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

Jul 2025

Project Reference Number

NIA_ENWL_041

Project Registration

Project Title

Smart ReStart

Project Reference Number

NIA_ENWL_041

Project Licensee(s)

Electricity North West

Project Start

August 2025

Project Duration

0 years and 8 months

Nominated Project Contact(s)

Elizabeth Wilson

Project Budget

£265,581.00

Summary

The forecasted growth of heat pump and EV chargers exposes networks to increasing challenges associated with cold load pickup following a prolonged outage, i.e. the initial demand could be beyond design parameters. Having a method to control and gradually ramp up demand after these prolonged shutdowns will allow DNOs to maintain network stability and reliability.

Smart Restart will develop and simulate a methodology for mitigating cold load pickup through smart meter-based load control. Central to the approach is the random offset feature built into smart meters, which could delay the reactivation of devices (such as heat pumps and EV chargers). Staggering when devices switch back on could prevent a sudden demand surge that could otherwise lead to a partial or total network shutdown.

Nominated Contact Email Address(es)

innovation@enwl.co.uk

Problem Being Solved

As GB transitions towards Net Zero, the number of electric vehicles and heat pumps is forecast to increase significantly. Electricity North West's Distribution Future Electricity Scenarios (DFES), published in January 2025, forecasts 3.5 million electric vehicles and 2 million heat pumps by 2050. This expected growth in low carbon technologies exposes networks to increased cold load pickup challenges following prolonged outages (24 hours or more), where the post-restoration demand could exceed current substation and feeder design parameters.

The UKPN innovation project, Cold Start, investigated the impacts of cold load pickup and clearly highlighted the scale of the challenge. By 2030, peak demand after outages could more than double, individual customer demand could exceed 4 kW, and LV feeders might experience up to 50% overloading. An 8-hour outage could result in loading beyond thermal limits, sustained for nearly 20 minutes after restoration. The project recommended that future work focus on exploring practical mitigation strategies and assessing their cost-effectiveness.

Smart Restart builds directly on this foundation, aiming to identify a scalable, low-cost solution using existing smart meter functionality to help DNOs proactively manage this risk.

Having a method to control and gradually ramp up demand after prolonged outages will allow DNOs to maintain network stability and reliability and avoid the need for additional network reinforcement to manage the high demand associated with cold load pickup.

Method(s)

This project will adopt both technical and commercial methodologies, combining desktop research, simulation-based modelling, and stakeholder engagement to assess how smart meter-based load control can mitigate cold load pickup events following prolonged outages. The core focus is to evaluate the feasibility and system impact of using SMETS meter functionality—specifically staggered reconnection and random offset features—to reduce peak network demand during restoration.

The method will be delivered through four interrelated work packages:

· Work Package 1: Technical Feasibility Assessment: A desktop review of SMETS smart meter functionality, with a focus on demand control features such as staggered reconnection and random offset timers.

· Work Package 2: Regulatory and Compliance Review: Assessment of the current regulatory landscape, including Distribution Code compliance and potential future changes. Engagement with key stakeholders (e.g. Ofgem, DESNZ, suppliers, DCC) to understand constraints and opportunities.

· Work Package 3: Implementation Methodology Design: Development of high-level operational strategies for staged load restoration, including prioritisation rules, randomisation windows, and load type-specific approaches (e.g. for EV chargers and heat pumps).

· Work Package 4: Simulation Roadmap: Definition of the data, network models, and software requirements (e.g. PowerFactory) to enable future simulation and validation of proposed methodologies.

· Work Package 5: Project Management and Reporting: Overarching project management and report for all work packages to ensure effective coordination among project team, partners and stakeholders.

This approach will provide an evidence base to inform the potential design of a field trial in a potential future phase.

Measurement Quality Statement:

Although this project does not involve physical testing, measurement quality remains important within the modelling and simulation context. Input assumptions, network data, and load profiles used in simulations will be based on industry-accepted sources and reviewed for appropriateness and completeness. Modelling processes will follow best practice, and all assumptions, parameters, and limitations will be clearly documented to support transparency and repeatability.

Data Quality Statement:

All data used or generated during the project will be reviewed to ensure it meets required standards for simulation accuracy and relevance. Data will be managed in accordance with the RIIO-ED2 Data Best Practice Guidance and Data Assurance Guidance, including version control, audit trails, and appropriate documentation. No personal data will be processed as part of this project.

Scope

Smart Restart will develop and simulate a methodology for mitigating cold load pickup through smart meter-based load control, reducing the risk of overloading LV networks during re-energisation. Central to this approach is the random offset feature built into smart meters, which can delay the reactivation of devices (such as heat pumps and EV chargers) controlled by a smart meter control switch—e.g., an Auxiliary Control or Consumer Access Device—by anywhere from 0 to 30 minutes. By staggering when each device switches back on, the random offset helps prevent a sudden demand surge that could otherwise cause significant voltage or frequency issues, potentially jeopardising system stability or leading to a partial or total network shutdown.

The project will include both a desktop study of smart meter capabilities and simulations of selected LV networks to test the impact of the proposed load control methodologies. In parallel, the project will develop a roadmap for potential future field trials to validate results of simulation and potential benefits.

The project will deliver benefits to the GB electricity distribution system, including:

Financial:

· Potential deferral of network reinforcement by mitigating peak demand spikes

· Reduced operational and maintenance costs from avoiding overloaded conditions

· Avoided CI/CML penalties by reducing the risk of secondary outages following restoration

Environmental:

· Enabling more reliable integration of LCTs such as EVs and heat pumps

· Supporting the net zero transition through smarter grid operation

Operational:

· Improved LV network resilience and recovery following prolonged outages

· Use of existing infrastructure (smart meters) to deliver new value with minimal cost

Objective(s)

The project aims to:

Assess the technical feasibility of using smart meter load control features to manage cold load pickup
Review regulatory and compliance considerations and engage key industry stakeholders
Develop high-level strategies for staged load reconnection using SMETS functionality
Define the data and modelling requirements for future simulation and validation
Provide recommendations and a roadmap for potential future trials and operational deployment

Consumer Vulnerability Impact Assessment

An assessment of distributional impacts (technical, financial and wellbeing related) for this project has been carried out using a bespoke assessment tool, which assesses the project as having a positive, negative or neutral effect on consumers in vulnerable situations. To help inform the assessment, this tool considers the categories of consumers identified in the Priority Services Register.

This project has been assessed as having an overall positive impact on consumers in vulnerable situations. The assessment has identified that this project will look to improve customers' ability to heat, cook, wash and use medical equipment during supply interruptions and reduce the duration of supply interruptions in the home.

Success Criteria

The success of the project will be determined by the completion and quality of the following key deliverables:

· Technical Feasibility Report –A review of SMETS smart meter functionality and its potential application for cold load pickup mitigation

· Regulatory and Compliance Review – A report outlining the current regulatory landscape, potential barriers, and stakeholder perspectives on controlled reconnection as well as policy recommendations

· Implementation Methodology Options – Development of high-level operational approaches for staggered reconnection using smart meter features.

· Simulation Roadmap – A plan specifying the modelling requirements, data needs, and proposed approach for simulating cold load scenarios in future work.

· Final Project Report – A consolidated summary of all findings and recommendations across work packages, including next steps for potential field validation.

Project Partners and External Funding

LCP Delta – contributing 10% to project cost £35,000

Potential for New Learning

This project offers significant new learning on SMETS capabilities and a supporting methodology to mitigate against the potential increase in cold load pick associated with the growth in heat pump and electric vehicle adoption.

The outputs from the project will be disseminated via the ENA Smarter Networks Portal and the Electricity North West website. We will also seek appropriate opportunities to disseminate at relevant conferences and events.

Scale of Project

The project will include both a desktop study of smart meter capabilities and simulations of selected LV networks to test the impact of the proposed load control methodologies.

Technology Readiness at Start

TRL2 Invention and Research

Technology Readiness at End

TRL4 Bench Scale Research

Geographical Area

Electricity North West's distribution network

Revenue Allowed for the RIIO Settlement

£0

Indicative Total NIA Project Expenditure

£207,523

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:

The forecasted growth of heat pump and EV chargers exposes networks to increasing challenges associated with cold load pickup following a prolonged outage. This project will mitigate the potential overload associated with this cold load pickup ensuring optimum economic network investment, increasing operational efficiency, and network resilience. This will result in a more cost-effective network for consumers whilst facilitating the energy transition and wider deployment of low-carbon technologies.

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

N.A.

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

This project is categorised as a Research project; however, an indicative benefit pathway has been considered based on the counterfactual scenario.

· Base Cost (Counterfactual): In the absence of the Smart Restart methodology, unmanaged reconnection following a prolonged outage can lead to excessive peak demand, which may exceed substation or feeder capacity. The counterfactual involves capital-intensive reinforcement of LV feeders, installation of additional monitoring/control assets, or reactive operational responses to secondary outages—all of which increase system costs and customer disruption.

· Method Cost (Smart Restart): The proposed approach leverages existing SMETS infrastructure to enable staggered reconnection via randomised offsets. This can be achieved without additional hardware installation, offering a significantly lower-cost alternative. It also has the potential to reduce engineering dispatch requirements during recovery, allowing resources to focus on more urgent or complex faults. Additionally, the result from Smart Restart can also help the thinking behind Regional Energy System planning.

A high-level calculation suggests that, if implemented effectively, Smart Restart could reduce the occurrence of secondary outages due to cold load pickup. Based on potential savings from avoided Customer Interruptions (CIs) and Customer Minutes Lost (CMLs), the solution could deliver annual benefits of approximately £1.5 million, assuming 90% of these secondary outages are prevented.

Recipients of the benefit include:

· Consumers, through improved supply reliability and lower network costs (which flow through to bills)

· Network operators, through reduced reinforcement, fewer site visits, more efficient use of existing assets, helping the thinking behind Regional Energy System Planning

The wider system, through enhanced grid flexibility and readiness for increasing LCT uptake

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

If successful, the SmartRestart solution could be applied to all low voltage networks across GB, providing smart meters are installed.

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

The Smart Restart methodology is designed to be low-cost and high-impact, as it leverages the existing national smart meter infrastructure rather than requiring new physical assets or reinforcement. However, a successful GB-wide rollout would still incur several categories of cost, including:

- Training and Governance Updates: Updating operational procedures and training staff to embed this capability within network operations.

- Regulatory and Stakeholder Engagement: Collaborating with suppliers, the Data Communications Company (DCC), Ofgem, and consumer representatives to develop a workable regulatory and data-sharing framework.

Although exact rollout costs will depend on factors such as network-specific characteristics, smart meter accessibility, and the final regulatory model, we assume that by the end of the project, the methodology could be made implementation-ready.

We estimate that the GB-wide rollout would require an additional investment of approximately £500,000 beyond the final development phase—covering remaining systems integration, staff training, and minor process changes. This brings the total solution cost across all phases (including feasibility, detailed design, and trials) to an estimated range of £1.5 million to £3.5 million.

Further refinement of these costs will be developed during the current phase, including specific implementation needs for different network contexts.

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

The learning from Smart Restart is intended to be applicable across all GB electricity distribution networks. The project will explore a generalisable methodology for mitigating cold load pickup using smart meter functionality, making its findings highly relevant to other Network Licensees.

Learning will be shared through regular updates, final reports, and stakeholder forums. Progress meetings, workshops, and industry collaborations will ensure knowledge reaches network licensees and relevant parties. Key outputs, will be widely distributed, fostering

replication, scalability, and adoption across the energy sector.

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 review of the Smarter Networks Portal and conversations with other networks has not revealed any other project addressing this issue.

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

This project is innovative because it explores a new application of existing smart meter functionality—specifically staggered reconnection and random offset timers—for a use case that has not been operationalised: mitigating cold load pickup on the low voltage network. While smart meters have been deployed widely, their potential to support post-outage network recovery remains untested at scale.

Smart Restart will be the first project to evaluate, through modelling, how this functionality could be coordinated by a DNO to improve network resilience and reduce the risk of overloads following a prolonged outage. The project also integrates regulatory, technical, and stakeholder insights to explore the practical steps required for controlled reconnection, which is not currently part of standard DNO practice. This novel operational use of consumer-side technology represents a new approach to post-outage load management.

Relevant Foreground IPR

There is no background IPR associated with this project beyond the existing expertise and tools of the project partners.

The project is expected to generate Foreground IPR in the form of research reports, prototype algorithms, and operational methodologies for managing cold load pickup using smart meter-based control.

Data Access Details

Data generated can be requested by interested third parties by contacting the innovation team in accordance with our data sharing policy which is available on our website.

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

The project involves multiple uncertainties—including the technical effectiveness of staggered reconnection, consumer acceptance, and regulatory compatibility—that make it unsuitable for business-as-usual funding. At this stage, there is no proven business case or clearly defined operational pathway for using smart meter features in this way. As a result, it does not meet the maturity or risk profile typically required for standard investment decisions under BAU funding.

Additionally, BAU funding would not typically support exploratory modelling and strategy development activities without evidence of effectiveness, value-for-money, and regulatory approval—all of which this project seeks to generate.

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

NIA funding is essential for this project because it is designed to test an unproven concept with clear technical, regulatory, and operational risks. These include:

- Technical risk: It is unknown how effective the smart meter randomisation feature will be in reducing peak demand at scale, or how it interacts with diverse LV network configurations.

- Regulatory risk: Remote load control raises policy questions around consumer protection, consent, and the role of suppliers vs. DNOs.

- Operational risk: There is no current process for DNOs to initiate controlled reconnection using smart meters, and significant changes to systems or practices may be required.

We have reviewed other potential funding mechanisms, including the Strategic Innovation Fund (SIF), and have determined that NIA is the most appropriate route for this project.

This project has been approved by a senior member of staff

☑ Yes