Energy Networks Innovation Process Project Closedown Report Document

The voice of the networks

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Project Closedown Report Document

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Project Title (*This cannot be changed once registered*)
Equal Electric Vehicles

Project Reference
NIA_SSEN_0049

Funding Licensee(s)
Scottish Hydro Electric Power Distribution
Southern Electric Power Distribution

Project Start Date
October 2020

Project Duration
18 months

Year
2022

Nominated Project Contact(s)
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1. Scope

The scope of the project is to carry out an initial desktop study of the enablers and barriers for disabled motorists as well as differences in charging behaviour. The project will recommend and develop an innovative solution to overcome challenges including trialling wireless charging technology. This project will also investigate the changes and new support and services to be offered to vulnerable customers by DNO.

2. Objective(s)

The project objectives are as below:

1. Identify the enablers and barriers for EV adoption for drivers with disabilities, along with recommending traditional and innovation solutions for making EV and EV infrastructure more accessible.
2. Trial the use of wireless EV charging solutions to consider contactless charging for disabled and otherwise vulnerable customers.
3. Investigate V2G technology for offering at-home resilience for vulnerable customers.
4. Explore how the services that DNOs offer need to adapt to support vulnerable customers adopting EVs.
5. Explore how best to data share between DNOs, OEMS and organisations like mobility to facilitate vulnerable customer’s needs.
6. Develop a cost benefit analysis to understand the viability of wider roll out and adoption of innovative solutions.

3. Success Criteria

If the project delivers the anticipated learning to GB stakeholders, then it is deemed successful.

4. Performance compared to the original project aims, objectives and success criteria

Details of how the Project is investigating/solving the issue described in the NIA Project Registration Pro-forma. Details of how the Project is performing/performed relative to its aims, objectives and success criteria.

Project background

There are over 2.3 million disabled parking badge holders in the UK, with approximately 630,000 vehicles registered through the Motability Scheme - a scheme focussed on vehicle leasing for motorists with disabilities and their care providers. Disabled motorists are often overlooked with regards to EV charging. There is a need to investigate and understand the enablers for both public and domestic charging solutions, not just for drivers with a disability but also for a wider range of potentially vulnerable customers such as elderly people or those with chronic illnesses.

Project performance

Following registration of this project the following has been achieved:

1. Identify the enablers and barriers for EV adoption for drivers with disabilities, along with recommending traditional and innovation solutions for making EV and EV infrastructure more accessible.

The project appointed Impact Research to investigate the enablers and barriers for drivers with disabilities adopting EVs. The findings identified the following barriers:

Access to charge points - The physical act of using an EV charge point can be a real challenge for those with mobility problems, with different considerations depending on the charge point location.

Cost - The initial outlay of EV is applicable to all drivers. However, driving can already be more expensive for mobility-impaired drivers than for able-bodied drivers due to adaptions needed to the car, increased insurance costs, and additional mobility equipment needs.

Psychological barriers and range anxiety - Through the literature review, we have identified that mobility-impaired drivers are likely to be more risk averse than able-bodied drivers and are more likely to be affected by EV range anxiety. Being able to travel independently is key, and so journeys are often subject to a higher level of planning and preparation than for able-bodied drivers. Uncertainty about where and when they may be able to charge is a key barrier for many mobility-impaired drivers. The amount of time needed to find a charger and charge their car is a further unknown.

Lack of information on accessible charging - Specialist organisations such as Motability, Disabled Motoring UK and publications such as UCan2, the driving magazine, all provide information on driving EVs. However, this information is not presented unless drivers have reached the consideration stage of their EV decision making journey, and actively search for it. In addition to this, many mobility-impaired drivers do not consider themselves disabled as such and wouldn't necessarily be exposed to specialist messaging. Without more widespread knowledge of and exposure to EVs, assumptions that EV charging isn't practical for these mobility-impaired drivers will be difficult to address.

There are also many positive benefits for EV usage for drivers with a mobility impairment and the findings identified the following enablers:

- Charging at home - Full EV cars (BEV) require no refuelling and use sophisticated monitoring so that the driver knows how much charge (and range) is left in the battery through the car. This reduces the risk of needing to charge during a journey, as drivers can plan their charge before leaving home.
- Car journey length and range - With most journeys being short, averaging just 17 minutes a journey and covering just 27 miles a day on average for new cars), EVs would seem to be a very good fit for drivers with a mobility impairment as they would never need to visit a petrol station and would rarely need to charge en-route.
- Cost to run - The upfront cost of the vehicle may be high, but great savings can be made over the lifetime of the car.
- Additional benefits for vulnerable groups:
    - They help build community resilience (empowering the public to harness local resources / expertise to help their community to plan and adapt to Long term social and environmental changes)
    - They are environmentally friendly
    - They are easy to use and fully accessible
    - They are cost-effective
    - They reach some of the most isolated people
      They are peaceful and serene (to enable transport for people who may have noise sensitivities possibly due to autism)
      This can be found in the Phase One final report (page 19): https://www.ssen.co.uk/globalassets/news--views/documents/1150-ssen-equal-ev-final-report-draft-final-version-240621-1.pdf

The project then appointed Energy Systems Catapult to identify and investigate potential solutions to address the above barriers. The study was carried out as a series of three workshops with relevant internal and external stakeholders and aimed to explore the customer experience of using an EV from a perspective of two vulnerable groups:

- People with mobility impairment
- People with high levels of anxiety

The three workshops generated 44 ideas/concepts for mitigating these barriers. The project also generated a further 71 ideas/concepts for ways that the DNO could improve the potential for members of the two vulnerable groups to engage in using EVs, many of which

were focussed on mitigating the problems they might encounter during power cuts. To determine which of these ideas/concepts to review in greater detail they were all reviewed against three criteria: 1. the chance of success, 2. the chance of an inadvertent negative outcome, and 3. the overall appeal of the idea. The research team developed a shortlist of the most promising ideas for Feasibility-stage development based on these evaluations plus an assessment of whether the idea was known to be being trialled elsewhere already, fell within the remit of other stakeholders (e.g. Disabled Motoring UK, Motability), and whether a practical trial of the idea could be envisioned.
Three ideas/concepts were explored in more depth to establish what would be required for a feasibility study, an assessment of the likely scale of the opportunity, and an assessment of the likely scale of costs involved. These ideas were:

- Setting up a Community of First Responders
- Enabling households registered in the Priority Services Register (PSR) to use Vehicle to Home (V2H) to provide back-up power for their dwelling during a power cut
- Providing a temporary EV charging service during power cuts.

A full overview and further analysis can be found in the final report as prepared by Energy Systems Catapult:
https://www.ssen.co.uk/globalassets/electric-vehicle/ssen-equal-ev-report.pdf

2. Trial the use of wireless EV charging solutions to consider contactless charging for disabled and otherwise vulnerable customers.

Due to low trial readiness, a lack of contactless charging in the UK and no available vehicles at an acceptable cost, this has not taken place. However, an alternative solution has been suggested as part of a follow-up project.

3. Investigate V2G technology for offering at-home resilience for vulnerable customers.

Vehicle to Grid (V2G) and Vehicle to Home (V2H) each go further than Smart Charging by enabling an EV battery to be charged when the price of electricity is low, and discharged to sell electricity back to the grid, or to provide power to the rest of the home, when electricity prices are high or during a power cut. This benefit is limited by the capacity of the EV's battery, but with many EV batteries now exceeding 40kWh it has some potential – though, of course, the need to retain some charge in the EV for mobility needs means that the limit may be smaller in practice.

A household equipped with an EV and a V2H system can potentially use charge stored in its EV's battery to provide a backup source of electricity for domestic loads during a power cut – subject to the limits mentioned above. This may be enough to power both essential medical equipment at home, and other domestic equipment.

A DNO-operated service could provide support for V2H adoption by any EV-using household within its operating areas, as this would increase overall resilience to power cuts. It could, in addition, provide extra support for V2H adoption to households on the PSR, such as a grant or other subsidy to facilitate V2H adoption for these households given their additional vulnerability in power cuts.

V2G-enabled chargers, like smart chargers, require a communications link to the supplier. V2G chargers are typically Direct Current (DC), enabling an EV's onboard uni-directional AC charging control electronics to be bypassed. Several hardware suppliers have developed V2G-enabled chargers, for instance Virta. At the moment these have maximum outputs of around 10kW, sufficient for domestic use.

Nissan is a pioneer among automotive manufacturers in producing V2G enabled vehicles: all its Leaf BEVs on sale today are V2G enabled. It has been trialling V2G enabled Virta chargers at its European Technical Centre in Cranfield, U.K. in conjunction with E.ON. There are concerns that V2G could mean many more charge-discharge cycles than conventional or smart charging, thus reducing an EV battery's lifetime. Proponents of V2G argue that in practice battery discharge events would be small and infrequent; however, this might also mean that the potential value to the EV user is reduced.

4. Explore how the services that DNOs offer need to adapt to support vulnerable customers adopting EVs.

The Priority Services Register (PSR) is a direct tool that DNOs can use for supporting people with mobility impairments and people with high levels of anxiety to engage with EVs. For instance, it can flag that such people may become immobilised at home when there are power cuts. Customers with mobility impairments are a relatively small fraction of all PSR households. SSEN can provide some specific help, for example deploying generators during outages to assist people who need electricity for wheelchairs or electrically assisted doors. The most valuable service SSEN sees itself as able to provide at present to those with high levels of anxiety is staff time: a friendly ear, or support if they are having a panic attack (for instance during a power cut). Staff can also refer people to charities such as the Samaritans. There might be potential for extending staff training to enable further support for customers with high levels of anxiety to engage with the transition to EVs.

A workshop was run by the Energy Systems Catapult (ESC) and SSEN staff to explore the potential for extending the DNO's role to provide greater support for people with mobility impairments and people with high levels of anxiety who have EVs.

Examples of suggestions for future improvements for investigating how DNOs may help customers with disabilities and other requirements to adopt EVs on a more equal level include:

- Introducing an EV needs code enabling a prewarn text for weather warnings, so customer can charge their car
- Procure an emergency EV partner during outages that could help a PSR customer in need if they need to charge their car to leave home or go elsewhere
- Building on our EV Charge Point Locator, so that customers we know who have an EV Charger, in a power cut we send them their nearest live charging point

- Revisiting the definitions of vulnerability to consider customers for whom an inability to use transport when needed would make them vulnerable so we can give them the extra support and protections they need
- Having a relationship with EV installers so we can let them know about planned maintenance in case it impacts a charging point, so customers aren't going to public charge points that aren't working

A full list with all the ideas generated can be found in the final report:
https://www.ssen.co.uk/globalassets/electric-vehicle/ssen-equal-ev-report.pdf

5. Explore how best to data share between DNOs, OEMS and organisations like mobility to facilitate vulnerable customer's needs.

Maintaining the PSR in compliance with GDPR requirements involves regular data cleansing: for instance, writing to register members to confirm details and see if they need further support. SSEN has agreed data sharing arrangements with water companies, NHS Scotland, Telecare, and oxygen providers. Other energy industry organisations such as energy suppliers also advise DNOs of customers with needs relevant to the PSR. The same concept can be extended to include other organisations such as OEMs or charities like Disabled Motoring UK.

Data sharing doesn't yet exist between the energy industry and vehicle manufactures or other EV focused organisations. Suggestions where this closer working could be beneficial to all parties, especially EV motorists with disabilities are included in the final report; one such idea listed is:

- To investigate the possibility of setting up data sharing agreements with the automotive industry (and charities like DMUK/Motability) to help increase visibility of customers with PSR eligibility and stimulate DNO support

6. Develop a cost benefit analysis to understand the viability of wider roll out and adoption of innovative solutions

Three of the shortlisted ideas were explored in further detail to look at the feasibility of further roll out as below and in the final report.

- Setting up a Community of First Responders:
  - This has the potential to help around 870 EV drivers with mobility impairments and 1,835 EV drivers with high levels of anxiety in the SEPD area by the early 2030s. Costs are estimated to be low for both variants of this concept – where first responders outside the power cut area provide PSR members with access to their home EV chargers, and where they provide other support, such as making shopping trips on behalf of EV drivers on the PSR.
- Enabling households registered in the Priority Services Register (PSR) to use Vehicle to Home (V2H) to provide back-up power for their dwelling during a power cut
  - This has the potential to help around 6,090 EV drivers with mobility impairments and 1,835 EV drivers with high levels of anxiety in the SEPD area by the early 2030s. Cost are estimated to be low in the early years, rising to medium by the early 2030s as EV uptake increases
- Providing a temporary EV charging service during power cuts.
  - This has the potential to help around 870 EV drivers with mobility impairments and 1835 EV drivers with high levels of anxiety in the SEPD area by the early 2030s. Cost are estimated to be fairly low for this concept.

5. Required modifications to the planned approach during the course of the project

The Network Licensee should state any changes to its planned methodology and describe why the planned approach proved to be inappropriate. Please confirm if no changes were required

N/A

6. Lessons learnt for future projects

Describe how the project (methodology, stakeholder engagement etc.) changed, or provided opportunities, from your expectation at the start of the project and therefore could be useful for a future project. In addition, please discuss the effectiveness of the research development or demonstration undertaken.

Below is a summary of the main observations, lessons learnt and opportunities for further exploration; for the full set of learnings, please see the Conclusions section of the final report.

- The market for electric vehicles is taking off in the U.K. Battery Electric Vehicles (BEVs) made up 11.6% of all new car sales in 2021, with sales of new Plug in Hybrid Electric Vehicle (PHEVs) making up a further 7%.
- Around 5.9% of drivers with full U.K. driving licence holders also hold “blue badge” disabled driver parking permits. The difficulties those with mobility impairments will have in using EVs have begun to be recognised but so far little has been done to address these difficulties.
- Around 6.6% of adults have high levels of anxiety in any given week. The potential difficulties that drivers with high levels of anxiety will face in engaging with electric vehicles have not yet been widely recognised.
- People with mobility impairments identified multiple pain points in acquiring and using EVs, particularly around the prospect of charging an EV, especially at public chargers.
- People with high levels of anxiety identified pain points at all stages in acquiring and using EVs.
- The main role that the DNO can play in facilitating these vulnerable groups is via their Priority Services Registers (PSRs), specifically in ensuring that their personal mobility is not compromised by inability to charge their EV during power cuts. This would require changes to the PSR, probably at an industry level, to allow recording of this data enabling services to be developed which would help disabled EV drivers.
- Although people with mobility impairments are able to join the PSR now, there is not a PSR category for those with high levels of anxiety, nor indeed for people with other mental health issues. Creating new PSR categories for those with mental health difficulties should be a priority for DNOs.
- There is considerable potential to improve charge point design to make charging more accessible to users with mobility impairments, but innovations remain largely at the trial/pilot stage so far
- Inductive (wireless) charging would considerably reduce the difficulties experienced by members of both vulnerable groups when charging, both at home and at public charging locations. Unfortunately, this technology is not yet deployed in the UK outside of small scale trials
- Some forms of Mobility as a Service, especially ride hailing, could considerably reduce the difficulties experienced by members of both vulnerable groups. However, the subjective impressions of research participants were that few of their vehicles are adapted for wheelchair users at present.
- Fully autonomous cars could considerably reduce the difficulties experienced by members of both vulnerable groups in engaging with electric vehicles, but these remain a rather distant prospect
- People with other mental health difficulties, and members of other vulnerable groups such as those with learning difficulties and acquired brain injuries may also experience substantial difficulties. Their needs have not been widely recognised and to date not researched.

7. The outcomes of the project

When available, comprehensive details of the Project's outcomes are to be reported. Where quantitative data is available to describe these outcomes it should be included in the report. Wherever possible, the performance improvement attributable to the Project should be described. If the TRL of the Method has changed as a result of the Project this should be reported. The Network Licensee should highlight any opportunities for future Projects to develop learning further.

Two comprehensive reports were produced as part of the project outcomes to document all the findings:

- The first report, produced by Impact Research, focused on identifying the barriers that motorists with mobility impairments face in their EV transition. Some of the key barriers were:
    - Lack of information on EVs and accessible charging
    - Availability and accessibility of charge points
    - Cost
    - And psychological barriers like range anxiety:
    - The second report, produced by Energy Systems Catapult, focused on identifying potential solutions to address these barriers and propose innovative solutions for further investigation. The project looked at the customer experience of using an EV from the perspective of two vulnerable groups:
    - People with mobility impairments
    - and People with high levels of anxiety
      A table of 65 potential solutions which require further assessment and feasibility studied is detailed in the Energy Systems Catapult report

- **Both reports can be found respectively in the links below:**

The first report, produced by Impact Research

The second report, produced by Energy Systems Catapult

8. Data Access & Quality Details

A description of how any network or consumption data (anonymised where necessary) gathered in the course of the Project can be requested by interested parties. Please include a link to the publicly available data policy.

See Network Innovation Competition (NIC) and Network Innovation Allowance (NIA) Data Sharing Procedure at https://ssen-innovation.co.uk/innovation-strategy/

9. Foreground IPR

A description of any foreground IPR that have been developed by the project and how this will be owned.

N/A

10. Planned implementation, recommendations or next steps

Please describe the next steps to implement this innovation project. What policies and standards need to be updated or created as part of this implementation.

Due to the DNOs' nature and limited capabilities in directly addressing these issues as identified throughout the project and mentioned above, there is difficulty in implementing a new Business-As-Usual process owned by a DNO. However, as next steps, the three shortlisted ideas will be explored further with the aim of an upscaled trial to further examine their suitability as problem-solvers and realise their benefits.

SSEN could then suggest, promote, or endorse one or more of these ideas to any relevant public or private organisations so that additional awareness can be raised and ensure transition to EVs is fair and accessible to all DNOs' customers.

11. Other comments

N/A

12. Standards Documents

Identify any industry standards that may require updating due to the outcomes or understanding developed from this innovation project. If no standards will need to be updated, please state - not applicable

N/A