Date of Submission

May 2021

NIA Project Registration and PEA Document

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.

Project Registration

Project Title

Future Control Room

Project Reference

NIA_SSEN_0053

Project Licensee(s)

Eastern Power Networks, London Power Networks, Scottish Hydro Electric Power Distribution, South Eastern Power Networks and Southern Electric Power Distribution

Project Start Date

January 2021

Project Duration

1 year and 3 months

Nominated Project Contact(s)

Colin Mathieson

Project Budget

£445,000.00

Nominated Contact Email Address(es)

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Problem(s)

As the country moves towards Net Zero, Distribution Network Operators (DNOs) will need to operate in a more complex, rapidly changing environment while interacting with a broader range of network participants. Similarly, managing the increasing number of new technologies such as Active Network Management schemes and ever more advanced network automation and control schemes will require a major change in control room design and operational practice.

The mass deployment of new Low Carbon Technologies (LCTs), and higher numbers of flexibility services being utilised across the network, will require DNOs to monitor and manage increasingly complex and variable power flows across the network. This will make it increasingly challenging for network operators to manage and act upon growing volumes of network data. This could have a potentially negative effect on their ability to safely and effectively manage their assets, maintain network reliability, and avoid any impact on customer service.

The combination of the amount of newly available data and increasing network visibility has the capacity to provide a very detailed view of the network's operation, far beyond current capabilities. It is important that network operators understand how to utilise this additional data to improve network operation, increase network utilisation and improve reliability while supporting the UK's transition to Net Zero. To maximise the benefits from these new data sources and provide control room staff with appropriate visibility of an increasingly complex system, the operation of the control centre needs to be re-defined. This requires a new approach to control room operation in order to de-risk the transition to Distribution System Operation (DSO) and help achieve Net Zero.

Failure to prepare for these future energy scenarios will cause significant issues on the GB network. GB network operators must rapidly start to define the future requirements, control architecture and functionality of GB whole system operation and co-ordination in order to meet the country's ambitious net zero targets.

This project aims to:

· Understand the requirements for future control room operations;

· Assess a range of technology options available to meet these requirements;

· Develop an understanding of optimum relationships between enhanced system automation, flexibility dispatch and the need for "human in the loop" to maintain system integrity;

· Understand the role of the LV control engineer when there is a fully represented, flexible and partially automated LV network control;

· Investigate the amount of automation that could be implemented into the future control room and the impact this will have on the demands of control engineers;

· Investigate DNO/DSO control room options for the near future (ED2 period) and the longer term;

· Understand the interactions of individual functions within a control room;

· Look at options for developing a simulated environment to safely test and develop new control room solutions, including use of machine learning and artificial intelligence;

· Develop appropriate Human Machine Interface and other dashboard type information to suit needs of network operators; and

· Assess the commercial options for the development of future control infrastructure.

Modelling future DSO scenarios and managing interactions via a whole systems lens is an inherently complex task that requires a comprehensive understanding of grid performance across generation, transmission, distribution, and future localised networks to ensure resilience and reliability. In this new digital world, data accuracy, model complexity and automation are the foundations to maintain operational excellence and maximise future investments. Therefore, the development of a safe and controlled environment to de-risk and validate proposed architectures, systems and technologies is critical.

Method(s)

The overall aim of the project is to explore how a simulated control environment could be used to develop an optimal design and provide a supporting roadmap for a future control room. This will include development and identification of the preferred platform architecture and associated technologies. This will enable an environment which can safely explore a wide range of network scenarios, simulate extreme operating conditions and safely research the utilisation and integration of new data sources and analytical techniques.

The project will be structured around three work streams:

WS1 – Requirements Capture and Stakeholder Engagement

WS2 – Development of Requirement Specification

WS3 – Business Impacts and Future Recommendations

In WS1 a series of workshops will be arranged to engage with key stakeholders (ESO, GB DNOs, OEMs, SMEs, and academia) and identify existing and new use cases for the simulated control room. These will capture current and future whole system operational needs and enable a prioritisation to be made for the subsequent project tasks. These use cases will enable a series of anticipated future control room operational scenarios to be populated, providing a high-level outlook of potential scope and service requirements. A first assessment on how today's control room would perform in future scenarios will be completed with support from operational control engineers from GB DNOs. This will enable the project team to identify key constraints and dependencies. WS1 will include a market engagement exercise to develop an understanding of currently available technologies, systems and facilities and gain a deeper understanding of suppliers' product development strategies. This WS will also include work to ensure alignment with wider industry initiatives such as the BEIS funded Industrial Strategy Challenge Fund 'Prospering from the Energy Revolution' Programme, Open Networks and the National Cyber Security Centre. Furthermore, this WS will define and understand the complex/challenging operational scenarios that will occur in the future that the current control room may be unable to manage.

WS2 will define the functionalities of the future control room including an assessment of the value of advanced functionalities (such as Artificial Intelligence (AI) and Machine Learning (ML)), which are driven by increased volumes of data streams, and how their value can be maximised. This WS will also identify the architecture of the platform that will host the future control room and the technologies that will support it. Furthermore, the team will define how the functionalities work together (interoperability) including their interfaces. Utilising knowledge from WS1 (use cases & future operational scenarios) and WS2 (technical requirements/functionalities and an analysis of the capabilities of existing innovation facilities that could simulate the UK electricity network), a preferred technical design option for the Future Control Room simulator will be proposed for future development.

WS3 will look at the development of the operational and research work programme for the Future Control Room simulator to ensure that the outputs are robust and reliable and can provide enough evidence to inform future DNO Control Room design and operation. The outcome of this WS will be an assessment of how effectively the proposed Future Control Room simulator design will assess, de-risk and implement new control room solutions to manage the scenarios defined in WS1. Furthermore, this workstream will also look at the development of an initial roadmap for the proposed control room simulator with an associated short, medium and long-term innovation programme.

Scope

As described above, the project will be delivered in three workstreams. The project will consider the requirements, the high-level architecture, operational need, and business impact of developing a future control room simulated environment. The outputs will include an initial roadmap and architectural design for the future control room simulator, as well as outline a proposed programme of works for the simulator's initial operational period. This NIA project will also make recommendations for future development, further work required, use cases and user requirements for the proposed simulator to assess its viability and ongoing benefits to the electricity industry.

Objectives(s)

The project has the following key objectives:

Capture the requirements from a range of internal and external stakeholders for a future control room.
Identify a range of existing and new use cases, create a set of future scenarios and perform a first assessment on how today's control room will need to adapt to be able to perform in these future scenarios.
Establish a preferred option, design, and requirements specification for a potential future control room simulator that will be used to simulate the requirements and future scenarios identified in objectives 1 & 2.
Capture the current and future functionalities and requirements of technology vendors and suppliers.
Demonstrate affordability and fundability of the preferred solution through the development of a robust financial business case.
Develop a roadmap for the facility with an associated short, medium and long-term innovation programme. This roadmap will extend beyond the build of a digital twin of the GB electricity network and will clearly highlight the critical path to enabling the DSO transition.

Success Criteria

The project will be deemed successful if it provides a clear understanding of the requirements for future control room operations and this is validated with key stakeholders such as academic partners and other DNOs. This includes the following:

· Carry out an investigation of existing and new use cases and future operational scenarios for the adoption of the existing DNO control room to enable DNOs to meet the future control room requirements of a DSO;

· Establish a preferred option, design and potential future control room simulator location;

· Demonstrate affordability and fundability of preferred option; and

· Develop a roadmap and programme for the proposed facility.

Technology Readiness Level at Start

TRL 2

Technology Readiness Level at Completion

TRL 4

Project Partners and External Funding

SSEN - Project Lead
UKPN – DNO partner
University of Strathclyde (Power Networks Demonstration Centre) – WS1, WS2 and WS3 lead
No external funding is provided for this project.

Potential for New Learning

The project will provide new learning on the functionality and requirements of future control rooms, including: user requirements, technical architectures, data analysis and cyber security needs across a range of future operating scenarios. The project will also evaluate the potential use of new analytical techniques such as machine learning and artificial intelligence, to better maintain network resilience in a network which has widespread use of automation, Active Network Management (ANM) and flexibility, as well as a huge range of new monitoring/power flow data available from LCTs, smart meters and enhanced network monitoring. The project will also provide insights into the role of the DNO Control Engineer (HV and LV) when managing an increasingly complex network in the future.

The project will also provide an overview of the research programme required to develop a robust evidence base to allow for adoption of these new techniques into future control rooms.

The learning will be disseminated through the sharing of reports and investigation results, as well as through appropriate industry/innovation channels.

Scale of Project

The project will be completed as a collaborative project between Scottish & Southern Electricity Networks and UK Power Networks. This is a research project to assess the future requirements and potential technical solutions for de-risking and validating complex interactions and systems as we move to a highly decentralised energy system to achieve net zero. The outputs of this project will provide an initial understanding of the issues and identify potential solutions to inform future works.

The size and cost of this project is based on a detailed project plan and budget breakdown produced by the WS1, WS2 and WS3 lead (University of Strathclyde). This has been reviewed and deemed appropriate by the major stakeholders if we are to capture and utilise the large amounts of data and stakeholder opinions on existing and future control room requirements.

Geographical Area

This is a research project, which will be a desktop investigation to assess the viability of a simulated environment for a future control room.

Revenue Allowed for in the RIIO Settlement

No revenue has been allowed for this project in the RIIO-ED1 settlement.

Indicative Total NIA Project Expenditure

The total expenditure for the project is £ 445K.
90% (£382.5k) is allowable NIA expenditure.
The total expenditure for Scottish Hydro Electric Power Distribution & Southern Electric Power Distribution is £225k.
90% (£202.5k) is allowable NIA expenditure.
The total expenditure for Eastern Power Networks, South Eastern Power Networks & London Power Networks is £220k.
90% (£198k) is allowable NIA expenditure.

Project Eligibility Assessment

Specific Requirements 1

1a. A 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 the GB the Network Licensee must justify repeating it as part of a Project) equipment (including control and communications systems and software)	X
A specific novel arrangement or application of existing licensee equipment (including control and/or communications systems and/or software)	X
A specific novel operational practice directly related to the operation of the Network Licensee's System	X
A specific novel commercial arrangement	

Specific Requirements 2

2a. Has the Potential to Develop Learning That Can be Applied by all Relevant Network Licensees

Please explain how the learning that will be generated could be used by relevant Network Licenses.

The outcomes from the project will be directly relevant to other network licensees as they look to address future network control and management as they transition to DSOs to support GB's move to Net Zero.

Please describe what specific challenge identified in the Network Licensee's innovation strategy that is being addressed by the Project.

n/a

2b. Is the default IPR position being applied?

Yes	X

2c. Has the Potential to Deliver Net Financial Benefits to Customers?

Yes	X

Please provide an estimate of the saving if the Problem is solved.

This is a research project – the project outputs include an assessment of future benefits.

Please provide a calculation of the expected financial benefits of a Development or Demonstration Project (not required for Research Projects). (Base Cost - Method Cost, Against Agreed Baseline).

n/a

Please provide an estimate of how replicable the Method is across GB in terms of the number of sites, the sort of site the method could be applied to, or the percentage of the Network Licensees system where it could be rolled-out.

The outputs will be relevant to all GB DNOs.

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

This is a research project – the project outputs include an assessment of future costs to rollout the solution(s).

2d. Does not Lead to Unnecessary Duplication

Yes	X

Please demonstrate below that no unnecessary duplication will occur as a result of the Project.

With many operational projects delivered or underway that have the low carbon DSO concept as a focus, the gap that remains is a coherent programme for future operational control room architectures and strategies (including business operation) of the GB energy system. This learning will be required for DNOs to effectively manage future electricity network scenarios and successfully transition to DSOs. In addition, the Energy Networks Association portal has been checked to confirm there is no duplication.
Existing projects largely focus on whole system modelling and analysis or improving the integration of flexibility services and network users

with their existing systems. They do not consider how to completely revise their control room functionality to address the longer-term requirements for network management and control across a range of future energy scenarios.

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

n/a

Additional Governance Requirements

Please identify

that the project is innovative (ie not business as usual) and has an unproven business case where the risk warrants a limited Research and Development or Demonstration Project to demonstrate its effectiveness	X

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

The project is innovative as it will consider network control requirements for a range of future electricity network scenarios and explore existing and emerging control room functionalities that may be required to manage them. This project will also look at the potential to utilise emerging data analysis techniques such as Artificial Intelligence (AI) and Machine Learning to support the future control room. These techniques require significant research and future development before they can be considered for integration into network management systems. The incorporation of any new approach to network control and control room operation presents significant risks to network owners. Therefore, it needs careful consideration before it can be deployed. New data analytics techniques such as AI, and their applicability to network control, have yet to be fully investigated and understood by network owners. This project will help develop a deeper understanding of their potential.

ii) Please identify why the Network Licensee will not fund such a Project as part of its business as usual activities

The control room is an extremely complex and critical part of the network. Any changes to its operation must be validated prior to implementation to avoid risking the supply security and continuity that is key to all aspects of modern life. Any issue with the control room operation can also significantly impact electrical safety in GB (particularly if its ability to successfully manage fault events is compromised). This project proposes a new, unproven method to address a future energy scenarios that are subject to change. It needs to be further developed, validated and de-risked before it can be introduced as business as usual.

iii) Please identify why the Project can only be undertaken with the support of the NIA, including reference to the specific risks (eg commercial, technical, operational or regulatory) associated with the Project

This project is speculative in nature and yield uncertain commercial returns. There is a commercial risk that the solution trialed is not further developed at the end of the project. If the project is successful, it will inform the development of further work to facilitate the implementation of a future control room simulator environment. The learning from this project will be applicable to all network operators. The collaboration opportunities presented by NIA will ensure alignment and agreement amongst all key GB stakeholders. This will ensure that maximum value and usefulness is delivered by the project. This will avoid network operators developing bespoke solutions in isolation, which would be less efficient and more expensive.

This project has been approved by a senior member of staff

Scottish & Southern Electricity Networks