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## NIA Project Registration and PEA Document

### Date of Submission

Jul 2023

### Project Reference Number

NIA2\_NGESO044

## Project Registration

### Project Title

Dispatch Optimiser Transformation (DOT)

### Project Reference Number

NIA2\_NGESO044

### Project Licensee(s)

National Grid Electricity System Operator

### Project Start

July 2023

### Project Duration

0 years and 6 months

### Nominated Project Contact(s)

Shaun Clohessy

### Project Budget

£750,000.00

## Summary

Great Britain's energy landscape is changing at an increasing rate, not only in terms of how energy is generated and distributed but also in how it is used by consumers. This increases the complexity for grid operators in forecasting power system conditions and in developing dispatch control strategies that can utilise more distributed intermittent renewable resources whilst retaining the reliability of supply required. Traditional dispatch tools and processes are becoming increasingly insufficient and cannot take advantage of the advancement of digital technologies such as Artificial Intelligence and Machine Learning. This project builds upon work undertaken in NIA2\_NGESO0013 Advance Dispatch Optimisation and will design a blueprint for transformation of control room tools and processes to meet the System Operator needs of the future.

### Nominated Contact Email Address(es)

box.so.innovation@nationalgrid.com

## Problem Being Solved

As the energy transition continues, more distributed intermittent renewable resources, many with integrated storage, will continue to be connected to the grid and more distributed technologies such as smart home controls and EV charging will continue to alter consumer behaviour. This trend will continue to create increasing uncertainty for grid operators in forecasting power system conditions, predicting which hours of the operating day will be most challenging and in developing dispatch control strategies to efficiently manage grid operations in a reliable manner.

As this uncertainty increases, traditional dispatch tools and processes will become increasingly insufficient and transformational revision of tools and processes is recommended. This project will build upon the feasibility study carried out in NIA2\_NGESO0013 Advance Dispatch Optimisation and produce a detailed gap analysis of potential future innovation projects required to enable the Advanced Dispatch Optimiser (ADO) to be built.

## Method(s)

This project brings together a team of experienced subject matter experts from the ESO and IBM, with significant technical experience in dispatch operations and ENCC systems, expertise in planning and delivering technical/IT work programmes and expertise in markets and associated reform work. They will work in close collaboration to deliver an end vision for the ADO programme with a detailed gap analysis and roadmap for how ADO will be built, whilst integrating with ESO's BAU systems and formalised business plan. A breakdown of the work packages is listed below:

### **WP1: Deep Dive: Adaptive Input Data Models**

**Aim:** The project will review and conduct a deep dive on the adaptive input data model groups defined in NIA2\_NGESO0013 Advance Dispatch Optimisation, these are:

1. Net Demand
2. Distributed Energy Resources (DER)
3. Transmission
4. Generation
5. Interconnectors

For each model the project will:

- Analyse what input data is needed to create and run the model.
- Identify what data currently exists, where it comes from, and investigate the feasibility of this data continuing to be source as it currently is.
- For data that doesn't exist, draft a specific plan to define how it could be created or sourced, and consider some mitigations for the eventuality that the data needed cannot be created or sourced.
- Consider possible transformations in a transformation model.
- Evaluate data quality and investigate how data uncertainty could be addressed.
- Understand and define what next steps would need to be taken to develop the adaptive models

### **WP1 Outputs**

- Data model report describing all five data models with the next level of detail regarding input, transformation, and output

### **WP2: Gap analysis of projects addressing ADO scope**

**Aim:** The project will analyse which project/initiatives the ESO has already launched or are part of Business Plan (BP) commitments, that address the end state of ADO described in NIA2\_NGESO0013 Advance Dispatch Optimisation. The goals are to:

- Undertake assessment of existing BAU systems
- Undertake assessment of BP commitments
- Identify gaps between BAU+BP and ADO vision that would still need to be resolved
- Challenge the suggested timeline and advise on which modules might be particularly challenging and should be trialled, e.g., as part of further Innovation as they need special attention
- Crosscheck updates in technology since the report for ADO was written
- Estimate order of magnitude of cost to complete gap filling work based on complexity of the capability

### **WP2 Outputs**

- Capability Framework with a clear view of the current status of each required capability
- Benefit analyses for each capability
- Requirements / technical capabilities backlog
- Detailed gap analysis report with sufficient detail to initiate procurement of identified activities

### **WP3: Conceptual Architecture**

**Aim:** The architecture should consider all relevant projects already running, that address ADO scope and consider the pieces of work still missing. Key questions:

- How do we connect the modules?
- How do we ensure the ability to plug modules in and out?
- Pros and cons of a distributed versus a centralised architecture approach
- How to achieve high security and high availability efficiently

## WP3 Outputs

- Architecture views detailing system context, data sources and interfaces, to best enable flexibility, security and availability

In line with the ENA's ENIP document, the risk rating is as follows:

- TRL Steps = 1 (2 TRL steps)
- Cost = 2 - £750k (£500k - £1m)
- Suppliers = 1 (1 suppliers)
- Data Assumptions = 2
- Total = 6 (Low)

## Scope

The project will last approximately six months with one project partner. IBM working alongside the ESO and Industry SMEs will develop the detailed data model report, gap analysis report, the iterative plan and architectural views.

## Objective(s)

The objectives are as follows:

- Utilising reports from the original ADO project and SME input to define clearly what ADO will build and how.
- Identify gaps in the planned infrastructure and suggest specific projects to address gaps.
- Identify wider factors or risks that could impact the delivery of the ADO vision and define mitigating actions.
- Develop an agile delivery plan that can be integrated with BAU and existing business plans.

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

- The Data Model report will be produced defining the type, source and quality of data required to be able to run the models.
- The gap analysis will identify the gaps in capability and provide sufficient detail to initiate activity to address missing capabilities.
- The iterative plan will be utilised as a blueprint for the ADO programme.
- Stakeholders across the ESO will have awareness of the approach to deliver ADO and be engaged in the project.
- The project delivers against objectives, timescales and budgets as defined in the proposal

## Project Partners and External Funding

IBM will be carrying out the work. No external funding is required.

## Potential for New Learning

The project will identify what input datasets are required to run the adaptive models, where this can be sourced now and in the future. The project will identify the most efficient sequence for building the optimiser components, and how best to connect the sub systems to enable flexibility, security and availability.

Finally, the project will identify what market rules need to be in place to best enable the use of the optimiser tool.

## Scale of Project

The project spans six months with one project partner. The project consists of extensive stakeholder engagement with ESO SMEs and consultation with Google X and OEMs.

## Technology Readiness at Start

## Technology Readiness at End

### **Geographical Area**

Project will be based upon the GB ESO area of operation

### **Revenue Allowed for the RIIO Settlement**

None

### **Indicative Total NIA Project Expenditure**

£750000

## 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 project is an enabler for the Dispatch Optimiser Transformation programme which will increase the Control Room's ability to be able to DERs and low carbon generation. Utilising a greater level of automation, machine learning and artificial intelligence the project will reduce BM costs whilst improving the management of an increasingly complex grid operation landscape as we transition to a zero carbon energy system.

#### 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

There are multiple benefits that can be realised from the delivery of this project:

##### Short Term:

- Identification of the detailed requirements for the system components and adaptive input models
- Development of the sequencing required to deliver a control room dispatch optimiser tool capable of assessing the multiple operational scenarios inclusion of distributed intermittent renewable resources present.

##### Longer Term Benefits

- Optimised forecasting and dispatch by leveraging flexible demand and storage technologies reducing rising BM costs. To give an understanding of scale, the forecast balancing costs for financial year 2023/24 are estimated to be £3,500m (forecast published June 22). If we assume modest efficiencies are achieved through optimised dispatch, there is the potential for significant financial savings.
- Management of increasingly complex grid operations through utilising adaptive input models and machine learning.
- Improved performance monitoring, evaluation and feedback of the system through machine learning and operator education.
- Improved operator situational awareness through the use of multi-dimensional visualisation tools utilising highly accurate input data, probabilistic trajectories, input scenario information, optimisation results and scenarios.

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

This project will outline the roadmap to develop ADO, a tool which will be applicable for the whole of the 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 the outputs to deliver ADO going forwards, the roadmap developed within this project

is the first step to realising the potential delivery of these tools.

### 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**

Reports and key learnings from the project 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 scope of Dispatch Optimiser Transformation is to develop an integrated roadmap ensuring existing business plans are combined with the DOT requirements to deliver an end state vision. This work builds upon the results of the NIA2\_NGESO0013 Advance Dispatch Optimisation project.

**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 will develop a plan to deliver a world first dispatch optimisation tool that incorporates fit-for-purpose BAU systems, planned business change enhancements and new capabilities using state-of-the-art technologies such as AI and ML. The forward-looking time coupled optimisation model has been deployed at several grid operators, but the functionality has been limited to generation. There is no implementation of such an approach that manages optimisation of limited energy resources in a time-coupled manner.

### Relevant Foreground IPR

The following Foreground IPR will be generated from the project:

- Data model report
- Capability framework
- Detailed gap analysis report
- Impact assessment document
- A conceptual architecture

### 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 the National Grid ESO Data Portal [data.nationalgrideso.com](https://data.nationalgrideso.com)
3. Via our Innovation website at <https://www.nationalgrideso.com/future-energy/innovation>
4. Via our managed mailbox [innovation@nationalgrideso.com](mailto: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 Project goes beyond what is planned in BAU for Balancing Transformation. This project is investigating and developing the roadmap and optimisation tools needed to change how the ESO control room operates the whole electricity system and therefore falls outside of BAU 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 project will develop a plan to deliver a world first dispatch optimisation tool that incorporates fit-for-purpose BAU systems, planned business change enhancements and new capabilities using state-of-the-art technologies such as AI and ML.

The modelling approaches for the Adaptive Distributed Energy Resource model, Adaptive Interconnector model and Adaptive Demand models have not been implemented by a Grid Operator before.

The forward-looking time coupled optimisation model has been deployed at several grid operators, but the functionality has been limited to generation. There is no implementation of such an approach that manages optimisation of limited energy resources in a time-coupled manner.

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

Yes