

NIA Project Registration and PEA Document

Date of Submission

Oct 2026

Project Reference Number

NIA3_NESO005

Project Registration

Project Title

AI-driven metering Fault Investigation and eXplanation (AIM-FIX)

Project Reference Number

NIA3_NESO005

Project Licensee(s)

National Energy System Operator

Project Start

October 2026

Project Duration

1 year and 1 month

Nominated Project Contact(s)

innovation@neso.energy

Project Budget

£170,000.00

Summary

The project aims to transform how NESO identifies, investigates and prioritises faulty operational metering across the GB National Electricity Transmission System. Current metering quality management relies heavily on manual processes and engineering judgement, limiting the ability to identify hidden, emerging and system-wide faults and understand their operational impact. The project will investigate the use of Artificial Intelligence (AI), combining operational metering data, system knowledge and advanced analytics to develop, test and demonstrate new approaches for fault identification, impact assessment and explainable reporting. Outputs include benchmarking current practices, fault identification models, a prototype visualisation and reporting capability, and recommendations for future implementation. Learning will strengthen metering quality management, improve confidence in operational data, and enhance situational awareness, state estimation and network operation.

Third Party Collaborators

The University of Sheffield

Nominated Contact Email Address(es)

Innovation@neso.energy

Problem Being Solved

Operational metering is fundamental to NESO's ability to monitor, analyse and operate the National Electricity Transmission System

(NETS). Operational metering data is used across a wide range of operational and planning activities, including system monitoring, state estimation, forecasting, network analysis, balancing actions and constraint management. The effectiveness of these activities depends on the availability of accurate and reliable metering data. As the electricity system continues to become more complex, with increasing levels of renewable generation, power electronic technologies and distributed energy resources, NESO's reliance on high-quality operational data is growing.

However, the current approach to metering quality management is largely manual, fragmented and difficult to scale. Existing processes can identify some obvious faults, they are less effective at detecting hidden, slowly degrading or system-wide metering issues that may develop over time. The increasing volume and complexity of data creates a significant challenge for manual approaches. There is currently no standardised framework that combines operational data, network topology and advanced analytics to support consistent detection, investigation and prioritisation of metering issues. Without such capability, metering quality risks becoming an increasing constraint on operational efficiency, reliability and decision-making as the volume of system data continues to grow.

Method(s)

The project will be delivered through three structured work packages, with regular engagement to ensure alignment with NESO operational needs and build confidence in the outputs. Regular bi-weekly engagement, milestone reviews, and final showcase internal sessions will ensure transparency, usability, and stakeholder confidence.

WP1 – Data acquisition, preprocessing, and benchmarking (Months 0–3)

Operational data from NESO's Supervisory Control and Data Acquisition (SCADA) system, which is used to monitor and supervise the real-time operation of the electricity transmission network, together with data from the Data Historian, a specialised database used to store and manage historical operational measurements and system information, and existing metering records will be integrated into a structured and quality-controlled dataset. A preprocessing pipeline will be developed to handle alignment, cleansing, and data consistency. Early findings will be shared through initial review sessions, validating assumptions and establishing a baseline benchmark with SMEs.

WP2 – Model development and prioritisation framework (Months 3–9)

Topology-aware analytical models (e.g. graph-based methods) will be developed to detect anomalous and faulty metering at a system-wide level. This will assess the relative impact of faults on system operation. Progress will be demonstrated through iterative working sessions and model walkthroughs, allowing NESO SMEs to verify results, provide feedback, and shape development.

WP3 – Prototype, visualisation, and demonstration (Months 9–12)

A demonstrable prototype will present outputs via clear visualisations and structured reporting. The final phase will include targeted demonstration sessions, showing how the solution works on real datasets and how it could align with future platforms, supported by a practical implementation roadmap.

In line with the ENA's ENIP document, the risk rating is scored 4.

TRL Steps = 1 (2 TRL Steps)

Cost = 1 (£170,000)

Suppliers = 1 (1 supplier)

Data Assumptions = 1 (Defined assumptions & principles)

Total = 4 (Low)

Scope

The AIM-FIX project is a research and development project investigating the use of Artificial Intelligence (AI) and advanced analytics to improve the identification, investigation and prioritisation of faulty operational metering across the GB electricity transmission system.

The project scope will include:

- >Acquisition, integration and preprocessing of metering data to support research, analysis and evaluation activities. This will focus on the data quality, consistency and completeness, including approaches for data cleansing, alignment and validation.

>Investigation of suitable approaches to identify anomalous and potentially faulty metering at a system-wide level. This will include exploration of methods capable of considering network topology and historical data patterns to improve fault identification capability beyond existing manual processes.

>Design of a fault prioritisation methodology to rank metering issues based on relative system impact

>Establishment of a benchmarking baseline for current metering quality and processes, including identification of key gaps

>Development of a prototype and visualisation outputs, demonstrating how insights can be interpreted and applied

The following items will be out of Scope of this project:

>Building a full operational, production-ready tool and operational rollout

>Full enterprise deployment and integration to NESO existing tools

>Business-as-usual implementation activities

Objective(s)

The objective is to prove a scalable, data-driven capability to identify and prioritise faulty operational metering, while establishing a standardised framework and clear pathway for future integration into live systems. There are five main objectives as follows:

>Establish a validated metering dataset and baseline: Deliver a structured and quality checked dataset and a documented baseline of current metering performance, agreed with SMEs, enabling consistent analysis going forward.

>Demonstrate system wide fault identification capability: Develop and validate analytical methods that can identify known and previously unflagged metering anomalies using historical data, with results reviewed and accepted by stakeholders.

>Define and evidence an impact based prioritisation approach: Deliver a clear and interpretable method to rank metering issues based on system impact, with outputs validated through stakeholder review sessions.

>Deliver a working prototype aligned to future integration: Provide a demonstrable solution showcasing detection and prioritisation outputs, with successful demonstration sessions confirming usability and relevance for platforms.

>Define a clear implementation pathway: Produce a documented roadmap outlining how capabilities can be scaled and integrated into NESO systems, including key dependencies and next steps agreed with stakeholders.

Consumer Vulnerability Impact Assessment

This project has been assessed as having a neutral impact on consumers in vulnerable situations because it focuses on developing and testing AI-enabled methods to identify and prioritise faulty operational metering across the GB electricity transmission system.

Success Criteria

WP1: Exploratory Metering Data Analysis and Benchmarking

Outputs: A comprehensive report detailing the analysis of current metering data, repair logs, and tag/marker info and a benchmarked framework for identifying and classifying metering fault and its original.

Success Criteria: Successful acquisition of multi-source metering data across ENCC systems and benchmarking of existing metering processes completed.

WP2: AI Model Development for Fault Identification and Prioritisation

Outputs: Proof of concept code that implements AI-enabled methods to find faulty metering and a proof of concept code that prioritise the metering

Success Criteria: the code is easy to read and explain, presented in a format acceptable by NESO users.

WP3: Explainable AI Interface and Visualisation Tool Development

Outputs: Presentation and handover of results along with associated code, final report and user guidance
Success Criteria: Deployment of the explainable AI interface and visualisation tool for user interaction and reporting along with successful demonstration with NESO users; Detailed report with clear user guidance.

Project Partners and External Funding

Project Partner: The University of Sheffield

No additional funding licensees or collaborating networks are currently included in the project, so there is no external funding agreed.

Potential for New Learning

The project aims to generate new knowledge on how advanced techniques can improve operational metering quality management across the electricity transmission system. The project will investigate the application of Graph Neural Networks, AI-driven State Estimation and explainable AI to identify, assess and prioritise faulty metering in a more scalable and systematic way than current manual approaches.

The project results will provide evidence on the effectiveness of AI-based methods for detecting hidden, degraded and system-wide metering issues, while improving understanding of the relationship between metering faults, network topology and operational impacts. It will also generate learning on data requirements, model validation and the practical deployment of advanced analytics in operational power system environments. The findings will support future developments in metering quality management, operational data assurance and AI-enabled network operations.

At the end of a project, the project learning, including recommended next steps will be shared on the ENA Smarter Network Portal.

Scale of Project

The project is a 12-month research-led, prototype-based analytical development focused on evaluating the feasibility of AI-enabled approaches for operational metering fault identification and prioritisation. The project is intentionally limited in scope to research, methodology development and prototype demonstration.

Technology Readiness at Start

TRL2 Invention and Research

Technology Readiness at End

TRL4 Bench Scale Research

Geographical Area

The project will focus on operational metering across the GB electricity transmission system and will be delivered through collaboration between NESO and UK based suppliers.

Revenue Allowed for the RIIO Settlement

N/A

Indicative Total NIA Project Expenditure

Project spent broken down by work package:
WP1- Exploratory Metering Data Analysis and Benchmarking: £50,000.00
WP2- AI Model Development for Fault Identification and Prioritisation: £50,000
WP3: Explainable AI Interface and Visualisation Tool Development: £49,695

Total estimated project cost £170,000

The costs presented by work package reflect the direct project delivery activities. In accordance with the NIA Governance and Licence Condition requirements (including the provision for up to 25% of project costs for internal expenditure), the total reported project cost may differ from the sum of work package costs outlined above. All costs are reported to Ofgem in full through formal regulatory reporting at the end of each financial year.

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 project will support the energy system transition by improving confidence in the operational data used to manage an increasingly complex, low-carbon electricity system. By investigating AI-enabled methods for identifying and prioritising faulty metering, the project will help support more accurate system monitoring, improved operational decision-making.

By developing scalable, data-driven methods that reduce reliance on manual processes, the project will generate knowledge that can support future implementation of automated metering quality management capabilities. This could enable more effective integration of renewable and distributed energy resources, improve operational resilience, and contribute to a more efficient and reliable electricity system as Great Britain transitions towards net zero.

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

The project is a research and development activity. However, if successfully implemented at scale, improved metering quality management could reduce avoidable operational costs associated with inaccurate data, inefficient balancing actions and system constraints. The project business case identified that metering-related operational issues can have significant cost implications, with indicative estimates suggesting approximately £64k of avoidable cost per event, and a potential future benefit in the range of £1m–£5m per year if similar issues can be identified and addressed more effectively across multiple events. These values are indicative only and will require further validation through future deployment activities.

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

The methodology is expected to have high replicability across the GB transmission network, as it addresses common operational metering quality challenges using data and analytical approaches that are not location-specific. The proposed AI-based approaches will be developed using standard operational data sources, such as metering measurements, network topology information and state estimation outputs, enabling the methods to be applied wherever similar data is available. If proven effective, the methodologies could be deployed across the wider GB transmission network and potentially adapted for use by other network operators facing similar challenges in operational data quality management. The project will therefore generate learning and analytical approaches with broad applicability beyond the initial demonstration scope.

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

As the proposed solution is software and analytics based, no significant physical infrastructure investment is anticipated. The methods are intended to be scalable and applicable across the GB transmission network using existing operational data sources. A more detailed deployment cost estimate will be developed if the project successfully demonstrates technical feasibility and progresses to a future implementation phase.

Future rollout costs are expected to relate primarily to:

- > Integration with existing NESO operational platforms and data sources.
- > Development of production-ready software and user interfaces.
- > Establishment of automated data pipelines and hosting infrastructure.
- > User acceptance testing, operational validation and cybersecurity assurance.
- > Staff training, change management and ongoing maintenance support

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 generated through the project will be applicable to NESO and other GB network licensees that rely on large volumes of operational data to monitor, analyse and operate electricity networks. The project will provide evidence on the use of advanced AI techniques for identifying, assessing and prioritising faulty operational metering. This learning could support the development of more scalable and consistent approaches to data quality management across transmission and distribution networks.

The project will also generate learning on data requirements, model validation, benchmarking methodologies and the practical application of AI in operational environments. These insights could help network licensees evaluate similar approaches for improving data quality, operational visibility and decision-making processes within their own organisations.

Project outputs, including technical reports, methodologies, lessons learned and implementation recommendations, will be shared, enabling other network licensees to assess the applicability of the approaches and build upon the findings in future innovation and operational improvement activities.

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 existing NESO activities, wider GB innovation projects and industry solutions identified no existing project that addresses the specific challenge of automation of operational metering fault identification, impact assessment and prioritisation across the GB transmission system. Current metering quality management largely relies on manual investigation, engineering judgement and existing operational processes, which do not provide a scalable, system-wide capability for identifying hidden or emerging metering issues.

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

The project is innovative because it introduces a novel, AI-driven framework to identify and prioritise faulty metering at a system-wide level, replacing largely manual and threshold-based approaches currently used.

Key Innovation elements are:

- > Not achievable with traditional methods: introduces topology-aware AI to identify system-wide and hidden metering faults, representing an industry step change beyond rule-based approaches
- > Moves from fault detection to impact-based prioritisation aligned with system risk
- > Replaces manual, fragmented processes with scalable, data-driven analysis
- > Delivers transferable models designed for future integration
- > Provides a practical prototype/demo, bridging research and operational application

Relevant Foreground IPR

Details of expected Relevant Foreground IPR which will be generated in the Project. If applicable, this must also explain if Background IPR will be required to use the Relevant Foreground IPR.

A final report will be shared on the Smarter Networks Portal, which will highlight any new methods, models materials, or outputs created through the delivery of the Project.

Data Access Details

Data for this project and all other projects funded under the Network Innovation Allowance (NIA), or Strategic Innovation Fund (SIF) can be found or requested in a number of ways:

1. A request for information via the Smarter Networks Portal at <https://smarter.energynetworks.org>, to contact select a project and click 'Contact Lead Network'. National Energy System Operator already publishes much of the data arising from our innovation projects here so you may wish to check this website before making an application.
2. Via our Innovation website at <https://www.neso.energy/about/innovation>
3. Via our managed mailbox innovation@neso.energy

Details on the terms on which such data will be made available by National Energy System Operator can be found on our website: [Data Sharing Approach | National Energy System Operator.](#)

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

The Network Licensees would not fund this project through business-as-usual activities because it is a research and demonstration project with technical and implementation uncertainty. The project seeks to develop and validate novel AI-based techniques, including

topology-aware analytics and advanced state estimation approaches, for the identification, assessment and prioritisation of faulty operational metering. Its outputs are intended to benefit NESO and other GB network licensees through the dissemination of project learning and best practice, making innovation funding the appropriate route.

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 can only be undertaken with NIA support because it involves the research, development and validation of novel AI-based methods for operational metering fault identification and prioritisation, where the technical feasibility, effectiveness and operational benefits remain uncertain. The project carries significant technical risk associated with developing and validating new analytical approaches, operational risk related to the quality and availability of data from multiple systems, and commercial risk because future benefits cannot be guaranteed until the methods have been proven. The project will generate new learning, methodologies, and prototype solutions rather than deliver a production-ready operational system, making it unsuitable for funding through business-as-usual activities. NIA funding enables NESO to manage these risks while creating knowledge and evidence that can benefit both NESO and other GB network licensees.

This project has been approved by a senior member of staff

☒ Yes