

Energy
Networks
Innovation
Process
Project
Closedown
Report
Document



Date of Submission: 28th July 2022

Project Closedown Report Document

Notes on Completion: Please refer to the NIA Governance Document to assist in the completion of this form. Please use the default font (Calibri font size 10) in your submission. Please ensure all content is contained within the boundaries of the text areas.

Project Title (<i>This cannot be changed once registered</i>) Future Control Room	Project Reference NIA_SSEN_0053
Funding Licensee(s) Scottish Hydro Electric Power Distribution Southern Electric Power Distribution	Project Start Date January 2021
Project Duration 15 months	Year 2022
Nominated Project Contact(s) SSEN NIA Programme Delivery Manager – Tim Sammon fnp.pmo@sse.com	

1. Scope

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.

2. Objective(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.

3. 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.

4. Performance compared to the original project aims, objectives and success criteria

Details of how the Project is investigating/solving the issue described in the NIA Project Registration Pro-forma. Details of how the Project is performing/performed relative to its aims, objectives and success criteria.

Project background:

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.

Project performance against objectives:

Through a mixture of industry engagement and academic insight, this project has informed and accelerated the evolution of the DNO control room.

- **Capture the requirements from a range of internal and external stakeholders for a future control room.**
Multiple stakeholder workshops were held with staff across SSEN & UKPN. These also involved staff from Strathclyde University facilitating breakout rooms through 'Microsoft Teams' and using Miro Virtual Whiteboards to capture requirements and use cases for a future control room. These were distilled into a workshop report.

- **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.**

The main use cases identified were:

- Flexibility and Ancillary Services Market Facilitation
- Network Stability and Extreme Events
- Internal Control System Interactions and Architecture
- External Control Systems Interactions and Communications
- Data Analytics Tools

These were each explored in more detail through the project deliverables, and their characteristics are summarised in Section 7 below.

- **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.**

Originally the project aimed to explore a physical simulator centre, similar to National Grid's Transmission simulator or the National HVDC Centre in Cumbernauld, Scotland. This evolved into exploring a virtual simulator that could be integrated into the DNO control room's existing infrastructure. This led to further investigations about the role of Artificial Intelligence (AI) and Automation in the BAU control room. Several reports were produced on these topics with possible systems architectures, use cases and requirements for systems that could assist the control engineer handle large amounts of data and make informed decisions in the future.

- **Capture the current and future functionalities and requirements of technology vendors and suppliers.**

A report was drafted detailing examples of other existing innovation facilities or virtual platforms where these technologies could be hosted and developed, including their advantages and disadvantages. Various technologies and functions for the simulator were investigated to meet the requirements previously determined from the stakeholder workshops.

- **Demonstrate affordability and fundability of the preferred solution through the development of a robust financial business case.**

Baringa Partners consultancy was brought on board to draft a short business case which demonstrated the affordability and fundability of our preferred solution.

- **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.**

A roadmap for future innovation in the control room has been created by the team at Strathclyde to provide tangible actions and timelines to address the problems and opportunities identified during this project. This was shared widely during our dissemination activities.

5. Required modifications to the planned approach during the course of the project

The Network Licensee should state any changes to its planned methodology and describe why the planned approach proved to be inappropriate. Please confirm if no changes were required

N/A

6. Lessons learnt for future projects

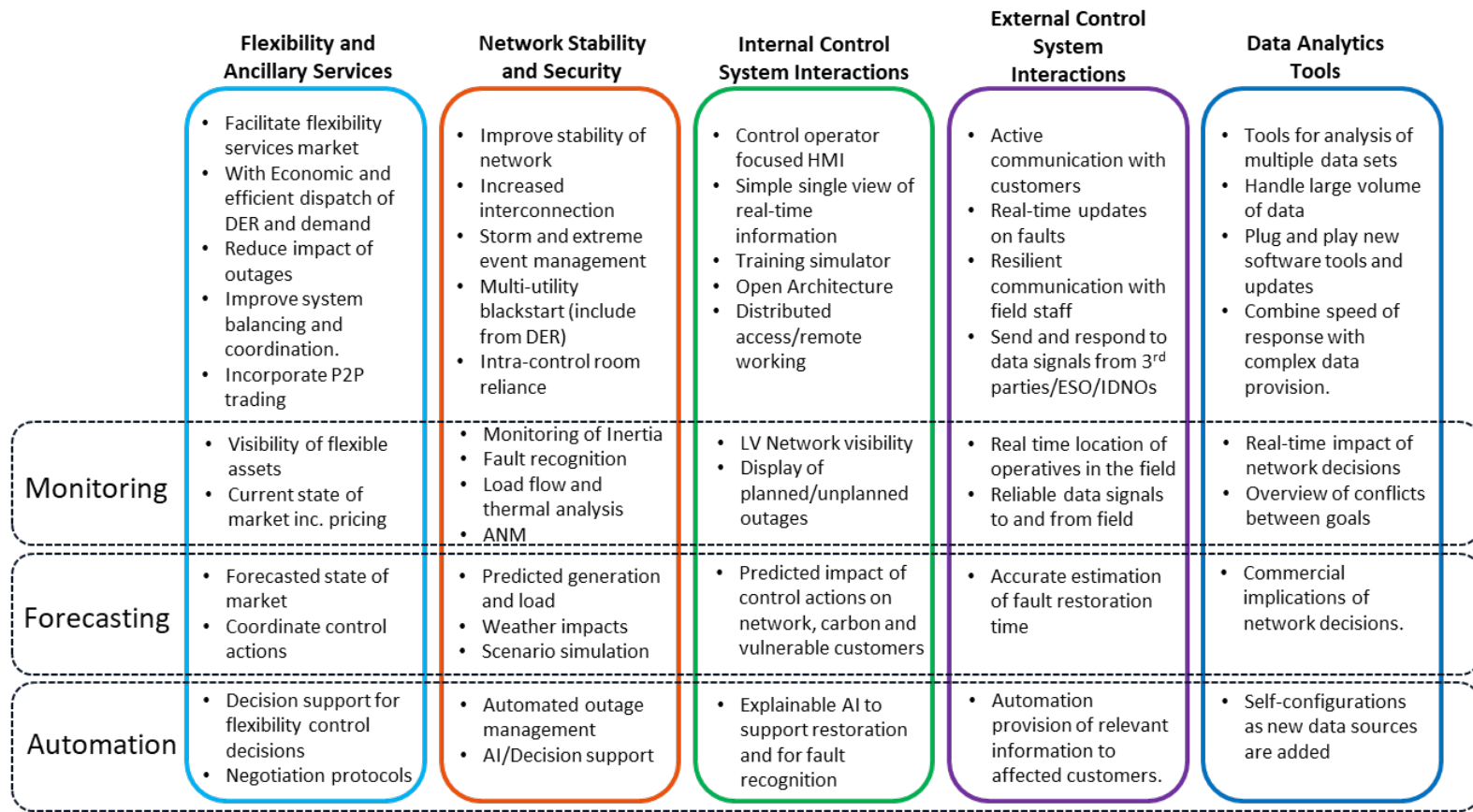
Describe how the project (methodology, stakeholder engagement etc.) changed, or provided opportunities, from your expectation at the start of the project and therefore could be useful for a future project. In addition, please discuss the effectiveness of the research development or demonstration undertaken.

- The initial internal workshop sessions have highlighted the importance of comprehensive stakeholder engagement (with diverse job roles) to enrich the content of the project. Early engagement is key when trying to organise large recurring workshops.
- It is undesirable by Ofgem and the DNOs to fund a physical bespoke DNO network simulator facility. However, there is a desire to better simulate the network by control room staff. This should be done virtually within the existing DNO infrastructure to ensure maximum usefulness, ease of data transfer, and transferability between companies.
- A future project could progress the creation of an “intelligent control system” which would use AI based analysis and control for future distribution network management and system-wide conflict management to assist the control room and its staff. This will be particularly necessary as the quantity of data control engineers are expected to process and act upon dramatically increases.
- Another topic for future projects is secure, real time data exchange between control systems. At the moment getting third party data into the control room in real time is not possible but it will eventually be required to coordinate future growing flexibility markets, local communities and independent DSOs.
- Future advances in technology also need to consider the human role in the future control room, what that role should be and how they interact with highly automated systems deployed by future control rooms.

7. The outcomes of the project

When available, comprehensive details of the Project’s outcomes are to be reported. Where quantitative data is available to describe these outcomes it should be included in the report. Wherever possible, the performance improvement attributable to the Project should be described. If the TRL of the Method has changed as a result of the Project this should be reported. The Network Licensee should highlight any opportunities for future Projects to develop learning further.

The project performance is stated in section 4 of this report and detailed reports are available upon request. Below are the key outputs from the project, Figure 1 is the Use cases from the stakeholder workshops and Figure 2 is the roadmap for innovation for the future control room system. These have led to proposals for follow on work which will be discussed in Section 10. of this closedown report. The fact that demonstrator projects will follow this research project provides evidence that the project has achieved its planned TRL increase from TRL2 to TRL4.



Across all use cases consideration of: (1) Control room operator experience, (2) Safety of staff in the field, and (3) Cyber security.

Figure 1: Use Cases from the project workshops

Detailed Future Control System: Roadmap

Challenge	2022	2023	2024	2025	2026	2027 Outcome
Interaction with new actors (Challenge 1)	Detailed Design Data Interface Actor Engagement workshops	Build of Data Interface Test Data Interface Virtualised & WESA actors	Scenario Implementation	Integrate Future Control Room components	Interface actors into system	Data interface deployment in DSO control room
Management of system of systems (Challenge 2)	Detailed Design of Digital Twin Technology vendor Engagement	Build of Digital Twin Test Digital Twin	Scenario implementation		Open simulation platform online deployment Full System Scenario Testing	Network Digital Twin deployment in DSO Control Room
Decision making from large data (Challenge 3)	Detailed Design of ICS system Develop ment proof concept modules Open Data access scheme AI partnership	Build of ICS Test ICS	Scenario implementation		Open source analytics & AI cloud platform deployed	Data analytics automation suite: Intelligent Control System deployment in DSO control Room
Peripheral challenges & support Interfaces	Market emulator detailed design Design End Users System WESA project to develop capability (Living Lab)	Build of market emulator Build End Users model Integrate Market & Users			Scaling and rollout New challenge identification & forward looking	Training with Control Room Engineers in the loop

Figure 2: Future Control System: Roadmap (draft subject to change)

8. Data Access & Quality Details

A description of how any network or consumption data (anonymised where necessary) gathered in the course of the Project can be requested by interested parties. Please include a link to the publicly available data policy.

In accordance with the Innovation Data Sharing Policies, SSEN and UKPN aim to make available all non-personal, non-confidential/non-sensitive data on request, so that interested parties can benefit from this data. Scottish and Southern Electricity Networks and UK Power Networks recognise that Innovation projects may produce network and consumption data, and that this data may be useful to others. This data may be shared with interested parties, whenever it is practicable and legal to do so, and it is in the interest of GB electricity customers.

To view the full Innovation Data Sharing Policies please visit the respective Scottish and Southern Electricity Networks' and UK Power Networks' websites below:

<https://ssen-innovation.co.uk/wp-content/uploads/2022/04/Network-Innovation-Competition-NIC-and-Network-Innovation-Allowance-NIA-Data-Sharing-Procedure-PR-NET-ENG-020.pdf>

<http://innovation.ukpowernetworks.co.uk/innovation/en/contact-us/InnovationDataSharingPolicy.pdf>

9. Foreground IPR

A description of any foreground IPR that have been developed by the project and how this will be owned.

N/A

10. Planned implementation, recommendations or next steps

Please describe the next steps to implement this innovation project. What policies and standards need to be updated or created as part of this implementation.

The specifications and recommendations provided by this project will influence DNO business plans throughout RIIO-ED2 and beyond.

The problems and use cases identified during the stakeholder engagement from this project informed a joint Network Innovation Competition (NIC) bid in 2021 by SSEN and UKPN called "REALISE the future control room". This bid was unfortunately unsuccessful.

Strathclyde University's Power Networks Demonstration Centre (PNDC) will take some of these concepts forward as part of its core research work, supported by SSEN and UK Power Networks. "Intelligent Control System Modules" aims to develop proof of concept modules for an Intelligent Control System as part of future control room technologies. This could then be developed further by the PNDC or the DNOs.

Further follow on project proposals are currently being discussed and evaluated.

11. Other comments

N/A

12. Standards Documents

Identify any industry standards that may require updating due to the outcomes or understanding developed from this innovation project. If no standards will need to be updated, please state - not applicable

N/A