

## NIA Project Registration and PEA Document

### Date of Submission

Feb 2026

### Project Reference Number

NIA2\_NESO123

## Project Registration

### Project Title

Energy Market Transaction Model (EMTM)

### Project Reference Number

NIA2\_NESO123

### Project Licensee(s)

National Energy System Operator

### Project Start

February 2026

### Project Duration

1 year and 1 month

### Nominated Project Contact(s)

innovation@neso.energy

### Project Budget

£630,000.00

## Summary

This project will develop a whole energy market impact analysis model that equips NESO with the capability to trace consumer energy costs across the electricity and gas markets and understand the interactions among the key entities involved. The model addresses a current capability gap, as existing NESO tools do not provide an integrated view across power and gas, limiting NESO's ability to evaluate consumer value, system resilience, and security of supply implications. Lessons learned from this project will enhance NESO's capacity to understand and assess distributional impacts and support more informed future NESO's actions and policy recommendations.

The project development will involve targeted engagement across key internal functions and selected external partners. Expected outputs include a feasibility study and prototype model demonstrate feasibility and scalability.

### Nominated Contact Email Address(es)

Innovation@neso.energy

## Problem Being Solved

It has been identified there are two challenges for NESO in meeting its legislative duties. NESO, firstly, needs to consider resilience and security, while also considering the impact on consumers and the whole energy system as outlined in the Energy Act 2023.

1. Currently, most of NESO's models are highly technical, focusing on the planning and operation of the power system. These models do not provide enough visibility into the transaction flows from consumers to final recipients, nor do they capture the detailed dynamic

interactions between different entities in the whole energy market.

2. After reviewing some existing consumer bill models and methodologies (i.e., Ofgem's Price Cap methodology, Cornwall Insight Price Cap Forecasting Model and other relevant commercial models). We found these models generally only capture the conventional market participants. However, the actions or behaviour of other non-conventional market participants (i.e., banks, service providers, regulators etc) can influence those conventional market participants and ultimately affect consumer bills. Without a deep understanding of these actions/behaviours of those entities in the whole energy market, NESO may struggle to identify potential unintended consequences in the future whole energy market.

## Method(s)

The method sets out the analytical and research approach that will be used to assess the feasibility of developing a whole energy market impact analysis model. It outlines the structured work plan for reviewing existing tools, developing modelling methodologies for electricity and gas markets, and testing these methods through a proof of concept (PoC).

### Work Package 1 – Literature Review

A structured review of existing energy market mapping and consumer bill tracking tools in Great Britain and internationally will be conducted. Tools such as Ofgem's Data Portal and Elexon's settlement systems will be assessed, alongside international examples including the U.S. Energy Information Administration's energy market flow visualisations and European market coupling models.

There will also be an evaluation on system dynamics and modelling tools used globally, drawing on its experience in developing forecasting and transaction flow models for energy markets. Capabilities in mapping transaction flows, capturing inter-entity dynamics, and visualising consumer bill components will be assessed.

Throughout the review, key criteria including transparency, granularity, adaptability to policy changes, integration potential with NESO systems, and suitability for whole system modelling—will be used to evaluate how the identified tools and models manage data governance, scalability, and user accessibility.

### Work Package 2 – Electricity Market Methodology

A structured methodology for entity selection based on criteria such as financial materiality, regulatory influence, data availability, and systemic importance will be developed in this Work Package. The methodology will be validated through stakeholder engagement, including workshops with NESO teams and industry experts, ensuring alignment with operational and policy priorities.

This Work Package also includes developing the modelling methodology for transaction flows and inter-entity dynamics. In the electricity market context, it will explore system dynamics, agent-based modelling, and network flow approaches. Each approach will be assessed for its ability to capture feedback loops, time lags, and behavioural responses to market signals or policy changes, as well as its adaptability to future market reforms.

### Work Package 3 – Gas Market Methodology

This Work Package will focus on the development of gas market modelling. It will explore system dynamics, agent-based modelling, and network flow approaches, assessing their ability to capture feedback loops, time lags, and behavioural responses to market signals or policy changes. Like the proposed electricity market methodology, it will also assess the adaptability of these approaches to future gas market reforms.

Alongside the development of modelling methodologies for both electricity and gas markets, this Work Package will also collaborate closely with NESO teams to ensure the modelling approach is grounded in real-world operations and can be scaled for implementation. This includes early validation of key assumptions and iterative refinement based on NESO feedback.

### Work Package 4 – Integration Methodology

This Work Package focuses on developing an agent-based market model that links the electricity and gas sectors through shared agents and transaction flows, allowing actions in one market to influence the other. The proposed model will jointly simulate network and price interactions across both sectors to capture these cross-market dependencies.

The core steps in this Work Package include mapping key agents and defining interaction rules. Gas and electricity trades are resolved sequentially or iteratively at each time step, resulting in a whole system model that represents gas flows (pipelines, storage) and electricity flows (grids, interconnectors) within a unified agent-based framework. Managing computational load will require abstraction and cloud scaling strategies. External influences—such as interconnectors or fuel tariffs—will be modelled as adjustable agents or parameters.

## Work Package 5 – Risk Assessment and Mitigation Solutions

This Work Package will identify key risks based on lessons learned from Work Package 1 and the development activities across Work Packages 2–4. The scoped risk areas include (1) modelling and development risks and (2) data risks. It will also explore solutions to mitigate these risks by trialling alternative approaches, engaging with relevant NESO teams and industry experts, and applying different data processing methods.

## Work Package 6 – Proof of Concept (PoC)

This Work Package will develop a small scale prototype that models a representative cross section of the electricity and gas markets. The entities included will span conventional market actors, financial and regulatory stakeholders, service providers, and infrastructure participants. This prototype will simulate realistic transaction flows and interactions within a manageable and testable scope. An agent based modelling framework, combined with a limited number of time steps based on synthetic demand and price data, will be applied to this prototype.

The validation metrics—including energy balance, internal price consistency, and reasonable variations in consumer bills across scenarios are also identified and selected to validate the prototype. Outputs will be cross checked against historical events and reviewed by subject matter experts. The validation process will assess the coherence of interactions between agents and evaluate whether the prototype supports parameter swapping to ensure adaptability to future market structures.

The whole prototype development process will strictly adhere to NESO's DD&T and security guidance. Sensitive data will be handled securely, with synthetic or anonymised datasets used throughout development.

## Work Packages 7 – Final Reporting

The above Work Packages will be consolidated and incorporated into a NESO branded report. The report will include the detailed methodologies approved by NESO, as well as the outcomes of the PoC, feasibility considerations and recommendations, and key insights generated throughout the project.

Cumulative ENIP Risk Score: 5 (Low)

In line with the ENIP document, the risk rating is scored 5

TRL Steps = (2 TRL Steps)

Cost = 1 (£630,000)

Suppliers = 1 (1 supplier)

Data Assumptions = 1

Total = 5 LOW

## Scope

The project includes the following five scope areas:

Scope Item 1: To review existing commercially available energy market mapping, consumer bill tools and system dynamic modelling tools in the GB and world-wide energy market.

Scope Item 2: To investigate the following three points in both electricity and gas market:

- 1) key entities that should be in the transaction flow
- 2) methods to modelling the detailed interactions among the captured entities in the transaction flow
- 3) the adaptability of these methods to future market reforms and policy changes, including associated limitations.

Scope Item 3: To investigate suitable methodology to integrate outcomes in scope 2 from electricity and gas markets to form a whole energy market model.

Scope Item 4: To investigate the implementation strategy and develop an understanding of the potential risks associated with implementation based on the interactions with various NESO teams (e.g., System Operations, DD&T Architecture, Cloud, Security

etc). Additionally, it expects the supplier to collaborate closely with relevant NESO teams to examine and recommend feasible measures to mitigate identified implementation risks.

Scope Item 5: To develop a small-scale prototype that demonstrates the functionality and validity of the proposed modelling methods of scope 2 and 3. The prototype should showcase how it can meet operational requirements by relevant NESO teams. Additionally, it is expected to explore and recommend necessary updates and changes for scaling up this small-scale prototype to the expected operational level through close collaboration with these NESO teams.

Out of Scope of this project:

- A full developed model that can accommodate a large set of entities as input and demonstrate the complex interactions between them.
- A full developed model to support other NESO existing tools in generating outputs as evidence.
- Generated output under specific policy scenarios to be used as evidence supporting NESO's policy recommendations.
- A fully integrated NESO system model.

## Objective(s)

Understand what already exists by reviewing current consumer bill models and whole systems modelling approaches used in GB and internationally.

Identify the key entities involved in the flow of transactions across the electricity and gas markets, and understand how their actions and behaviours interact.

Develop clear methods for representing these entities and their interactions in both markets in a simple, structured and explainable way.

Explore how the electricity and gas insights can be brought together to form an early whole energy market view that reflects how the two markets influence each other.

Test whether the approach can work in practice by creating a small scale proof of concept to demonstrate and validate the modelling methods.

Improve understanding of how different market actions could affect consumers by illustrating how changes across the whole energy market may impact consumer bills.

## Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

N/A

## Success Criteria

The project can be considered successful if each deliverable within the defined work package meets the agreed success criteria, as reviewed and approved by the steering group members.

## Clear and Well Justified Methodologies

The project must produce clear, evidence based methodologies for identifying key entities and modelling interactions in the electricity and gas markets. The rationale for each modelling choice must be well explained and supported by findings from the literature review.

## Comprehensive Review and Insightful Analysis

The literature review should provide a thorough overview of existing consumer bill and system modelling tools, with clear analysis of their applicability, strengths and limitations. The output must give a strong foundation for developing the project's methodologies.

## Coherent Whole Energy Market Framework

The project must demonstrate how the electricity and gas methodologies can be combined into a consistent whole energy market model framework, with clear explanation of the conceptual connections between the two markets.

## Feasibility Demonstrated Through a Proof of Concept (PoC)

The small scale PoC must show that the proposed modelling approaches function effectively at a limited scale. It should validate key

assumptions and demonstrate the potential for wider development of the model.

## Clear Learning and New Insights

The project must generate new understanding of how transaction flows operate across the whole energy market and how market actions and behaviours may affect consumers. These insights must be clearly explained and accessible to a broad audience.

## High Quality Final Report

The final report must be well structured, clear and complete. It should summarise all methodologies, findings, and PoC outcomes in a way that supports NESO's future decision making and provides robust learning for internal and external stakeholders.

## Project Partners and External Funding

Supplier Engage Consulting

Project duration - 12 months.

## Potential for New Learning

The following expected knowledge the project aims to contribute to the wider industry along with the project development and the expected outcomes:

- The method to select the key entities in both electricity and gas market, and identification of those key entities in the current market arrangement.
- The method for modelling transaction flows and interactions among the key entities in both the electricity and gas markets.
- The method for integrating previously developed individual transaction flow models for electricity and gas markets into a new, unified whole-energy market model.
- A small-scale prototype model to demonstrate how the developed theoretical methods are applied in practice.
- Develop a strong knowledge base of how transaction flows from consumer bills via key entities to final recipients in electricity, gas and potential future unified whole energy markets.
- Develop a sound understanding of how interactions between key entities could alter transaction flows and affect consumer bills under specific market arrangements and policy options.

All outcome reports from each work package will be made accessible and published on the ENA website.

Additionally, we will host a public workshop to share key findings and learning outcomes with a wider audience, including academics, NESO strategic partners and stakeholders, as well as other interested parties).

## Scale of Project

This project will be delivered in 7 work packages, following an agile approach over 12 months and will require industrial and partner engagement throughout.

## Technology Readiness at Start

TRL1 Basic Principles

## Technology Readiness at End

TRL3 Proof of Concept

## Geographical Area

This project is being delivered by UK based suppliers and funding by NESO, it therefore has a geographical scope of Great Britain.

## Revenue Allowed for the RIIO Settlement

None

## Indicative Total NIA Project Expenditure

The total project cost is £630,000

## 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:

The outcomes of this project will help NESO and the wider industry understand how NESO's actions and future policy options can influence transaction flows in the whole energy market and impact consumer bills. With this understanding, NESO will be better positioned to take well-informed actions, propose system-wide beneficial policy options, and effectively engage with stakeholders across the industry to ensure a secure, sustainable, and affordable 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

#### Please provide a calculation of the expected benefits the Solution

The following benefits are expected to be achieved upon successful completion of the project:

- **Capability:** visibility of the entire transaction flow and the interrelationship between entities in the whole energy market.
- **Consumer value impact and empower decision-making:** the developed model allows NESO teams to understand and visualise how actions and policy suggestions could impact consumers.
- **Adaptability:** The developed model is both adaptable and responsive, ensuring that it can continue to provide valid results by allowing for adjustments to inputs under future market design options.
- **Efficiency gains:** This model can better support NESO in visualising and analysing the potential effects of various policies on consumer bills

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

As this model captures the impact on representative consumer archetypes through interactions between key entities, the modelling approach can be replicated at a regional level to explore transaction flow impacts on specific consumer types within a given region. The model builds upon the EMTM project but is adapted to assess bill impacts at both regional and consumer-archetype levels, based on interactions between key entities.

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

As this project is a research and proof of concept exercise, it does not involve any physical deployment or installation. Therefore, no GB-wide rollout costs apply at this stage.

Any future rollout would depend on the outcomes of this project, the level of refinement required beyond the PoC, and decisions on how

a full model might be developed, maintained or integrated in future phases.

At present, the costs of rolling out the Method across GB cannot be estimated. This is consistent with early stage research projects where the Method is still being defined and tested.

### 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

The outcomes of this project will help NESO deepen its understanding of how intended actions and policy suggestions could impact consumer bills. This enhanced knowledge will enable NESO to take well-informed actions, develop robust policy recommendations, and effectively engage with stakeholders to better fulfil its consumer-centric and other duties outlined in the Energy Act 2023.

#### 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

#### 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.

This project does not duplicate any existing or ongoing work. A review of current NESO activities and wider GB innovation projects

confirms that no equivalent modelling approach or whole energy market transaction flow framework currently exists. Existing tools focus either on system operation, technical modelling, or consumer bill methodologies in isolation, and none provide a combined view of electricity and gas markets or map interactions between key entities across the whole energy market.

The project therefore fills a clear knowledge gap by developing new methodologies and a proof of concept to explore whole market transaction flows. This ensures that the work adds new learning rather than replicating existing tools or research.

### **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**

Based on the preliminary desktop research, we have found no existing model offers visualisation of transaction flow from a whole energy system perspective across current and future electricity and gas market. The proposed project is first of its kind in GB energy market.

Additionally, the project aims to bring different priorities and views from across NESO together and provide a single model that can be used by different parts of the organisation. While many teams within NESO develop bespoke models tailored to their specific needs, an innovative consumer impact model that offers a unified understanding—and delivers benefits beyond those of individual, business-as-usual models—would be a valuable asset.

### **Relevant Foreground IPR**

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

### **Data Access Details**

All data generated or used within the EMTM project will be stored in a secured NESO SharePoint workplace dedicated to this project. NESO will provide access to Engage Consulting to review and download data.

Other interested third parties may request access to project data through NESO's standard external data-sharing request process, align with the RIIO-2 NIA Governance Document requirements.

A detailed Data and Resource List has been created internally for the project and will continue to be updated as the project develops. This list will support NESO in reviewing data requests and determining what can be shared externally.

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

The outcomes of this project aim to enhance NESO's knowledge of how our actions and policy suggestions could impact consumers - creating new knowledge. Additionally, some of the involved modelling work in this project, such as modelling dynamic interactions between entities, is highly complex and may present significant development challenges. As a result, there is a possibility that certain modelling components may not be delivered as initially expected. Therefore, the project is more suitable for innovation pathway rather than business-as-usual activities. The knowledge and experience derived from this project will be eventually made publicly available to be shared across NESO teams and interested industry parties via innovation project 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**

This project requires support through NIA because it carries a level of uncertainty and exploratory risk that cannot be justified under business as usual funding. The work seeks to develop a novel whole energy market modelling approach, and it is unknown whether the proposed methodologies can be designed, validated or combined into a coherent framework. This presents clear technical risks, as the interactions and behaviours across electricity and gas markets have not previously been modelled in this way. There are also commercial risks, as the potential value, scalability and future applicability of the concept cannot be confirmed until feasibility is demonstrated. Given these uncertainties and the project's focus on generating new knowledge, NIA is the appropriate and necessary funding route.

**This project has been approved by a senior member of staff**

Yes