National Grid ESO and Element Energy have successfully delivered a project to better understand the charging behaviour of electric vehicle (EV) owners. This project provides exciting new insights into the charging behaviour today, that will allow us to understand and mitigate the impacts of electric vehicles on the energy system in the future.

“This study, funded through Ofgem’s Network Innovation Allowance, has allowed Element Energy to investigate charging behaviour at an unprecedented level of detail, not previously possible with existing data. The analysis has provided National Grid with valuable insights to take forward with their load forecasting, ensuring that they, and the wider industry, are ready to support the expected growth in electric vehicles.” Tristan Dodson, Senior Consultant, Element Energy

We felt it was necessary to produce a single national view of the current charging behaviour, that can then help industry understand what occurs at each hour within a year, and this would also feed into our Future Energy Scenarios (FES) 2019 analysis.

To do this, we embarked upon this project to examine the behaviour of EV charging, looking at: residential, workplace and public charging. As part of this novel 6-month project, which is funded using Ofgem’s Network Innovation Allowance, we received charging data from multiple charge point operators, the Office of Low Emission Vehicles (OLEV) and engaged Element Energy, to analyse millions of rows of charging data we received, to turn it into an hour-by-hour profile of charging throughout the entire year.

“This project is a great example of how innovation is helping to improve our analysis by deepening our understanding of charging behaviour, and feeds directly into the Future Energy Scenarios.” Marcus Stewart, Energy Analysis Senior Manager

Why is electric vehicle charging behaviour important?

The number of EVs on the road is increasing year-on-year and we need to understand the potential impact on the electricity system, especially at times of high demand. Any increases in electricity demand at existing peak demand periods, could trigger costly investment in networks and generation capacity.

To avoid costly investment, the energy industry must work together to encourage vehicle charging to move away from these peak demand times. However, for these parties to mitigate this potential additional peak demand, they need to understand what the current charging behaviour is, and when in the day it could be potentially moved to. What is that overall pattern?
In the rapidly expanding EV sector, no single party is entirely sure where and when charging occurs at a national level at present. A large amount of work has already been done by various Distribution Network Operators, each with a focus on their location, or an aspect of charging, or the impact on a network.

Further analysis

The project was completed in time to be included in the analysis for this year’s FES. This means that we now have a greater understanding of how EVs charge throughout the year, and have subsequently updated our analysis to reflect the new information this innovation project has provided.

The project offers the opportunity for a huge amount of further work. Not only the refinement of the analysis based on more data as time progresses, but also for example, exploring how EV charging can be optimised within the electricity system.

A brief look at a single piece of the project outcomes on residential charging is included below.

Residential behaviour

We currently know, that the main way that car drivers charge their EVs at present, is at home. But is it the same every day? From the project, we know it is not. Our results show that between Monday and Thursday, there is a regular pattern in daily demand that changes across Fridays and the weekend. The shape of the residential demand profile shows a large evening peak on weekdays, with a maximum between 7-8pm. This same peak is lower on weekends.

As well as the residential charging behaviour, we also have the results for both workplace and public charging. The project also produced more granular distribution network licence level results for the different chargers. These results as well as the final report can be found at http://www.smarternetworks.org/project/nia_nigo0021

If you would like to know more about innovation in the System Operator, including our Innovation Strategy and how to get involved, please look at www.nationalgrideso.com/innovation