricity Networks to solve common problem areas, like fleets, to enable faster deployment for companies that work all across the country.
- We are working with Northern Power Grid to understand what the horizon could look like for electric vehicles using Vehicle to Grid technology
- We are collaborating with Scottish Power in preparing smart technology solutions in response to unlocking capacity for EVs in our project Active Response, and SPEN's LV engine projects
- Finally, we are working with National Grid Transmission Operator on how to unlock motorway service areas (MSAs) in the interest of finding lowest cost solutions for customers

Collaborating with key industry partners

Some of our best examples of collaboration include:

- Working with 16 organisations on the London Mayor's EV Taskforce, to deliver the first infrastructure development plan for EV infrastructure in the capital
- Collaboration with Hitachi, Royal Mail, Uber and Centrica has led to the world's largest EV fleet trial
- There are over 24 organisations involved in our five Innovate UK funded Vehicle to Grid projects.
- These include Chargepoint Services, Energy Saving Trust, Open Energi, Imperial College London, National Grid, Nuvve, BYD, University of Leeds and Durham County Council. These projects are setting the UK as the leading V2G country
- Working with disruptor suppliers such as OVO and Octopus we are co-designing customer propositions for enabling smart charging
- Collaboration and team work with UPS allowed them to fully electrify their Camden depot. We are also working with Capula, TCS and CGI to deliver the first timed connections tool that will allow network planners to design this type of connection
- We have looked externally and collaborated with utilities across the world. One good example is Southern California Electric, whose EV delivery team has taught us about best practices to deliver EV infrastructure
- Our collaboration with EV manufacturers and chargepoint operators like Charge point/PodPoint/chargemaster/Energy UK/OLEV/Ford/Nissan/Society of Motor Manufacturers & Traders (SMMT) have led to our first smart charging trial
- We are working with Trojan Energy, a technology start up, and Brent Council on designing and testing street level EV charger solutions

Supporting the OLEV – EV Energy Taskforce

Since its inception we have taken an active role in this collaborative industry activity. We co-chair one of the four Working groups, focused on data, and actively participate in the other three exploring the customer journey, energy system and smart charging technical requirements. Whilst separate organisations will be responding to government consultations, the outputs come highly considered in forming an industry consensus on the mechanisms for smart charging and how best to facilitate the implementation of electric vehicles with the energy system.

We are informing each of the working groups through our evidence base delivered by innovation trials and experience in international e-mobility stakeholder groups. We see the value of these outputs to have consistent approaches across the country to deliver EV readiness.

QUESTIONS FOR OUR STAKEHOLDERS

26. Who else should we be engaging?

Have Your Say

We instigated a radical, embedded, company-wide programme cutting across boundaries and business functions to reshape the way we do business around our customers' needs. Our EVolution business change programme touches every area of the business, from our call centre to the engineers who decide when and where we invest in our network, from the control room in our nerve centre to the network operations staff charged with keeping the lights on.

Our EV strategy sets out how we are preparing for the transition and is reviewed and updated regularly to ensure we continue to focus on the right areas and that our priorities are aligned to those of our customers.

We value all forms of feedback. Please help shape our business offerings by sending us your comments at

electricvehicles@ukpowernetworks.co.uk

We look forward to hearing from you!





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FSC – Forest Stewardship Council. This ensures there is an audited chain of custody from the tree in the well-managed forest through to the finished document in the printing factory.



ISO 14001 – A pattern of control for an environmental management system against which an organisation can be credited by a third party.



Carbon Balancing by the World Land Trust tackles climate change through projects that both offset carbon dioxide (CO₂) emissions and conserve biodiversity.