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.
Network Licensees must publish the required Project Progress information on the Smarter Networks Portal by 31st July 2014 and each year thereafter. The Network Licensee(s) must publish Project Progress information for each NIA Project that has developed new learning in the preceding relevant year.

NIA Project Close Down Report Document

Date of Submission

Jul 2025

Project Reference Number

NIA2_NGESO053

Project Progress

Project Title

Exploring the Economic Benefits of Co-optimising Procurement of Energy, Response and Reserve

Project Reference Number

NIA2_NGESO053

Funding Licensee(s)

NESO - National Energy System Operator

Project Start Date

September 2023

Project Duration

1 year and 5 months

Nominated Project Contact(s)

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Scope

The project consists of four work packages. These will be delivered through both qualitative and quantitative assessments. This project is an initial exploration of co-optimisation in a GB context, and we expect more detailed phases of work would be needed before any introduction of a co-optimised system.

Work package 1: Qualitative discussion of hypothesised pros and cons of co-optimising energy and ancillary services in the context of GB's wider market reform work. This work will consider potential issues such as computation complexity and cross-border trading in a co-optimised model.

Work package 2: Assessment of the historical-cost savings of co-optimised day-ahead and/or real time procurement of energy and ancillary services in the GB market.

- By modelling a reliable representation of the GB electricity market, the model then considers the counterfactual scenario wherein energy and Ancillary Services (AS) have been co-optimised. This in turn will provide a historic assessment of cost savings for a specific year.

Work package 3: Quantify the potential efficiency savings for GB from 2025 – 2035 co-optimising procurement of energy and ancillary services.

- In taking the current electricity market as the counterfactual, this work package would compare this against a fully co-optimised system. Doing so returns a future cost saving.

Work package 4: Quantitative assessment of the potential efficiency savings from the co-optimised procurement of energy and AS in

a GB nodal market from 2025 – 2035.

- This work package tests the hypothesis that the procurement and utilisation of resources would be more optimal in a more locational pricing system as market participants would consider the physical realities and constraints of the transmission network and reflect this knowledge in their day-ahead and real-time bids and offers.

If this project finds substantial potential benefits from co-optimisation, next steps may include developing the work into a further phase to understand the design/deliverability challenges in more depth.

Objectives

The key objectives are to:

1. Enhance understanding of the advantages and disadvantages of implementing a co-optimised system within GB.
2. Assess historic and future efficiency savings which stem from co-optimising across energy, response and reserve products.
3. Explore the relative merits of locational pricing for optimised ancillary service procurement.
4. Disseminate key findings to stakeholders and inform the debate on the role of a co-optimised. electricity system, informing the wider REMA discussion about future dispatch mechanism options

Success Criteria

The project will be considered successful upon the delivery of:

- A qualitative assessment of the relative merits and shortfalls of a co-optimised system which enhances understanding of key potential issues such as cross-border trading compatibility.
- A robust quantitative assessment of the historic and future efficiency savings of co-optimisation of energy, response and reserve.
- A robust quantitative assessment of the future efficiency savings of co-optimisation of energy, response and reserve in the context of a nodal wholesale market.
- The above findings in a timely manner which allows us to inform industry, DES-NZ and Ofgem of the merits/shortfalls in pursuing central dispatch and co-optimisation.

Performance Compared to the Original Project Aims, Objectives and Success Criteria

National Energy System Operator (“NESO”) has endeavoured to prepare the published report (“Report”) in respect of Exploring the Economic Benefits of Co-optimising Procurement of Energy, Response and Reserve NIA2_NESO053 (“Project”) in a manner which is, as far as possible, objective, using information collected and compiled by NESO and its Project partners (“Publishers”). Any intellectual property rights developed in the course of the Project and used in the Report shall be owned by the Publishers (as agreed between NESO and the Project partners).

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The project has delivered in-line with the original project aims, objectives and success criteria, with multiple learnings that have been used to support a subsequent innovation project within NESO about scheduling and dispatch under self- and central-dispatch regimes, and, importantly, is providing valuable qualitative and quantitative analysis to feed into the REMA process.

Two comprehensive qualitative reports were delivered to cover **Work Package 1:** the first one covered a breadth of market design considerations using their expertise across multiple markets, spanning the scope of co-optimisation and its theoretical benefits, the economic foundations, bidding product design, locational considerations, and the role of real-time and scarcity pricing.

The second qualitative report focused on the applicability of co-optimisation to GB, looking at the existing market design, the evolution expected as go through the energy transition, the co-optimisation of energy with response and reserve (main focus) and with inertia and voltage, and helpful comparisons under different scheduling regimes and international comparisons.

A quantitative report then assessed "full co-optimisation" under a central-dispatch regime under both national and zonal pricing, and at both the Day Ahead stage and for real-time activations. This used a proprietary PLEXOS model incorporating data including Future Energy Scenarios and network build plans, historical weather years, forwards price data assumptions for different fuel types, ancillary services clearing prices, and assumptions about how GB might be split into zones under any change due to REMA.

For **Work Package 2**, a historic analysis was done to calibrate the model against a 2022 outturn to produce a reliable representation of the GB electricity market, replicating as best as possible market participant behaviour, considering the counterfactual scenario wherein energy and Ancillary Services (AS) have been co-optimised. This provided a historic assessment of cost savings for the historic baseline year of 2022.

This calibrated model was then used as the baseline for assessing the variable under work packages 3 and 4 (i.e. co-optimisied or not under national, and co-optimised national vs. co-optimised zonal).

For **Work Package 3,** the potential efficiency savings for GB from 2025 – 2035 co-optimising procurement of energy and ancillary services were quantified.

For **Work Package 4,** the potential efficiency savings from the co-optimised procurement of energy and AS in a GB zonal market from 2025 – 2035 were quantified.

The qualitative reports covered Work Package 1, and the quantitative report covered Work Package 2, 3 and 4. Overall, the reports provide a robust evaluation of the impact of co-optimisation, including changes in total consumer costs and the costs of producing electricity.

Required Modifications to the Planned Approach During the Course of the Project

The project largely followed the planned approach, with refinements along the way around the focus areas for each party and splitting the reports into an initial qualitative and subsequent quantitative edition.

The complexity of modelling sequential markets and of calibrating the models extended the timeline of the project, but it was worthwhile as that ensured the results were robust and representative.

Lessons Learnt for Future Projects

Future project involving market modelling should account for the fact that market participant behaviours and pricing in a self-dispatch market are likely to be different from that seen in a centrally-dispatched market, where the latter is most akin to the approach used for modelling.

Note: The following sections are only required for those projects which have been completed since 1st April 2013, or since the previous Project Progress information was reported.

The Outcomes of the Project

The project has delivered useful qualitative insight into the theory and practicalities of the co-optimisation of energy, ancillary services and transmission, along with background about the considerations for implementing such a change in GB. The quantitative results show that there is scope for savings on both system cost (the cost of producing electricity) and cost to end consumer (the total amount that bill payers would pay) both historically and into the future. These should be explored and verified by further work under the REMA programme.

Data Access

Details on how network or consumption data arising in the course of NIA funded projects can be requested by interested parties, and the terms on which such data will be made available by NESO can be found in our publicly available "Data sharing policy related to NIA projects (and formerly NIC)" and Innovation | National Energy System Operator.

National Energy System Operator already publishes much of the data arising from our NIA projects at www.smarternetworks.org. You may wish to check this website before making an application under this policy, in case the data which you are seeking has already been published.

Foreground IPR

The following three reports and insights were produced from the project:

- Co-optimisation of Energy and Ancillary Services in GB – Market Design Report
- Investigation into sequential and co-optimised procurement of energy, reserve and response services - Qualitative assessment
- Investigation into sequential and co-optimised procurement of energy, reserve and response services – Quantitative assessment

The reports will be published on the SNP when they are available.

Planned Implementation

While the work will not be implemented directly by NESO, multiple learnings have been used to support a subsequent innovation project within NESO about scheduling and dispatch under self- and central-dispatch regimes (NIA2_NGESO091 Quantitative assessment of self and central scheduling and NIA2_NGESO094 Compatibility assessment of dispatch options with GB cross-border markets)

This assessment has supported the REMA Programme's understanding of scheduling approaches and the key trade-offs between different designs. The results have strengthened the evidence base and inputted into ongoing decision-making processes.

Next steps:

- Continue to use the results for REMA decision-making and provide deeper understanding of reform options under consideration.
- Utilise the findings and data from the project to support wider discussions on market design beyond REMA.
- Subsequent innovation project within NESO about scheduling and dispatch under self- and central-dispatch regimes.

Net Benefit Statement

While the work will not be implemented directly by NESO, multiple learnings that have been used to support a subsequent innovation project within NESO about scheduling and dispatch under self- and central-dispatch regimes, and, importantly, has provided valuable qualitative and quantitative analysis to feed into the REMA process around the Operability, Wholesale and Locational workstream, to understand the potential value of moving to a central dispatch regime (which could include co-optimisation) and the additional considerations that would be needed for design and implementation This has allowed for a much more informed assessment of this key REMA decision. Without the innovation project we would not have had a direct assessment of the potential savings and specific consideration needed for GB, instead having to rely on international comparisons which may not have been directly mappable to our system.

Other Comments

The Project outcomes and results contain confidential information and intellectual property rights that cannot be disclosed in this Report due to their proprietary nature. Should the viewer of this Report ("Viewer") require further details this may be provided on a case by case basis following consultation of all Publishers. In the event such further information is provided each and any Publisher that owns such confidential information or intellectual property rights shall be entitled to request the Viewer enter into terms that govern the sharing of such confidential information and/ or intellectual property rights including where appropriate formal licence terms or confidentiality provisions. Dependent upon the nature of such request the Publishers may be entitled to request a fee from the Viewer in respect of such confidential information or intellectual property rights.

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