NIA Project Registration and PEA Document

Date of Submission:

*Notes on Completion: Please refer to the NIA Governance Document to assist in the completion of this form. Please use the default font (Calibri font size 10) in your submission. Please ensure all content is contained within the boundaries of the text areas. The full-completed submission should not exceed 10/12 pages in total.*

1. Project Registration

|  |  |  |
| --- | --- | --- |
| Project Title (*This cannot be changed once registered*) |  | Project Reference |
| 3MD (Market Monitoring Model Development) |  | NIA2\_NGESO025 |
| Funding Licensee(s) |  | Project Start Date |
| National Grid ESO |  | November 2022 |
| Nominated Project Contact(s) |  | Project Duration |
| Caroline Rose-Newport |  | 12 months |
| Contact Email Address |  | Project Budget |
| [innovation@nationalgrideso.com](mailto:innovation@nationalgrideso.com) |  | £250,000 |

**Project Summary (125 words limit)**

NGESO are required by our License and by the REMIT regulation (EU Regulation on wholesale Energy Market Integrity and Transparency) to monitor the market for suspicious activity relating to manipulation, insider trading, breach of Grid Code etc. Our current, manual, processes are not infinitely scalable or transferable as the market grows so greater automation and sophistication is required.

The development of a more sophisticated, Machine Learning (ML) based solution will be investigated to increase the efficiency of team activities and be scalable to new products and increasing market participant numbers.

**Lead Sector**

|  |  |
| --- | --- |
| Electricity Distribution | Gas Distribution |
| Electricity Transmission  x | Gas Transmission |

**Other Sectors**

|  |  |
| --- | --- |
| Electricity Distribution  x | Gas Distribution |
| Electricity Transmission | Gas Transmission |

**Research Area**

|  |  |
| --- | --- |
| Net zero and the energy system transition | Optimised assets and practices  X |
| Flexibility and Commercial Evolution  X | Whole Energy System |
| Consumer Vulnerability | Energy System Transition |

**Development steps**

|  |  |
| --- | --- |
| Technology Readiness Level (TRL) at Start  6 | TRL at Completion  8 |

1. Project Details
   1. Problem(s)

This should outline the Problem(s) which is/are being addressed by the Project. This cannot be changed once registered.

NGESO are required by our License and by the REMIT regulation to monitor the market for suspicious activity relating to manipulation, insider trading, breach of Grid Code etc. This is a new role for the ESO and, at present, we are limited in the number of parameters we can feasibly monitor using manual investigation techniques which are not infinitely scalable, or transferable, as the market grows. Therefore, greater automation and sophistication is required.

* 1. Method(s)

This section should set out the Method or Methods that will be used in order to provide a Solution to the Problem. The type of Method should be identified where possible, eg technical or commercial.

For RIIO-2 projects, apart from projects involving specific novel commercial arrangement(s), this section should also include a Measurement Quality Statement and Data Quality Statement.

This project will investigate whether ML will allow for the consideration of uncertain variables that cannot currently be factored into analytical techniques. It will investigate the development of statistical models which identify anomalous pricing and positioning strategies in relation to constraint data.

5 work packages have been defined. These will cover:

* + - WP1: Exploratory data analysis of National Economic Database (NED) data files
    - WP2: Detect securing of artificial price
    - WP3: Detect false physical notifications
    - WP4: Detect constraint-related manipulation
    - WP5: (Dependant on Successful Outcomes) Prototype integration

In line with the ENA’s ENIP document, the risk rating is scored Low.

TRL Steps = 1 (2 TRL steps)

Cost = 1 (£250k)

Suppliers = 1 (1 supplier)

Data Assumptions = 2

Total = 5 (Low)

* 1. Scope

The scope and objectives of the Project should be clearly defined including the net benefits for consumers (eg financial, environmental, etc). This section should also detail the financial benefits which would directly accrue to the GB Gas Transportation System and/or electricity transmission or distribution.

Whilst ML and hidden variable models are used across multiple innovation projects for different purposes and also in other industries and organisations outside of the ESO, they have not been applied in a utility for a similar purpose.

Learnings will be shared within the ESO where applicable, however this will be a non-default innovation project and, as such, detailed findings and models will not be shared externally.

Ultimately, knowledge of enhanced monitoring capabilities being used, may encourage market participants to better consider REMIT and Grid Code requirements as they develop new trading strategies and support the market monitoring team in working with trading parties to reduce instances of potential breaches. This may reduce costs to consumers through a reduction in incidents of prices that do not directly result from normal market supply and demand interactions. It will also enable detection of changes in pricing or positioning in response to the management of system conditions, reducing the risk for exploitation of dominant market positions where they arise because of geographic or technological monopolies.

* 1. Objectives

This cannot be changed once registered.

1. Develop methods for out-of-characteristic market prices, physical positions in response to system operability issues such as constraints by applying statistical techniques to identify potential market abuse.
2. Develop methods for detecting and characterising anomalies.
3. Enhance current manual investigative techniques by using multiple new data sources to generate alerts. This will enable detection of cross market events and ensure alerts better consider market externalities, reducing false positives compared with current monitoring systems.
4. Enable models of pricing and positioning to be developed that are individual to Balancing Mechanism Units (BMUs) which each have different economic drivers and therefore will behave differently given the same set of system and external conditions.
   1. Consumer Vulnerability Impact Assessment (RIIO-2 projects only)

Details of the expected effects of the Method(s) and Solution(s) upon consumers in vulnerable situations. This must include an assessment of distributional impacts (technical, financial and wellbeing-related). For RIIO-1 projects please add “Not Applicable”

The ESO does not have a direct connection to consumers, and therefore is unable to differentiate the impact on consumers and those in vulnerable situations. Benefits to all consumers are detailed below.

This project has been assessed as having a neutral impact on customers in vulnerable situations because it is a transmission project.  

* 1. Success Criteria

Details of how the Funding Licensee will evaluate whether the Project has been successful. This cannot be changed once registered.

The project will be successful if it improves potential REMIT breach detection and provides contextual information regarding pricing and positioning this will be tested through:

1. 90%+ effectiveness at detecting known anomalies within historic datasets
2. An input/output method that enables live system data to be assessed in this way
3. A low level on the number of false positive investigations to review

* 1. Project Partners and External Funding

Details of actual or potential Project Partners and external funding support as appropriate.

Project partner: UKRI, no external funding contribution

* 1. Potential for New Learning

Details of what the parties expect to learn and how the learning will be disseminated.

Through analysis of the statistical properties of the ESO’s Economic Database and the development of new methods for detecting and characterising anomalies, the ESO’s current investigative techniques will be enhanced significantly. Models which are individual to BMUs based upon historic market activity will reduce any sized based bias that may come about through standard threshold or rule-based detection and may better characterise availability and pricing of units for given system conditions that could be applied to other business activities.

This is a non-default innovation project and, as such, detailed findings and models will not be shared externally.

* 1. Scale of Project

The Funding Licensee should justify the scale of the Project – including the scale of the investment relative to the potential benefits. In particular, it should explain why there would be less potential for new learning if the Project were of a smaller scale.

This project will span 12 months and consist of desk-based research.

* 1. Geographical Area

Details of where the Project will take place. If the Project is a collaboration, the Funding Licensee area(s) in which the Project will take place should be identified.

This project will cover the whole of the GB network.

* 1. Revenue allowed for in the current RIIO settlement

An indication of the funding provided to the network licensee within the current RIIO settlement that is likely to be surplus to requirements as a result of the Project.

None

* 1. Indicative Total NIA Project Expenditure

An indication of the total Allowable NIA Expenditure that the Funding Licensee expects to reclaim for the whole of the Project (RIIO1).

An indication of the Total NIA Expenditure that the Funding Licensee expects to reclaim for the whole of the Project (RIIO2).

Total: £250k

1. Project Eligibility Assessment

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).

* 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:

* + 1. How the Project has the potential to facilitate the energy system transition:

By incorporating more datasets, including the interaction between different marketplaces, detection of cross market mechanisms to manipulate ENCC (Electricity National Control Centre) decision making will be more readily identifiable. This may encourage more timely notification of changes in operating profiles and prices to the ENCC, making the plan more secure and reducing decision making pressure.

Furthermore, by applying machine learning techniques, anomaly detection can be individualised to the resource economics, size, and technology types, enabling market monitoring to identify anomalies across new technology types, and better support all market participants in improving compliance with market rules, without unintentional bias to larger BM Units that may result from standard rules-based alerting. This will become more important as the energy system has greater participation from small energy providers in the energy transition.

* + 1. How the Project has potential to benefit consumer in vulnerable situations:

Principle benefits to the end consumer (including consumer in vulnerable situations) will be through challenge of generator pricing whereby a change in behaviour may be adopted and lower costs may be observed through the BM. These cost savings will be indirect and are not readily quantifiable. Realising them will depend upon ESO activity post identification.

Secondary benefits to the end consumer will be intervention by Ofgem following a case of market manipulation which is progressed through to settlement or fine levy issued in court. There is a high probability that a well-functioning detection tool might identify at least one significant issue that may be progressed through to a REMIT decision.

* 1. 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.

* + 1. Please provide an estimate of the saving if the Problem is solved (RIIO-1 projects only)

* + 1. Please provide a calculation of the expected benefits the Solution

This is for Development or Demonstration Projects, not required for Research Projects. It should be (Base Cost – Method Cost, Against Agreed Baseline) and include a description of the recipients of the benefits.

Knowledge of enhanced monitoring capabilities being used, may encourage market participants to better consider REMIT and Grid Code requirements as they develop new trading strategies. This may reduce costs to consumers through a reduction in incidents of prices that do not directly result from normal market supply and demand interactions. It will also enable detection of changes in pricing or positioning in response to the management of system conditions, reducing the risk for exploitation of dominant market positions where they arise because of geographic or technological monopolies.

As the approach will detect anomalous behaviour rather than specific identified risk factors it will ensure the monitoring function remains responsive to changes in market rules and new trading strategies. This would allow for faster identification of new problems and resolution with providers ahead of escalation through to a formal investigation where appropriate.

Should an issue be escalated, the maximum fine issued to date has been £37m and this compensation is provided back to consumers. There is a high probability that a well-functioning detection tool might identify an issue that is progressed to a REMIT decision.

* + 1. Please provide an estimate of how replicable the Method is across GB

This must be in terms of the number of sites, the sort of site the Method could be applied to, or the percentage of the Network Licensees system where it could be rolled-out.

This will be a non-default project and therefore the models developed will not be shared with other networks for replication across GB. However ,if successful, the approach will be applied by the ESO to the GB electricity market.

* + 1. Please provide an outline of the costs of rolling out the Method across GB.

N/A

* 1. Requirement 3 / 1 – involve Research, Development or Demonstration
     1. RIIO-1 Projects

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 systems and 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 GB electricity transmission or distribution systems |  |
| A specific novel commercial arrangement |  |

* + 1. RIIO-2 Projects

A RIIO-2 Project must involve the Research, Development or Demonstration of at least one of the following:

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

* 1. Requirement 4 / 2a – develop new learning

A Project must develop new learning that can be applied by Gas Transporter and/or Electricity Transmission or Electricity Distribution licensees. For RIIO-1 Network Licensees may wish to address challenges specific to their network.

Please answer one of the following:

* + 1. Please explain how the learning that will be generated could be used by relevant Network Licenses

We are planning to share the following project results for 3MD (via a Completion Report on the Smarter Networks Portal):

* Learnings from the statistical/machine learning techniques can be disseminated to other network licensees.
* Outcomes of the project including a general discussion of functionality and detection capability can be shared alongside lessons learned from the process
* Discussion of applications for these techniques in other business areas (if identified through the workpacks) can also be shared

However, due to the obligations of REMIT as a PPAT (Persons Professionally Arranging Transactions), we will not be able to share any specific identified cases with anyone except OFGEM. We would also not be able to publish the full code or full data models developed due to ability to infer thresholds for detection or methods of avoiding detection

* + 1. Or, please describe what specific challenge identified in the Network Licensee’s innovation strategy is being addressed by the Project (RIIO-1 only)

* + 1. Is the default intellectual Property Rights (IPR) position being applied?

This cannot be changed once registered.

|  |  |
| --- | --- |
| Yes | No  X |

If “no”, the following questions must be answered:

* + - 1. Demonstrate how the learning from the Project can be successfully disseminated to Network Licensees and other interested parties:

This will be a non-default innovation project and therefore detailed learning will not be shared with network licences.

* + - 1. Describe ~~how~~ any potential constraints or costs caused, or resulting from, the imposed IPR arrangements:

There are no costs caused or resulting from the IPR arrangements

* + - 1. Justify why the proposed IPR arrangements provide value for money for customers:

Knowledge that enhanced monitoring capabilities are being employed may encourage market participants to price and position in accordance with REMIT rather than potentially utilising a position of dominance.

The work-packs are structured so that each data model identifies an increasingly complex form of market manipulation and builds on the existing data model. Each work pack delivers a standalone code block which has been trained on historic versions of available live (day + 1) data points, this means it is individually useful without a reliance on completion of the next phase. At each stage, progression to the following work package is conditional on achieving acceptable detection rates within each of the areas identified to a suitable degree through historic data sets.

The costs of developing, implementing and maintaining these detection methodologies are outweighed through prevention of even 1 case of unacceptable pricing or positioning on large generators as these can become significant balancing costs which are then passed on to consumers. Furthermore, given that the project proposal enables significant additional volumes of data to be considered, this will reduce FTE time required to evaluate each incident as compared with traditional methods.

* 1. Requirement 5 / 2c – be innovative

A Project must be innovative (ie not a business as usual activity) and have an unproven business case entailing a degree of risk warranting a limited Research, Development or Demonstration Project to demonstrate its effectiveness. This could include Projects which are untested at scale, or in relation to which there are risks, which might prevent the widespread deployment of the equipment, technology or methodology.

* + 1. Why is the project innovative?

RIIO-1 projects must include description of why they have not been tried before.

GB has never used sophisticated ML and hidden variable models for a similar application.

As the approach will detect anomalous behaviour rather than specific identified risk factors it will ensure the monitoring function remains responsive to changes in market rules and new trading strategies, this would allow for faster identification of new problems and resolution with providers ahead of escalation through to a formal investigation where appropriate. This represents a step change from the current process of identifying a risk and then setting up alerting for that issue which limits the team to known risks and to issues that may already require escalation.

* + 1. Why is the Network Licensee not funding the Project as part of its business as usual activities?

Until the initial analysis is undertaken, it is unclear what will be discovered from the data sets.

It is possible that the data analysis techniques do not work for the specific data sets available or that some data sets cannot be used, and it is possible that the identified anomalies do not fit the strict REMIT requirements against which the ESO reports.

* + 1. Why can the Project can only be undertaken with the support of NIA?

This must include a description of the specific risks (e.g. commercial, technical, operational or regulatory) associated with the Project.

This work will be exploratory based upon many data sets with uncertain outputs. Whilst it has the potential to dramatically improve detection of incidents and overall performance it is beyond the core requirements to comply with licence conditions. As a result of the numerous potential datasets, there is no clear design or path to delivery until key questions are answered and a Proof of Concept (PoC) is developed.

* 1. Requirement 6 / 2d – 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.

* + 1. Please demonstrate below that no unnecessary duplication will occur as a result of the Project.

This is a new, unique, role for the ESO in the GB market. Although ML techniques are being developed and utilised elsewhere in the ESO, and in other industries, this approach has not been investigated or implemented in a similar situation within the ESO or the GB market to date.

There is no other function in the GB market specifically reviewing ESO facilitated markets for potential market manipulation so there will be no duplicate learning generated.

* + 1. If applicable, justify why you are undertaking a Project similar to those being carried out by any other Network Licensees.

1. PEA approval

The senior person (RIIO-1) or senior network manager (RIIO-2) responsible for implementing RIIO-2 NIA Projects must approve the PEA. It must then be published on the Project Registration page of the Smarter Networks Portal.

|  |  |
| --- | --- |
| **Please confirm this project has been approved by a senior member of staff** |  |