



**ELECTRIC
NATION**

YOUR
ELECTRIC
VEHICLE
YOUR
SMART
CHARGE

SMART CHARGING: A BRIEF GUIDE TO MANAGED ELECTRIC VEHICLE HOME CHARGING

PROTECTING LOCAL ELECTRICITY NETWORKS



Serving the Midlands, South West and Wales

ELECTRIC VEHICLE HOME CHARGING

Year on year there has been a significant rise in the number of electric vehicles (EVs) taking to the road, and this is expected to increase rapidly in the coming years.

This rise is due to many factors including the drive for improvements in air quality and reducing carbon emissions across the UK.

The increase in EV take-up goes hand in hand with a need for more charging points. Distribution Network Operators (DNOs) distribute the electricity to these charge points and provide the supplies to connect them to the electricity network.

DNOs such as Western Power Distribution (WPD) will play a crucial role in facilitating the increasing numbers of EVs. WPD is exploring a range of different

projects that will improve the resilience and security of the existing distribution system at a local level, while meeting the changing needs of all customers.

One such project is Electric Nation, funded through Ofgem's Network Innovation Allowance. Working in collaboration with EA Technology, DriveElectric, Lucy GridKey and TRL, the project has recruited 700 EV drivers who are either trialling, or due to trial, smart charging and a managed EV charging system.

Electric Nation is assessing both the smart charging technology and customer acceptance of the managed EV charging system through its trial. To date, the vast majority of EV drivers have not been aware of any managed charging events, and overall have been supportive of the concept of smart charging.

Smart charging is included in the Government's 'Automated and Electric Vehicles Bill' and is expected to be mandated.

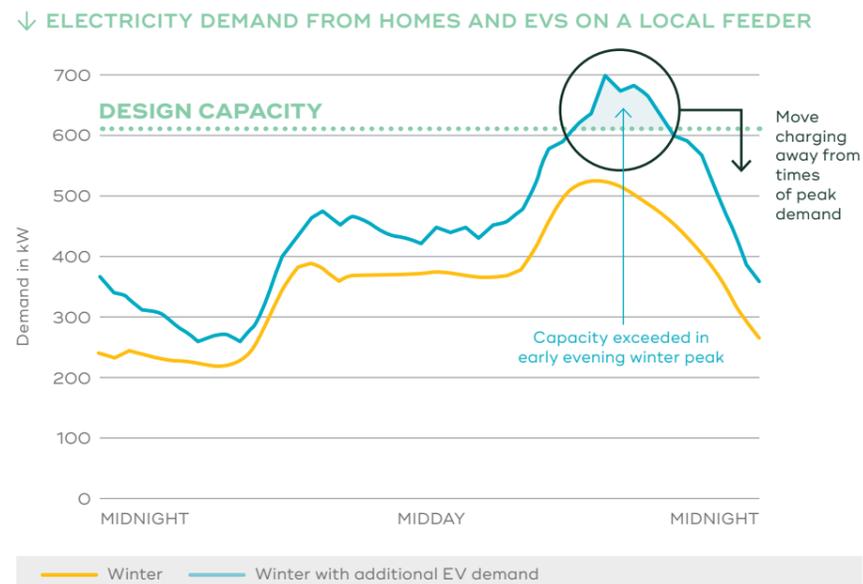
ELECTRIC VEHICLES AND THE GRID

A previous project, My Electric Avenue, funded by Scottish and Southern Electricity Networks and delivered by EA Technology, modelled the impact of EV charging on GB electricity distribution networks and estimated that, based on 3.5 kW charging, one in three distribution networks would not cope with more than 30-70% of cars being electric and charged at home.

My Electric Avenue and Electric Nation have measured when, and for how long, people charge their EVs at home. This has produced an understanding of the power consumed by home charging throughout the day which, when combined with normal daily demand, results in the total power consumed increasing significantly. For example, the graph shows how early evening peak demand on the electricity network increases in winter when one in three cars are electric and charged at home, leading to the capacity of the local substation being exceeded.

THE SOLUTION TO EV CHARGING COULD BE TO MOVE CHARGING AWAY FROM TIMES OF PEAK DEMAND

If some EV charging in the peak demand period could be shifted to later in the evening or overnight, the network operators could manage customer demand, allowing more EVs to be charged at home at a different time of day. This approach would avoid the need for costly and disruptive upgrades to the low voltage network or at the very least defer the need to carry out this work.



MANAGED ELECTRIC VEHICLE CHARGING

Put simply, managed electric vehicle charging is a 'system' that can control the time and/or rate of charging of one or more electric vehicles.

Managed EV charging systems generally consist of three key components; a smart charger, a control system and the service user.

BENEFITS OF MANAGED EV CHARGING

Managed charging can offer benefits to a range of people including EV drivers, network operators and customers. These include.

- + Giving EV drivers increased visibility of how much energy their car uses, useful for those wanting to reclaim driving costs from employers or for income tax purposes
- + Providing EV drivers the ability to access 'time of use' tariffs in the future, with potential financial savings
- + Offering EV drivers the ability to link their EV charger to home energy management systems, solar

panels (photovoltaics) and home energy storage systems, with potential cost savings on energy bills

- + Giving households with one or more EVs the ability to manage charging alongside other electricity-hungry appliances in the household within the limits of their electricity supply connection, and avoiding the need for connection upgrades
- + Helping to avoid the need to upgrade existing electricity networks that approach capacity due to EV charging
- + Contributing to minimising the build of extra power generation for peak electricity demand periods – saving money on customers' energy bills.

EV CHARGING MUST BE MANAGED IN RELATION TO THE LOCAL NETWORK

Distribution network operators have a responsibility to provide a safe and secure supply to all of their customers. DNOs are best placed to manage energy demand at a local level to enable all customers to fulfil their individual energy needs.

CUSTOMER IMPACT FROM MANAGED EV CHARGING

A customer impact assessment has been undertaken to understand the impact of smart charging on EV drivers. The results show that the number of EVs that can safely charge from the distribution network could be substantially increased with modest amounts of charge management. The analysis demonstrates that each charge management event would be of short duration, generally less than 30 minutes, around four times per year. This means that smart charging is likely to have negligible impact on an EV driver's ability to drive as they wish after a smart charging event has taken place.



CONCLUSION

What is the next step to ensure the increasing numbers of electric vehicle drivers in Great Britain can charge their cars at home, without any serious impact to the local electricity network?

Some local electricity networks are likely to need capacity upgrades as EV numbers continue to grow, especially when clustering of EVs and charging at peak times at home become the norm.

The solution, in the form of managed charging, can be enabled by the installation of smart chargers.

Electric Nation has demonstrated there is broad customer acceptance of managed EV charging at home.

Therefore standards need to be developed for smart charging in conjunction with the Government progressing the 'Automated and Electric Vehicles Bill' to mandate smart charging.

In addition, regulatory changes to allow network operators to control charging and balance their networks also need to be implemented.

This implementation of smart charging will allow EV drivers to charge reliably at home and will enable maximum uptake of EVs for minimum costs associated with the reinforcement of local electricity networks.

While there are many stakeholders involved in the EV charging ecosystem, it is the distribution network operators who are on the front line, dealing with capacity challenges as the numbers of EVs rise. A responsible approach towards this issue needs to be adopted and smart charging presents a cost-effective and workable solution.

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COLLABORATION PARTNERS

Electric Nation is the customer-facing brand of CarConnect, a Western Power Distribution (WPD) and Network Innovation Allowance funded project. WPD's collaboration partners in the project are EA Technology, DriveElectric, Lucy Electric GridKey and TRL.

