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

Oct 2023

Project Reference Number

NIA2_NGESO058

Project Registration

Project Title

InterCast

Project Reference Number

NIA2_NGESO058

Project Licensee(s)

National Energy System Operator

Project Start

October 2023

Project Duration

0 years and 3 months

Nominated Project Contact(s)

Sara Alizadeh , Joseph Harwood

Project Budget

£50,000.00

Summary

Currently, the ESO produce a forecast of hourly interconnector flow at a lead time of day ahead to 1 week ahead. This forecast is based on the expected difference between electricity prices of the two interconnected countries.

To forecast the hourly electricity price in each country, the ESO have acquired future market price data for the peak and baseload periods from external data sources. This is transformed to hourly prices using a technique based on similar historical days. However, this method does not produce the level of accuracy required for a key input into the ESO interconnector flow model, published externally. This project therefore seeks to produce an improved method of converting future market prices data into a forecast of hourly electricity prices.

Third Party Collaborators

Faculty Science Ltd

Nominated Contact Email Address(es)

box.so.innovation@nationalgrid.com

Problem Being Solved

To forecast key metrics relating to the electricity system, such as system margins, level of inertia and response requirement, an

accurate forecast of interconnector flows is required. At present the ESO produces a forecast of the flows on the North Sea Link interconnector at an hourly resolution with a lead time of up to 7 days. This forecast is based on the expected difference between electricity prices of the two countries which is derived from future market price data. However, this method does not produce the level of accuracy required for the flows on the North Sea Link interconnector. This project seeks to improve the methodology by which the ESO forecasts price differentials between GB and Norway at a lead time of day ahead to week ahead.

Method(s)

At present, future market price data for Norway and Great Britain is transformed to an hourly time series of future prices using a technique based on similar historical days. This project will focus on:

1. Examine current methodologies and data including:
How does the ESO currently predict price at an hourly level and where are the biggest challenges with the approach. How accurate are predicted prices? Determine what, if any, relationships exist between previous and future hourly prices.

2. Assess alternative techniques with two possible options:
Compare different similarity scoring techniques to isolate previous hourly price/forecasted price combinations that are most predictive of future hourly price spread. Examine using other methods such as time series forecasting with historical hourly price data and potentially other factors. In each case, examine whether such predictions can be improved by including other data such as weather or calendar data or national demand forecast.

3. Build out Proof of Concept (PoC):
Create a PoC model to assign forecasted peak price to hourly intervals based on most promising strategy identified in previous phase. The PoC will be for one country in the first instance but with a stretch goal to examine other countries. Validate model performance compared to baseline models and currently used approaches. Assess model performance under different conditions (e.g., summer vs winter, peak vs trough demand).

4. Ensure full handover of PoC and related documentation:
Fully document all work in data processing and exploration as well as model training and validation.

In line with the ENA's ENIP document, the risk rating is scored Low.
TRL Steps = 1 (2 TRL steps)
Cost = 1 (£50k)
Suppliers = 1 (1 supplier)
Data Assumptions = 2
Total = 5 (Low)

Scope

This project will focus on forecasting the North Sea Link interconnector (NSL), however the learnings and methods generated can be applied to models for the other interconnectors. NSL has been selected as the focus of this project as the ESO currently does not have a model to forecast the hourly Norwegian electricity prices. The project will focus on 3 main work packages and a final deliverable.

- An examination of current methodologies and data
- An assessment of alternative techniques comparing 2 scoring techniques
- Build a PoC model
- Deliver a PoC and related documentation

Objective(s)

- Improve understanding of the relationship between future market price data and in-day prices.
- Develop a PoC model in notebook form for predicting price at hourly level based on the future market price data.
- Develop a report on model validation, performance against current methodology and potential next steps, including applying the learning to the other interconnectors.

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

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.

Success Criteria

The project can be deemed successful if:

- The new interconnector model delivers higher accuracy forecast in comparison to the existing NGESO model.
- The new interconnector model provides higher granularity output of GB Norway price spreads (target is hourly) than the existing ESO model.
- The improved model is deployable in a way which meets the ESO's business needs (e.g., ease of use, run time, practicality, cost).
- The ESO will have an improved forecast of interconnector flows at a lead time of day ahead. An improved forecast will be defined based on a comparison of forecast error (forecast price against actual price) relative to the current ESO forecast model.

Project Partners and External Funding

Faculty AI, no external funding.

Potential for New Learning

This project offers the opportunity to learn, and apply, new state-of-the-art data science methods to the new problem of electricity price forecasting.

Scale of Project

This is a 6-week project focussing on one interconnector which is aiming to apply well established, complex data science techniques to a new problem.

Technology Readiness at Start

TRL2 Invention and Research

Technology Readiness at End

TRL3 Proof of Concept

Geographical Area

The scope of the project will cover the whole GB system.

Revenue Allowed for the RIIO Settlement

None

Indicative Total NIA Project Expenditure

£50,000

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:

One method to mitigate the variability of weather dependent electricity sources (wind, solar PV) is increased connection with neighbouring countries. This project aims to reduce the uncertainty associated with interconnector flow.

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

Due to the low TRL of this research, it would not be appropriate to provide a calculation of the expected benefits. However, it is expected that improving the accuracy of interconnectors forecast flow would increase the confidence of the Electricity National Control Centre (ENCC) in reserve products, hence supporting a reduction in balancing costs and the costs to consumers. With over £3 billion being spent per year on balancing, even small changes to balancing actions as a results of better Interconnector forecasting could have significant financial savings.

An improved forecast of interconnector flows could be included in a number of processes within the ESO, leading to more efficient, cost-effective decision making.

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

This project focuses on the relationship between electricity prices in GB and Norway. However, the learnings from this project can be applied to all other interconnected countries.

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

This is a research project and as such the cost of rolling out these methods across GB will not be known at this stage. The output of this project will help inform future market reform decisions and therefore cost calculations.

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

Interconnector flow impacts the operations of a range of electricity system participants. The learnings from this project can be incorporated into their forecast products.

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.

We are not aware of any other publicly available price spread models that would be suitable for the ESO to use, and no other innovation projects have addressed this problem.

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

N/A

Additional Governance And Document Upload

Please identify why the project is innovative and has not been tried before

This project is innovative because it applies cutting-edge techniques in time-series modelling to the new problem of electricity price forecasting.

Relevant Foreground IPR

A report detailing the techniques applied, performance of the models, the methodology developed and the learnings of the project.

This will be published on the Smarter Networks Portal on completion of the project.

Data Access Details

Data for this project and all other projects funded under the Network Innovation Allowance (NIA), Network Innovation Competition (NIC) or the 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 Grid ESO 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.nationalgrideso.com/future-energy/innovation
3. Via our managed mailbox innovation@nationalgrideso.com

Details on the terms on which such data will be made available by National Grid ESO can be found in our publicly available "Data sharing policy relating to NIC/NIA projects" at https://www.nationalgrideso.com/document/168191/download.

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

The ESO have already dedicated time and resource to this challenge, and it is now believed that new innovative thinking from a data science specialist is required. Fundamentally this is a research-based project and as such there are risks that following detailed data examination, the objectives cannot be met.

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

- Due to the low TRL, there are a number of risks associated with this project.
- There is a risk that there is limited benefit of using the new model and methodology if the project finds it is not possible to improve upon the existing model.
- There is also a risk that there is difficulty with incorporating the new model into internal operation (everyday business). Productionising the model will be dependent on internal IT.

This project has been approved by a senior member of staff

☑ Yes