Notes on Completion: Please refer to the appropriate NIA Governance Document to assist in the completion of this form. The full completed submission should not exceed 6 pages in total.

NIA Project Registration and PEA Document

Date of Submission

Dec 2024

Project Reference Number

NPG_NIA_053

Project Registration

Project Title

Power Wheels

Project Reference Number

NPG_NIA_053

Project Licensee(s)

Northern Powergrid

Project Start

February 2025

Project Duration

0 years and 6 months

Nominated Project Contact(s)

Emma Burton

Project Budget

£350,000.00

Summary

The rising costs of energy, coupled with high poverty rates, disproportionately impact vulnerable households, especially those with disabilities and/or caring responsibilities. Statistics reveal that the proportion of working age disabled people living in poverty is 27%, and their energy bills can be significantly higher than average (Scope, 2022). These costs are forcing many of these families to go without heating or essential medical equipment. As electric vehicle (EV) adoption grows, particularly within the Motability scheme, there is an urgent need to address the energy demands of these vulnerable populations by making the most of emerging technology and maximising the benefits of flexible EV Charging.

Preceding Projects

NIA_NPG_026 - Resilient Homes

Third Party Collaborators

Centre for Energy Equality Ltd

Energy Systems Catapult

Nominated Contact Email Address(es)

yourpowergrid@northernpowergrid.com

Problem Being Solved

The rising energy costs in the UK, has aggravated the financial strain on everyone, and this financial strain is becoming far more intense for vulnerable households, particularly those who live with disabilities and caring responsibilities. Statistics reveal that the proportion of working age disabled people living in poverty is 27%, and their energy bills can be significantly higher than average

(Scope, 2022), often due to the need for essential medical equipment. These households often find themselves not being able to afford to sufficiently heat their homes, or power essential medical devices, forcing vulnerable households into energy poverty. On the other hand, the increased adoption of EVs, particularly within schemes like Motability, has introduced new energy demands. However, the potential for these EVs to be better utilised in supporting those most in need remains underexplored. Current practices such as government energy grants or price caps work but are limited in scope. Energy poverty requires a more proactive approach, taking further consideration of the specific needs of disabled individuals or households who require uninterrupted energy supply for medical equipment. Currently, most households lack sufficient energy storage systems to meet the substantial needs of vulnerable individuals. However, the growing adoption of V2G and V2H technologies presents an untapped solution. The challenge lies in effectively leveraging these technologies to achieve the dual objectives of providing financial relief and ensuring energy stability for disabled and vulnerable households, particularly during periods of peak demand.

Method(s)

Energy Flexibility from EV Charging, Vehicle-to-Home (V2H) and Vehicle-to-Grid (V2G) technologies represent significant advancements in energy storage and distribution. V2H allows an electric vehicle's battery to act as a power source for a household, providing critical energy during outages or peak demand times. This is especially important for homes reliant on medical equipment that cannot afford power interruptions.

Flexible charging of EVs offer immediate opportunities to reduce bills for vulnerable customers, particularly when aggregated at a large scale. V2H enables the EV’s battery to function as a continuous power source for the home, especially during electricity outages, which is vital for families dependent on medical equipment. It also enables homes to store energy during low prices periods and use it during the high price periods, lowering energy costs for those most in need, such as households with higher bills due to essential medical equipment. When used as a VPP, such systems can also provide frequency response, respond to DSO flexibility services, and support LV networks by managing demand. By forming a grid-supporting VPP, Power wheels will optimise existing assets without the need for new infrastructure, making it a socially responsible solution. There are also opportunities to deploy advanced software and AI for real-time monitoring and dynamic control, further enhancing the efficiency and responsiveness of the VPP. This initial research phase shall conduct the underlying research, aiming to demonstrate the evidence required to move towards more in depth, future demonstrator phases.

Scope

Stage 1 Conceptual Investigation and Feasibility Study

- Explore the technical feasibility of integrating large numbers (000’s) Motability EVs into a Virtual Power Plant (VPP)
- Assess the potential for leveraging Vehicle-to-Home (V2H) and Vehicle-to-Grid (V2G) technologies for vulnerable households

Stage 2 End-User Research and Engagement

- Conduct research into the perspectives and needs of vulnerable households, particularly those with disabled members, to ensure the project is designed to meet their specific requirements.

Stage 3 Energy Network Impact Assessment:

- Assess at a high-level, the potential benefits and impact of the Power Wheels VPP on local, regional and national energy networks, focusing on grid stability, demand balancing, and infrastructure and investment requirements.

Stage 4 Financial Model Development and Analysis

- Develop and analyse a financial model that outlines the potential costs, savings, and revenue streams associated with the "Power Wheels" project, including benefits to vulnerable households and energy networks.

Stage 5 Transition Planning and Pilot Preparation:

· Develop a detailed plan for transitioning from the initial research phase to a larger, scalable trial Selection of pilot sites, partnerships, and monitoring frameworks

Objective(s)

Stage 1

To explore the technical feasibility of integrating large numbers (000’s) Motability EVs into a Virtual Power Plant (VPP) and assess the potential for leveraging Vehicle-to-Home (V2H) and Vehicle-to-Grid (V2G) technologies for vulnerable households.

Measure: Feasibility Report that details V2H/V2G integration requirements and VPP potential for vulnerable households.

Stage 2

To conduct research into the perspectives and needs of vulnerable households, particularly those with disabled members, to ensure the project is designed to meet their specific requirements.

Measure: End-User Research conducted with ~6-10 vulnerable consumers to identify needs, preferences, and barriers for vulnerable households.

Stage 3

To assess at a high-level, the potential benefits and impact of the Power Wheels VPP on local, regional and national energy networks, focusing on grid stability, demand balancing, and infrastructure and investment requirements.

Measure: Energy Network Impact Assessment that evaluates grid stability and demand balancing benefits.

Stage 4

Develop a Financial Model demonstrating the value of the Power Wheels project.

Measure: Model outlines costs, savings, and benefits for vulnerable households.

Stage 5

To develop a plan for transitioning from the initial research phase to a trial phase.

Measure: Transition Plan outlines pilot site selection and partnership strategies that can be used to scale the project in future phases and can include preparation for a SIF application.

Consumer Vulnerability Impact Assessment

The project has been assessed as having an overall positive impact for vulnerable customers

Overall Project Score: 10.0/10

Relative Impact Score 9.1/10
Positive Impact Score 8.2/10
Negative Impact Score 0.0/10

Success Criteria

- Conducted research that shows how EVs can be integrated into Virtual Power Plant (VPP).
- Determine current readiness of V2H and V2G technology including consideration of safety and operational standards.
- Identify how the solution may be made affordable over time, particularly for vulnerable consumers.
- Determine scalability of both the VPP and V2H/V2G technologies considering various vulnerable households' needs.
- VPP's contribution towards grid stability has been analysed.

Project Partners and External Funding

N/A

Potential for New Learning

Understanding of how large number of EVs can be integrated into a VPP to support vulnerable households' energy demands with a focus on Motability scheme participants.
• Insights into scaling V2H and V2G technologies particularly for use in diverse household settings such as urban, suburban and rural environments.
• Learning how V2H technology can provide energy resilience to households reliant on medical equipment especially during power outages.
• Behavioural insights from users in the vulnerable households, their preferences, energy demands, and openness to adopt a more efficient suggestion.

• Models to understand financial benefits and cost savings derived from using V2H and VPP technologies.
• Exploration of how energy sharing could work within a VPP framework, enabling surplus energy from EVs to be distributed or used as needed.
• Learning about potential regulatory and policy barriers for integrating VPPs and V2H/V2G systems into the energy market.

Scale of Project

The project is a predominantly desktop feasibility study. This phase shall not include real-world demonstration in homes; however, consideration shall be a made to a future demonstration that will specifically showcase the Vehicle-to-Home (V2H) functionality.

Technology Readiness at Start

TRL2 Invention and Research

Technology Readiness at End

TRL4 Bench Scale Research

Geographical Area

Thr project will focus on the Northern Powergrid region but it is anticipated that learning will be scalable aross all networks

Revenue Allowed for the RIIO Settlement

none

Indicative Total NIA Project Expenditure

£350,000

Project Eligibility Assessment Part 1

Requirement 1

Facilitate the energy system transition and/or benefit consumers in vulnerable situations

Please answer **at least one** of the following:

How the Project has the potential to facilitate the energy system transition:

n/a

How the Project has potential to benefit consumer in vulnerable situations:

A key part of this research is to explore Vehicle-to-Home (V2H) technology. V2H enables EV batteries to serve as a reliable power source for homes, especially during power cuts, which is crucial for vulnerable households who depend on medical equipment. It also helps to reduce energy costs by storing electricity during low-cost periods and using it when prices are high. This phase will assess V2H options with eligible households and key stakeholders, ensuring the technology meets safety and operational standards for vulnerable users.

Requirement 2 / 2b

Has the potential to deliver net benefits to consumers

Project must have the potential to deliver a Solution that delivers a net benefit to consumers of the Gas Transporter and/or Electricity Transmission or Electricity Distribution licensee, as the context requires. This could include delivering a Solution at a lower cost than the most efficient Method currently in use on the GB Gas Transportation System, the Gas Transporter's and/or Electricity Transmission or Electricity Distribution licensee's network, or wider benefits, such as social or environmental.

Please provide an estimate of the saving if the Problem is solved

N/A

Please provide a calculation and/or description of the expected benefits of the solution

Potential financial benefits for consumers will be determined in a later phase of the project, anticipated to be a SIF Alpha.

Please provide an estimate of how replicable the Method is across GB

It is anticipated that the method will be replicabale at a national level.

Please provide an outline of the costs of rolling out the Method across GB.

This initial research phase shall conduct the underlying research, aiming to demonstrate the evidence required to move towards more in depth, future demonstrator phases and as such, there are no roll out costs associated with this feasibility phase.

Requirement 3 / 1

Involve Research, Development or Demonstration

Projects must have the potential to have a Direct Impact on a Network Licensee's network or the operations of the System Operator and involve the Research, Development, or Demonstration of at least one of the following (please tick which applies):

☐ A specific piece of new (i.e. unproven in GB, or where a method has been trialled outside GB the Network Licensee must justify repeating it as part of a project) equipment (including control and communications system software).

☐ A specific novel arrangement or application of existing licensee equipment (including control and/or communications systems and/or software)

☐ A specific novel operational practice directly related to the operation of the Network Licensees system

☐ A specific novel commercial arrangement

Involve Research, Development or Demonstration - Please select all that apply

☐ A specific piece of new equipment (including monitoring, control and communications systems and software)

☑ A specific piece of new technology (including analysis and modelling systems or software), in relation to which the Method is unproven

☐ A new methodology (including the identification of specific new procedures or techniques used to identify, select, process, and analyse information)

☐ A specific novel arrangement or application of existing gas transportation, electricity transmission or electricity distribution equipment, technology or methodology

☐ A specific novel operational practice directly related to the operation of the GB Gas Transportation System, electricity transmission or electricity distribution

☐ A specific novel commercial arrangement

Specific Requirements 4 / 2a

Please explain how the learning that will be generated could be used by the relevant Network Licensees

Understanding of how large number of EVs can be integrated into a VPP to support vulnerable households' energy demands with a focus on Motability scheme participants.
• Insights into scaling V2H and V2G technologies particularly for use in diverse household settings such as urban, suburban and rural environments.
• Learning how V2H technology can provide energy resilience to households reliant on medical equipment especially during power outages.
• Behavioural insights from users in the vulnerable households, their preferences, energy demands, and openness to adopt a more efficient suggestion.
• Models to understand financial benefits and cost savings derived from using V2H and VPP technologies.
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• Learning about potential regulatory and policy barriers for integrating VPPs and V2H/V2G systems into the energy market.

n/a

Is the default IPR position being applied?

☑ Yes

Project Eligibility Assessment Part 2

Not lead to unnecessary duplication

A Project must not lead to unnecessary duplication of any other Project, including but not limited to IFI, LCNF, NIA, NIC or SIF projects already registered, being carried out or completed. Networks must explicitly mention similar projects that they have considered and how these differ.

Please demonstrate below that no unnecessary duplication will occur as a result of the Project.

A search of related network projects has been carried out and no known duplication has been found. The project has been put to all networks through ENA and no concerns have been raised.

If applicable, justify why you are undertaking a Project similar to those being carried out by any other Network Licensees.

N/A

Additional Governance And Document Upload

Please identify why the project is innovative and has not been tried before

Flexible charging of EVs offer immediate opportunities to reduce bills for vulnerable customers, particularly when aggregated at a large scale. V2H enables the EV's battery to function as a continuous power source for the home, especially during electricity outages, which is vital for families dependent on medical equipment. It also enables homes to store energy during low prices periods and use it during the high price periods, lowering energy costs for those most in need, such as households with higher bills due to essential medical equipment. When used as a VPP, such systems can also provide frequency response, respond to DSO flexibility services, and support LV networks by managing demand. By forming a grid-supporting VPP, Power wheels will optimise existing assets without

the need for new infrastructure, making it a socially responsible solution. There are also opportunities to deploy advanced software and AI for real-time monitoring and dynamic control, further enhancing the efficiency and responsiveness of the VPP.

Relevant Foreground IPR

N/A

Data Access Details

There will be no large data sets associated with the outputs of the study

Please identify why the Network Licensees will not fund the project as a part of it's business and usual activities

The nature of the research and uncertainty around outcome, mean it is suited to be delivered through innovation funding.

Please identify why the project can only be undertaken with the support of the NIA, including reference to the specific risks (e.g. commercial, technical, operational or regulatory) associated with the project

The project remains an emerging activity with uncertainty around the technical feasibility

This project has been approved by a senior member of staff

☑ Yes