

NIA Project Registration and PEA Document

Date of Submission

Feb 2023

Project Reference Number

NIA2_NGESO032

Project Registration

Project Title

Course-correction Dispatch Instructor

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NIA2_NGESO032

Project Licensee(s)

National Grid Electricity System Operator

Project Start

February 2023

Project Duration

1 year and 2 months

Nominated Project Contact(s)

Colin Webb

Project Budget

£1,700,000.00

Summary

The Electricity National Control Centre's (ENCC) current approach of manual instructions is limiting the number of units that can be instructed in real-time operation of the GB electricity system. With an increasing number of units to dispatch across multiple services, this approach is not sustainable for future economic and reliable operation of the system. The project will deliver a proof-of-concept decision-support tool to the ENCC, aiming to release operators of manual tasks and enabling them to focus on validating results and ensuring timely decisions are made. While control room decisions within-day span operational planning, scheduling and dispatch, the project will first focus on course-correction for dispatch decision-support problems. The tool will be developed and tested using advanced optimisation techniques and data-driven approaches, including development and implementation of a mathematical model, demonstrating the model performance on selected real-world data examples.

Nominated Contact Email Address(es)

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Problem Being Solved

Balancing the electricity system involves planning, procurement of services, scheduling, and dispatch across several instruments. Currently, manual instruction of units by control room engineers limits the number of units that can be instructing in real-time operation of the GB electricity system. While instructions are informed by modelling, the decision-making in the control room is largely based on the judgement of highly skilled control room engineers. With an increasing number of units to dispatch across several services, this approach is not sustainable for future economic and reliable operation of the system. The ENCC needs decision-support algorithms that are scalable, reliable and can provide economic and explainable decision-support.

Method(s)

Phase 1 of this project aims to use advanced optimisation techniques and data-driven approaches to develop course-correction models for dispatch decision-support problems, creating scenarios to test scalability of developed methods. The development and

testing of models will be desktop-based research delivered in a single work package across 14 months, consisting of the following tasks:

- Task 1.1 – Identification of the main components of course-correction
- Task 1.2 – Determining a method to select a small set of units for instruction
- Task 1.3 – Implementation of the course-correction tool
- Task 1.4 – Credible operational scenarios for testing, including data needs for scalability test of the method
- Task 1.5 – Pilot testing of the approach

Following completion of the first phase, this project will then consider scoping the following work packages in more detail for phase 2:

- WP2: Short-term dispatch (within 90mins)
- WP3: Long-term dispatch (90mins – 4hrs)
- WP4: Explanation of optimisation advice tool

The project will cover workshops with the ESO Balancing Programme throughout, and a dissemination event including key industry stakeholders identified.

In line with the ENA's ENIP document, the risk rating is scored Low:

- TRL Steps = 1 (1 TRL steps)
- Cost = 3 (>£1mk)
- Suppliers = 1 (1 supplier)
- Data Assumptions = 1
- Total = 6 (Low)

Scope

This project aims to discover, develop, and test a world first course-correction methodology to balance an electricity system. The project will deliver proof-of-concept (PoC) capabilities for course correction dispatch decision support, aiming to release operators of manual tasks and ensure timely decisions are made for economic and reliable operation of the system. The PoC tool will be developed and tested using advanced optimisation techniques and data-driven approaches, including development and implementation of a mathematical model, demonstrating the model performance on selected real-world data examples.

Following successful delivery of the course-correction methodology and PoC, this project will then explore further dispatch support tools covering short-term and long-term energy dispatch, as well as further work to provide explainable solutions within the advice tools developed.

Objective(s)

- Identify the main components of course correction
- Define a method to select a small set of units for instruction
- Develop a PoC course correction tool and demonstrate the method on selected examples identified
- Define data needs to test the scalability of the course correction method, including scenarios with a larger number of balancing units
- Refine the PoC tool and complete performance tests of the developed course correction methodology

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

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

Success Criteria

The following will be considered when assessing whether the project is successful:

1. The project delivers against objectives, timescales and budgets as defined in the proposal
2. PoC tool for dispatch decision-support developed using mathematical models
3. Course correction methodology and scalability successfully demonstrated using real world data examples
4. Clear roadmap for development to achieve an operational tool in the control room, and the development of further tools for short-term and long-term dispatch.

Project Partners and External Funding

University of Strathclyde, no external funding.

Additional partners may be required if phase 2 is progressed following completion of phase 1.

Potential for New Learning

This project aims to develop and test a world first course correction methodology to balance an electricity system. The tool delivered will be a key enabler towards future automation of dispatch actions, and for operating a zero-carbon electricity system, releasing ENCC operators of manual tasks and ensuring that timely decisions are made for economic and reliable operation of the system.

Dissemination of the learnings from the project will include a dissemination event to demonstrate the course correction tool and outcomes and recommendations from the project. Project reports and updates will be shared via the Smarter Networks Portal.

Scale of Project

The research will be conducted over a 14-month period by the University of Strathclyde in close collaboration with ENCC control room engineers. This will involve articulation of requirements, development of methods to meet those requirements and stress testing of the methods on real world system data.

Following successful completion of phase 1, this project will then consider scoping phase 2 to complete the dispatch decision support timeline. The timescales of this will be confirmed upon completion of phase 1 but are expected to be a further 18-months to 2 years of work.

Technology Readiness at Start

TRL2 Invention and Research

Technology Readiness at End

TRL3 Proof of Concept

Geographical Area

The project will be based upon the GB ESO area of operations.

Revenue Allowed for the RIIO Settlement

None

Indicative Total NIA Project Expenditure

£1.7m (including phase 2)

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:

System balancing is performed by highly skilled control engineers within the ENCC, instructing units across the country to not only balance demand and generation, but also ensure that the system is secure against credible faults. As the number of balancing units continues to rapidly increase across multiple services, the current control room practices of manually instructing units are becoming more challenging to manage. This project will deliver a novel decision support tool for course correction dispatch, with the goal of releasing operators of manual tasks and enabling them to focus on validating results, ensuring timely decisions can be made for economic and reliable operation of the GB electricity system. The models delivered will also provide a step towards increased transparency of dispatch decisions made within the control room.

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

Not required as this is a research project

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

This project will develop a tool for course-correction of balancing units across the whole GB network.

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

At this stage the costs are unknown for rolling out foundation learning into further development.

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 course-correction dispatch methodology developed within this project will aim to provide economic and transparent decisions, including explainable reasons behind instructions made. The scalability of the method delivered could be used by other Networks to develop similar tools considering different scenarios. The reports and key learnings from the project, including methodology, scalability and testing results will be disseminated with relevant industry stakeholders following project completion.

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.

The Balancing Transformation programme at ESO is aimed at developing balancing capabilities that ENCC need to deliver reliable and secure operation, facilitate competition, and meet net-zero carbon operability. While there is an optimisation engine currently under development within BAU, there remains several dispatch challenges that need to be discovered, modelled, tested, and developed. Academic collaboration, including the work within this project, is essential to feed in specialist modelling and optimisation knowledge, facilitating future optimisation development for an ever-increasing number of units across the GB network.

The previous NIA project, NIA2-NGESO0013: Advanced Dispatch Optimisation (ADO), highlighted several gaps and areas for innovation within dispatch optimisation. The project detailed within this PEA document is to develop a Course Correction Dispatch Instructor, delivering cutting edge tools and methods and enabling NGESO development from current manual based operation to future optimisation and automated control.

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 aims to discover, develop, and test a world first course correction tool to balance an electricity system. There are several challenges associated with the modelling of dispatch optimisation problems and it requires specialist knowledge in both optimisation and power systems analysis. This project will develop solutions based on cutting-edge research in power system optimisation, developing a dispatch methodology based on mathematical modelling. The course-correction methods developed through this project are novel, and as with other research projects there is a risk of not meeting the expected targets. The proposed project plan therefore includes initial development considering a minimal set of requirements and a small number of units, this will then be tested and scaled as the project progresses to assess and develop the methodologies delivered.

Relevant Foreground IPR

The following Foreground IPR will be generated from the project:

- A proof-of-concept of the course correction method
- Report summarising the course correction method
- Report on the performance testing of the course correction model and insights to enhance performance
- Report, code, and test data on course correction methodology
- Further IPR to be delivered in subsequent project phases will be scoped upon completion of phase 1

Data Access Details

Data for this project and all other projects funded under the Network Innovation Allowance (NIA), Network Innovation Competition (NIC) or the new 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

Due to the nature of the project and the development of novel mathematical methodologies for dispatch decision-support and optimisation, this does not fall into current business as usual activities.

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 TRL of the overall framework is relatively low. Therefore, innovation funding is more suitable for exploring the project's potential and increasing the TRL through proof-of-concept prototype tools before transferring into subsequent development.
- Conducting this project with NIA funding will ensure that the project findings can be shared more widely with other interested Network Licensees.
- There are increased risks associated with developing the novel course-correction methodology which makes this project better suited to NIA.

This project has been approved by a senior member of staff

☒ Yes