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

Feb 2026

Project Reference Number

NIA_UKPN0118

Project Registration

Project Title

Loadscape

Project Reference Number

NIA_UKPN0118

Project Licensee(s)

UK Power Networks

Project Start

February 2026

Project Duration

1 year and 1 month

Nominated Project Contact(s)

innovation@ukpowernetworks.co.uk

Project Budget

£458,488.00

Summary

The Loadscape project aims to enhance UK Power Networks' understanding of electricity demand profiles among non-domestic customers. By analysing half-hourly metered data, the project will classify organisations, identify clusters in demand, and develop a taxonomy of consumption patterns. This data-driven approach will enable more accurate forecasting of maximum demand and support efficient electricity network planning. The project is delivered in collaboration with Environmental Insight Partners and will produce a predictive model to assign new customers to demand profiles before meter data is available. If successful, Loadscape will facilitate quicker, cheaper connections for customers and support a more resilient and flexible electricity network.

Nominated Contact Email Address(es)

innovation@ukpowernetworks.co.uk

Problem Being Solved

UK Power Networks currently has limited understanding of consumption behaviours amongst its non-domestic customers. The standard approach across DNOs is to look at the total amount of capacity requested for a new connection and to consider a fixed diversity factor to account for non-coincident peaking. However, this crude approach means that capabilities for strategic consideration of flexibility, constraint management and network investment are limited due to a lack of credible load profiles for different categories of non-domestic customers.

This makes it challenging to analyse network implications when new commercial and industrial connection requests are received. Enhancing our capability to understand commercial and industrial customer energy consumption is important for the following key reasons:

- It will improve our long-term forecasting of consumption behaviours for this customer group

- It will allow us to offer a better service to connection customers (in the form of quicker and/or lower cost quotes and connections)
- It will allow more efficient use of existing network and avoid unnecessary reinforcement.

Additionally, it could lead to further opportunities to customers embracing profiled connections, on a decarbonisation journey and/or participating in flexibility services.

Method(s)

UK Power Networks will carry out the overall management for the project, with our partners the Environmental Insight Partners leading the work specified in the work packages. The overall method is to leverage data science and engineering to create a set of 'consumption patterns' that can be applied to any type of commercial and industrial customer with a known level of confidence.

The approach will be to carry out three sequential work packages which will involve analysing data, classification of non-domestic customers, and developing usage profiles for each classification. The project will carry out the following three work packages:

Work Package 1: Extract and Transform

Meter Point Administration Number (MPAN) details and half hourly consumption data for non-domestic premises will be extracted from UK Power Networks' data systems. The data will then be reviewed to identify and resolve any data integrity issues, accounting for missing data and dealing with outliers. External geospatial reference datasets, address categorisation and weather conditions will be acquired.

Work Package 2: Classify non-domestic customers and locations

The project will match standardised source data to the reference datasets and develop rules to assign each non-domestic MPAN according to the type of non-domestic customer and building which is being supplied. Loadscape will also identify organisations who could be on our Extra Care Register based on the relevant eligibility criteria. Rules will be developed to provide a measure of confidence on each match.

Work Package 3: Identify clusters in demand

Statistical techniques will be used to identify clusters of MPANs which have the same consumption pattern, initially in an unsupervised way (i.e., the algorithms are left to identify clusters of consumption patterns according to the data). The non-domestic customer and location classifications are then used to interpret the resulting clusters. Engineering and statistical judgement will be used to create a taxonomy of consumption patterns which are anonymous, clearly differentiated and statistically significant.

The final deliverables are the taxonomy of "consumption patterns", a dataset which assigns all existing half hourly metered customers to a consumption pattern, and a predictive model which assigns new customers to a consumption pattern with a maximum demand forecast (prior to any meter data being available). The predictive model will allow the maximum demand forecast to be aggregated up to connection point.

Measurement Quality Statement:

All data used within this project is for the purposes described above, and therefore quality will be measured on this basis. The project will follow all data quality rules, logging, and prioritising issues as they arise in line with the approved methodology set out in our Enterprise Data Management Policy, which forms part of the UK Power Networks Integrated Management System. Data quality will be measured across five dimensions where applicable: Accuracy, Completeness, Consistency, Validity and Uniqueness.

Data quality rules for each of the appropriate data quality dimensions above will be set by the project, measuring them closely on a regular basis to identify quality issues.

Data Quality Statement:

Data quality issues will be logged in a central location and prioritised using an approved matrix which combines the importance of the issue, and the amount of data affected, this gives an indication of the issue's impact on the project and wider business, considering factors such as:

- The impact on the health and safety of the public and employees
- Whether it may result in a breach of our licence conditions or relevant regulations
- The impact on UK Power Networks' reputation
- The impact on our operations and efficiency
- The financial impact, including project delays and charges from external service providers.

The project will then seek support for resolving the issues in priority order. All data and background information will be stored centrally and securely in a project specific SharePoint folder or in our Enterprise Data Store if required by the wider business in accordance with data protection requirements.

Scope

The purpose of the project is to better understand the demand profiles of different types of non-domestic customers. This project includes desktop research and analysis, which will produce outputs that can be used by the DSO and Asset Management departments.

The project scope is to:

Analyse data from sufficient sample of half-hourly metered non-domestic customers
Assign non-domestic customers to the half-hourly metered data
Identify MPANs which have similarities in demand
Produce a taxonomy of consumption patterns for non-domestic half-hourly metered customer types

Objective(s)

The objectives of the project are as follows:

- Produce a classification of non-domestic customers to support broader assessment of demand trends. The assessment approach will lead to classifications of different confidence intervals.
- Produce a taxonomy of consumption patterns for half hourly metered customer types based on historical available data.
- Validate the consumption patterns produced in the project against new metering data that becomes available throughout the course of the project.

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

This initiative is focused on non-domestic customers, not individual consumers. The objectives do not require site-based trials or local deployments. Developed techniques and processes will be tested based on historical data and, if implemented, will contribute to UK Power Networks' internal suite of tools and processes.

Success Criteria

The project will be considered a success if:

· Classification of non-domestic customers on half-hourly metering is completed, and we understand the confidence levels and limitations of the assessment.

· Proposed electricity usage profiles are created for each high confidence classification, and we understand the confidence levels and limitations of the proposed profiles.

· Low confidence classifications are used to clarify what categories of customer are not useful to predict their likely electricity uses. Legacy approaches to estimating electricity use will be used for these types of customers.

· There is clear understanding of what categories of customer are useful to predict their likely electricity usage. There is clear understanding of how to categorise new customers into these categories to therefore be able to predict their electricity usage.

· There is clear guidance on how to assess the accuracy of customer profiles, which will be developed and tested during the project.

· There is clear guidance on how to improve the accuracy of customer profiles, such that improvements can be made in future if there is a business need/appetite to do so.

Project Partners and External Funding

Our intended collaboration partner is the Environmental Insight Partners (EIP – previously known as the Institute for Environmental Analytics, IEA). The EIP is a specialist R&D organisation focused on applying advanced data science techniques and software engineering to develop new decision-support capabilities for organisations in the energy sector.

The project is not receiving an external funding from either the project partner or any other sources.

Potential for New Learning

Neighbourhood Green, a previous UK Power Networks NIA project, was an extremely valuable project that investigated the demand profile of homes with heat pumps. This has transitioned into BAU, and the data is being used to support business activities. This project will take a similar approach, but with a different customer group, and using different source data as appropriate.

We expect to develop learnings around the classification of non-domestic customers, and their profile of electricity usage. The learning can be disseminated by sharing the classifications and profiles, along with guidance on how to use both. Dissemination will also include a description of analysis conducted, and sufficient information for other networks to carry out a similar assessment based on their customers.

Scale of Project

Loadscape is a large-scale, innovative data science project requiring significant resources because it processes multi-year, half-hourly data for 70,000 non-domestic customers – the entire UK Power Networks half hourly metered base.

Working on the full dataset ensures economies of scale: data preparation and model training occur once, avoiding repeated costs and inefficiencies. The complexity of developing, validating, and benchmarking forecasting models also requires a multidisciplinary team and compute-intensive experimentation. The budget is proportionate to the challenge and necessary to deliver robust, scalable insights that support accurate demand forecasting, efficient network planning, and the energy system transition.

Technology Readiness at Start

TRL6 Large Scale

Technology Readiness at End

TRL9 Operations

Geographical Area

This is a desktop project, which will cover customers across all three of UK Power Networks' licence areas.

Revenue Allowed for the RIIO Settlement

No funding was provided within the current RIIO-ED2 settlement that will become surplus to requirements as a result of this project.

Indicative Total NIA Project Expenditure

The total approved project budget is £458,488 of which £412,639 (90%) will be recovered from NIA funding.

Project Eligibility Assessment Part 1

There are slightly differing requirements for RIIO-1 and RIIO-2 NIA projects. This is noted in each case, with the requirement numbers listed for both where they differ (shown as RIIO-2 / RIIO-1).

Requirement 1

Facilitate the energy system transition and/or benefit consumers in vulnerable situations (Please complete sections 3.1.1 and 3.1.2 for RIIO-2 projects only)

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

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

This project supports the energy system transition by providing UK Power Networks with a much more granular understanding of electricity demand among non-domestic customers. Traditionally, network planning has relied on broad assumptions and fixed diversity factors, limiting the ability to integrate new technologies, manage flexibility, and optimise network reinforcement.

Loadscape addresses this by analysing non-domestic customers' half-hourly metered data to classify customer types and identify distinct demand clusters. This enables the creation of accurate, data-driven consumption profiles and a predictive model for new connections. With these insights, network planners can:

Enable more connections at lower cost: By understanding when and how different businesses use electricity, planners can safely connect more customers without costly reinforcements, supporting the integration of low-carbon technologies.
Optimise network investment: Accurate demand forecasting reduces the risk of unnecessary infrastructure upgrades, leading to customer benefits.
Support decentralisation and flexibility: The project's outputs help identify opportunities for demand-side response and flexibility services, which are crucial for a net zero energy system. Understanding what customer types have a demand profile that matches a local network's need for flexibility services will allow more targeted engagement to support flexibility service uptake.
Accelerate customer connections: Faster, cheaper connections encourage electrification and the adoption of new technologies across the commercial and industrial sectors.

By underpinning smarter, more responsive network management, Loadscape directly contributes to a resilient, efficient, and low-carbon energy system—key pillars of the energy transition.

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 (RIIO-1 projects only)

N/A as this is a RIIO-ED2 project.

Please provide a calculation of the expected benefits the Solution

The total benefits calculated across ED2 and ED3 is £19.2m and further details and assumptions can be found below.

Benefit 1 – Customer Benefits

The expected benefits arise from having accurate commercial/industrial customer profiles. These will enable more efficient customer connections to take place. This means that more customers can connect to the nearest main substation without reinforcement, compared to a counterfactual of connecting to a substation further away, as capacity is not available at the nearest substation.

Customers benefitting from this solution will have lower connection costs, as connecting to the nearest substation will lead to lower costs for their sole-use assets.

Customers will also benefit from quicker connections. This time benefit has not been calculated, as it is difficult to quantify and is therefore conservative to exclude it from the calculation.

Benefit 1 calculation- £2,566,800 per year

- We believe that 69 jobs per year would benefit from this project.
- Saving estimate per job is £37.2k
- 69*£37,200 = £2,566,800

Benefit 2 – Quotes received more quickly by customers

This is an additional benefit as because Network Planning Engineers will have to assess fewer complex options for impacted referrals, therefore allowing quotes to be returned to customers more quickly.

Benefit 2 calculation – 300 quotes per year issued more quickly to customers

- Network Planning Engineers will have to assess fewer complex options for impacted referrals and customers will therefore be able to receive their quote more quickly.
- Benefit of one day per referral
- We believe 300 referrals per year could benefit from this project.

*NB the volume of 69 used for Benefit 1 is related to the number of jobs that are likely to proceed out of the 300 quotes issued in Benefit 2

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

Using this method is highly replicable across Great Britain, as all networks have customer connection requests for new commercial and industrial customers. As the scope of the project is to assess UK Power Networks' customers, further analysis would be required to confirm whether any usage profiles would be relevant for use in other licence areas or if DNO specific usage profiles would be required.

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

The solution could be deployed in any licence area providing the DNO implements processes and systems to incorporate it into their BAU process. Other DNOs wishing to implement the method would need to carry out further analysis to confirm which usage profiles would be appropriate for use in their licence areas. The cost of doing this would vary depending on the level of detail taken for the analysis.

Requirement 3 / 1

Involve Research, Development or Demonstration

A RIIO-1 NIA Project 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

RIIO-2 Projects

☐ 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

Loadscape will deliver detailed classifications and consumption profiles for non-domestic customers, using advanced data analysis. Network Licensees can adopt these outputs to improve demand forecasting, optimise reinforcement decisions, and enable faster, lower-cost customer connections. The project's outputs and guidance will be shared, allowing other networks to replicate the approach and enhance their own planning processes. This supports more efficient, flexible network management and helps integrate new technologies, directly contributing to the energy system transition.

Or, please describe what specific challenge identified in the Network Licensee's innovation strategy that is being addressed by the project (RIIO-1 only)

N/A as this is a RIIO-ED2 project.

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.

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

The National Energy System Operator (NESO) project known as Consumer Building Blocks developed a set of industry standard consumer archetypes to support modelling of the future energy system, for example in the Future Energy Scenarios (FES).

This was extended to a Phase 2 but still focuses on domestic customers and focuses on low carbon heating, therefore there is no duplication.

Further info on the projects: Consumer Building Blocks | ENA Innovation Portal and Consumer Building Blocks Phase 2 | ENA Innovation Portal

A literature review revealed two other projects which worked to categorise non-domestic electricity consumption outside of the UK:

· A classification and profiling project by a Chilean DNO looked at smart meter data for one year from 934 non-domestic customers. From this, they proposed seven typical consumption curves. More data here: Classification of Behavior Profiles for Non-Residential Customers Considering the Variable of Electrical Energy Consumption: Case Study—SAESA Group S.A. Company

· A study commissioned by the French DNO Enedis: In this project hourly data from 55,000 customers was used to establish 18 load profiles for a sample year at hourly resolution. The techniques and results from this project have been studied and lessons learned will be applied in the proposed initiative. The intended scope covers 100% of our non-domestic customers currently metered at half hourly resolution across our licence areas (there are 71,000 customer total) indicating a favourable basis for applying lessons to the profiling of our non-domestic customers.

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

Loadscape is innovative because it applies modern data science techniques to non-domestic energy customer consumption data to produce outputs to support smarter, more flexible network planning and faster, lower-cost connections. The scale and granularity of the approach have not been trialled before in the UK, or internationally as far as the project team have been able to ascertain.

The project will explore the potential for extracting more insight from existing non-domestic demand data and is bespoke in nature. The focus is not on the development of a new technology per se, nor the demonstration of an existing technology. Nevertheless, modelling of demand for electricity has been subject to much research both in GB and internationally.

In addition, research carried out by our proposed project partner identified the following points:

· The proposed innovation project distinguishes itself through its proposed scale, granularity and methodological innovation compared to previous studies. The inclusion of multi-year trends is novel and addresses seasonal and interannual variability in customer demand.

· Handling the size of data required (e.g. 2.5 billion data points (70k customers × 48 intervals/day × 5 years) requires the development of new and innovative cloud-based clustering and computational techniques to characterise loads.

· By combining large-scale temporal analytics with locational clustering and a focus on reinforcement avoidance, this project addresses a critical challenge for DNOs' seeking operational efficiency, offering a tangible pathway to reduce connection costs and defer network expenditure.

Relevant Foreground IPR

Foreground IP expected to be generated in the project:

- The final deliverables are the taxonomy of “consumption patterns”, a dataset which assigns all existing half hourly metered customers to a consumption pattern and a predictive model which assigns new customers to a consumption pattern with a maximum demand forecast (prior to any meter data being available).

- Methodological approaches to create the taxonomy of “consumption patterns”

There’s no Background IP required to use the Foreground IP.

Data Access Details

UK Power Networks recognises that Innovation projects may produce network and consumption data, and that this data may be useful

to others. This data may be shared with interested parties, whenever it is practicable and legal to do so, and it is in the interest of GB electricity customers. In accordance with the Innovation Data Sharing Policy, UK Power Networks aim to make available all nonpersonal, non-confidential/non-sensitive data on request, so that interested parties can benefit from this data.

To view the full Innovation Data Sharing Policy, please visit UK Power Networks' website here: Home of Innovation - UKPN Innovation

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

In the NIA Governance document, Distribution Network Operators (DNOs) are encouraged to explore various methods and solutions to address challenges impacting customers and network operators.

These activities are not part of routine operations due to the low Technology Readiness Level (TRL) and the inherent risks associated with the project, given the unproven benefits. Therefore, NIA project funding is essential to advance the innovative aspects of the project and manage the associated risks for its implementation.

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 Loadscape project requires NIA support due to the innovative nature of the solution and the risks associated with its development and deployment.

The project proposes a novel approach to managing Commercial & Industrial load assessment that has not been trialled within UK Power Networks or across other DNOs and therefore carries a degree of uncertainty in terms of technical feasibility.

Without NIA funding, the speculative nature of the project and the lack of a proven commercial return would make it difficult to justify investment under standard operational budgets.

This project has been approved by a senior member of staff

☑ Yes