NIA Project Close Down Report Document

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Date of Submission

Jul 2024

Project Reference Number

NIA2_NGESO012

Project Progress

Project Title

COMMANDER – Coordinated Operational Methodology for Managing and Accessing Network Distributed Energy Resources

Project Reference Number

NIA2_NGESO012

Project Start Date

October 2022

Project Duration

1 year and 4 months

Nominated Project Contact(s)

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Scope

To ensure DERs can provide flexibility services to multiple entities, efficient coordination between the ESO and DSOs is critically important when accessing DERs for flexibility service provision. At present there is a lot of uncertainty in relation to the roles and responsibilities of the ESO and DSO's in this new smart energy world.

This project seeks to build on the work of the Open Networks and the Regional Development programmes by researching the current international trends in this area and defining a roadmap for the practical implementation of the schemes across GB. With WPD as a project partner, it will give greater insight into the challenges from both a system operator and DNO perspective.

The ESO/DSO coordination schemes will have a focus on maximising the use of flexibility provided by DERs with respect to enabling them to participate equally alongside other flexibility and balancing service providers, including conventional and renewable transmission connected assets as well as interconnectors.

Enabling efficient access to DERs through streamlined ESO/DSO coordination will deliver:

- Opportunities for customers to realise value from services and new technology
- More sustainable energy markets and networks
- Reduced costs to consumers through more optimised use of services
- Enhanced security of supply
- Transition to net zero at the lowest overall cost for customers

Objectives

The project aims to:

- Identify and define alternative ESO/DSO coordination schemes for accessing and managing DERs with respect to their qualification, procurement, dispatch, and settlement. In particular, the roles and responsibilities of the key actors involved, their interfaces across different timescales and information exchanges as well as key market arrangements to facilitate the process;

- Quantify and assess the techno-economic feasibility of alternative ESO/DSO coordination schemes for accessing and managing DERs for service provision at operational timescales; and
- Develop an engineering-based roadmap and recommendations for the practical implementation of the preferred ESO/DSO coordination scheme.

Success Criteria

The project will be classed as successful if the following criteria is met:

- There is a greater understanding of the latest national and international trends on ESO/DSO coordination schemes and how they could potentially be applicable to the GB system.
- There is a detailed techno-economic feasibility and analysis of each ESO/DSO coordination scheme.
- There is a developed roadmap which outlines the physical deployment of the preferred ESO/DSO coordination schemes.
- To operationalise the findings from this project, further functional workstreams will have been identified, which encapsulates all of the technological, commercial, regulatory and operational change required at granular organisational level.

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

National Grid Electricity System Operator ("NGESO") has endeavoured to prepare the published report ("Report") in respect of COMMANDER – Coordinated Operational Methodology for Managing and Accessing Network Distributed Energy Resources NIA2_NGESO012 ("Project") in a manner which is, as far as possible, objective, using information collected and compiled by NG 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 NG and the Project partners).

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Project Summary

With increasing participation from end consumers, Distribution Network Operators (DNOs), and Distributed Energy Resources (DERs) in providing flexibility to the Great Britain (GB) electricity system, there is uncertainty regarding the roles and responsibilities of the Electricity System Operator (ESO) and Distribution System Operators (DSOs) in this new energy landscape. This project aimed to address these gaps and deliver whole systems benefits by creating new flexibility market opportunities for service providers. Key deliverables included reports on national and international trends, a techno-economic feasibility assessment of developed ESO/DSO coordination schemes, an impact assessment of these schemes, and a roadmap for the physical deployment of the preferred scheme.

The project team comprised experts from WSP and Imperial College London, bringing extensive knowledge in power systems the transition to DSO, and whole electricity system planning and operation. The project's structure was divided into five distinct workstreams, each targeting specific objectives.

Workstream 1: Development of ESO/DSO Coordination Schemes

Workstream 1 focused on researching and analyzing alternative ESO/DSO coordination schemes. The process began with a comprehensive review of national and international trends in ESO/DSO coordination, identifying relevant practices and extracting lessons applicable to the GB electricity system. Stakeholder engagement within the ESO provided diverse perspectives, aspirations, and boundaries for future coordination schemes.

The team then developed two high-level ESO/DSO coordination schemes detailed below. This involved defining roles and responsibilities for key actors, such as suppliers, aggregators, DER providers, and local energy systems, and detailing their interfaces and information exchanges.

Scheme 1: Enhanced Coordination

Scheme 2: Distributed Flexibility Coordinator

The **principles of Scheme 1** are as follows:

ESO will maintain direct visibility and control access to large or aggregated distributed flexibility resources while DSO can access all distributed flexibility resources;

The coordination between ESO and DSO is done iteratively or sequentially through agreed primacy rules to mitigate operation conflict while maximising the synergy across the procurement and dispatch activities. Details of the rules that will be applied in the quantitative studies will be explored further in the subsequent WPs;

The scope of coordination is limited to the planning and operation of electricity distribution networks, not including gas or heat networks;
Share of DER capacity based on fixed thresholds and/or primacy rules, not on an optimal basis;
There is a coordinated planning based on ESO and DSO flexibility needs. This planning is focused on the electricity vector and entails a limited coordination with other energy vectors (e.g. heat networks);
The **principles of Scheme 2** are defined as follows:
In Scheme 2, the independent distributed flexibility coordinator (DFC) acts a neutral market facilitator for all distributed flexibility sources, ESO and DSO. ESO and DSO can access full potential of distributed flexibility capacities;
DFC is responsible for collecting service requirements from both DSOs and the ESO, and volumes and costs associated with distributed flexibility services, optimising those across all timescales and optimise procurement solutions for both ESO and DSO;
There are common flexibility procurement platform(s), in an integrated system with visibility and managed access for all relevant stakeholders;
The DFC enables the visibility of flexibility volumes not only in electricity networks, but also gas, and heating/cooling systems enabling sector-coupling flexibility benefitting the electricity system.
Outputs:
Report on National and International Trends: Comprehensive analysis of global ESO/DSO coordination schemes.
Report on Developed Coordination Schemes: Detailed descriptions of two high-level schemes, including roles, responsibilities, and key operational aspects.

Workstream 2: Techno-Economic Feasibility Assessment

In Workstream 2, the team performed techno-economic modeling of the whole electricity system to assess the feasibility of the developed ESO/DSO coordination schemes at operational timescales. The model, based on Security Constrained Optimal Power Flow, aimed to minimize the costs of balancing the transmission and distribution systems by considering dynamic operational constraints.
The team enhanced the existing whole electricity system model to incorporate the developed coordination schemes. They defined use cases reflecting different geographic locations, types of flexibility services, and technologies. These use cases were mapped onto the model to quantify and assess the costs and benefits of the coordination schemes.
Outputs:
Enhanced Whole Electricity System Model: Incorporating developed coordination schemes.
Defined Use Cases: Reflecting geographic and technological diversity.
Techno-Economic Feasibility Report: Assessment of costs and benefits for the developed schemes.

Workstream 3: Impact Assessment of ESO/DSO Coordination Schemes

Workstream 3 undertook a comprehensive impact assessment combining quantitative and qualitative evaluations. The enhanced model balanced investment costs in generation, transmission, and distribution infrastructures against the operational benefits of flexibility service provision.
Quantitative assessment involved evaluating the economic case of the schemes, while qualitative assessment was informed by stakeholder feedback, covering criteria such as customer experience, market viability, and environmental sustainability. The combined assessments provided in-depth insights into the strengths and weaknesses of each scheme, leading to the selection of the preferred scheme for roadmap development.
Outputs:
Impact Assessment Report: Quantitative and qualitative evaluation of the coordination schemes.
Preferred Coordination Scheme: Selected based on combined assessment outcomes.

Workstream 4: Roadmap for Physical Deployment

Workstream 4 developed an engineering-based roadmap for the practical implementation of the preferred coordination scheme. The team identified key activities and initiatives, covering technical, commercial, and regulatory aspects necessary for deployment. Stakeholder engagement provided feedback on the roadmap activities, which were then organized by priority and time-sequenced to reflect dependencies and alignment with ESO strategic objectives. A high-level assessment of the ESO's capability to manage the rate of change was also conducted, and management KPIs were developed to track roadmap delivery.
Outputs:
Roadmap Report: Detailed plan for the physical deployment of the preferred scheme.
Management KPIs: To monitor and track the effectiveness of the roadmap.

Workstream 5: Broader Application of Findings, Reporting, and Knowledge Dissemination

Workstream 5 focused on completing all project reporting and disseminating knowledge as part of the Network Innovation Allowance (NIA) requirements. This included regular project management reports, an annual report, a project close-down report, and organizing knowledge dissemination events such as webinars and workshops.
Outputs:
Annual Project Report: Comprehensive overview of project progress and outcomes.
Project Close-Down Report: Summary of project completion and achievements.
Knowledge Dissemination Events: Webinars and workshops to share findings with industry stakeholders.

Conclusion

The project successfully met its aims and success criteria. Key achievements included identifying and defining alternative ESO/DSO coordination schemes, assessing their techno-economic feasibility, and developing a practical implementation roadmap. The project highlighted the complexity of the ESO-DSO coordination space, the importance of adaptable partners, and the necessity of robust stakeholder engagement. Enhanced modeling and comprehensive impact assessments provided a solid foundation for future ESO-DSO coordination, ensuring value for end consumers. The project has laid the groundwork for improved whole system coordination through detailed planning and stakeholder collaboration.

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

The project incurred an additional cost of £25,000, which has been duly updated on the Smarter Networks Portal. This increase was necessitated by the departure of the Project Lead from NGED, requiring the engagement of external support to ensure continued project delivery.

A second cost modification of £8,960 was proposed by WSP and ICCL. This adjustment facilitated an early-stage workshop in Workstream 3, involving a broad spectrum of stakeholders, including the ESO, NGED, and other GB DNOs. This proposal was accepted and approved by the ESO, recognizing the value of comprehensive stakeholder consultation.

The project delivery timeline experienced delays primarily due to changes in the ESO and WSP project teams. Additionally, extensive stakeholder engagement initiatives, which exceeded the original project scope, contributed to these delays but ultimately enhanced the quality of the deliverables.

Lessons Learnt for Future Projects

Some key learning points to date are:

- This is a complex area and to that end clarity at the start of the project can be challenging
- Having capable partners that can adapt to changing priorities or views is extremely helpful when trying to establish projects like this. During Workstream 2 and 3, ICCL considered the request from NGESO and NGED to create a sensitivity in IWES to consider two system evolution pathways (full electrification and hydrogen). WSP has considered the latest policy changes after Ofgem's consultation, The Future of Distribution Flexibility, which brought significant factors influencing the ESO-DSO Coordination space.
- Business engagement is vital and continuity in personnel throughout helps in that regard. WSP and ICCL focused on stakeholder engagement throughout the project and proposed a 3rd workshop with a wide range of industry stakeholders.
- The IWES model has proved during this initial phase to be extremely adaptable to changing industry dynamics and produced some interesting results when broken down across GB into geographical areas
- The project would benefit from a shorter timescale of implementation, given the complexity and frequent policy changes that influence the ESO-DSO Coordination topic.

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 following milestones/outcomes have been achieved:

- Enhanced the current whole electricity system model to represent the developed ESO/DSO coordination schemes at operational timescales
- Defined whole electricity system use cases against which to assess the coordination schemes. These will consider particular geographic locations of the networks, specific types of flexibility services, different technology types of flexibility services, etc.
- Modelling and analyses of Scheme 1
- Modelling and analyses of Scheme 2
- There is a developed roadmap which outlines the physical deployment of the preferred ESO/DSO coordination schemes.
- Gap analysis between as-is and Scheme 1, and between Scheme 1 and 2

- Three stakeholder workshops
- Five reports (including Workstream 5 report, to be delivered until the end of July 2024).

The following conclusions can be taken from the project:

- A range of ESO-DSO coordination schemes and innovation projects in the UK and EU highlight a range of critical needs for efficient flexibility markets and access to DERs: automation of operator interfaces and accurate forecasting, an effective market architecture that facilitates greater E(T)SO-DSO coordination in operational timescales and integrated planning to manage the future system complexity and facilitate integration of DERs.
- Stakeholder engagement revealed that both suppliers and DNOs recognise that whole system solutions should deliver the best value for the end consumer and that the lack of visibility of DERs is a primary challenge. Energy suppliers do not consider primacy rules as sufficient and favour structural change to mitigate conflicts of interest. DNOs' view is that they already have the best functions for delivering local flexibility recognising challenges with case-by-case rulings.
- The impact assessment showed clear long-term benefits and stronger scores for Scheme 2 (Distributed Flexibility Coordinator), which provides an overall energy network with greater capacity and resilience than Scheme 1. Several suboptimality conditions in Scheme 1 (Enhanced Coordination) that may increase the system cost up to £4.28bn/year have been identified. In both schemes, optimal whole energy system planning and coordination are essential.
- Implementation costs of both schemes are marginal (~1%) in comparison against total savings in system costs against business as usual. Although, there are multiple concerns over the potential complexity of the Scheme 2 implementation, given the creation of a new entity and further definition of roles and boundaries between energy system actors.
- The gap analysis and roadmap creation revealed significant risks in areas such as coordination in the development and implementation of flexibility products, implementation of coordination schemes across multiple industry players, asset visibility and data exchanges.

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 National Grid can be found in our publicly available "Data sharing policy related to NIC/NIA projects" and www.nationalgrideso.com/innovation.

National Grid Electricity System Operator already publishes much of the data arising from our NIC/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 team continues to make progress in accordance with the plan to develop the following documents which form the basis of new Foreground IPR:

- Report on national and international trends on ESO/DSO coordination schemes.
- Report on the developed ESO/DSO coordination schemes.
- Report on the techno-economic feasibility assessment of the developed ESO/DSO coordination schemes at operational timescales.
- Report on the impact assessment of the ESO/DSO coordination schemes.
- Report on the roadmap for the physical deployment of the preferred ESO/DSO coordination scheme.
- Gap analysis between business as usual and Scheme 1, and between Scheme 1 and Scheme 2
- Roadmap with Scheme 1 and Scheme 2 implementation roadmap
- Cost Benefit Analysis of the implementation of Scheme 1 and Scheme 2
- Scheme 1 and Scheme 2 models in IWES, including sensitivity of full electrification and hydrogen pathways.

All of the outputs will be shared on the Smarter Networks Portal.

Planned Implementation

- Develop and implement Scheme 1 in the short term, taking effect in the period 2025-2035, and implement Scheme 2 by 2035 to take effect on later stages of the energy transition (2035 and onwards).
- Create an industry-wide programme to effectively develop ESO-DSO coordination, accounting for developments in the following

areas: a) Policy and Regulation; b) Primacy Rules; c) Asset Visibility; d) Communication Protocols; e) Data access and governance; f) Whole system investment benefits; g) flexibility market platforms developments; h) level playing field for all participants

- Form an industry-wide Working Group to lead and monitor strategic developments in the ESO-DSO Coordination space. This could include the identification and review of existing issues and proposed solutions, establishment of priorities for long term enhanced coordination which promotes whole energy system optimisation, and establishment and monitoring of enablers and blockers for long term enhanced coordination, as well as specific implementation KPIs
- Identify where current trials and initiatives can strategically contribute to whole system coordination and where further trials are required
- The Roadmap for schemes implementation identifies a series of actions to be developed and implemented across the industry.

Other Comments

Project Commander has laid a robust foundation for enhancing coordination between the Electricity System Operator (ESO) and Distribution System Operators (DSOs) in Great Britain. This project has driven thought leadership in ESO-DSO coordination, fostering exchanges essential for the flexibility required by a Net Zero energy system.

The project developed two specific coordination schemes, detailing roles, and responsibilities of all energy system participants, along with a comprehensive roadmap for implementation. These schemes were refined through extensive stakeholder consultations, including three workshops with representatives from ESO and DNOs, ensuring industry alignment and practical applicability.

A thorough Cost-Benefit Analysis (CBA), using the standard Ofgem network investment assessment template, was conducted to evaluate the financial viability of the proposed schemes. Scenarios were modeled across flexibility unit price points (£30/MWh to £100/MWh) and efficiency gains (3% to 7%). The analysis identified 2028 as the optimal year for implementing improved coordination, with the investment occurring in the preceding two years, providing the best 45-year net present value (NPV) for the majority of scenarios. Delaying implementation to 2031 resulted in a lower NPV compared to starting in 2028, even under minimal cost and improvement scenarios.

The implementation roadmap includes over 30 specific actions across technical, commercial, and regulatory initiatives. Additionally, a set of Key Performance Indicators (KPIs) was established to monitor the schemes' efficiency and effectiveness, covering areas such as procurement effectiveness, curtailment volumes, effective activations, and market liquidity.

Project Commander has significantly advanced the practical application of ESO-DSO coordination, which is crucial for achieving a flexible and resilient Net Zero energy system. The project's findings and recommendations provide a clear path forward for industry stakeholders, ensuring maximum benefits to consumers while maintaining system reliability and cost-effectiveness.

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