

NIA Project Registration and PEA Document

Date of Submission

Mar 2025

Project Reference Number

NIA2_NESO098

Project Registration

Project Title

Options for optimising GB Data Centres

Project Reference Number

NIA2_NESO098

Project Licensee(s)

National Energy System Operator

Project Start

December 2024

Project Duration

0 years and 2 months

Nominated Project Contact(s)

innovation@nationalenergyso.com

Project Budget

£530,000.00

Summary

This project aims to understand drivers behind the location of data centres from a holistic viewpoint, within GB and internationally. This includes factors like land cost, telecoms infrastructure, labour for construction and water access, as well as energy-related factors like connection availability and power cost. It includes potential challenges and opportunities to the system of various scenarios.

The project will consider energy consumption of data centres (both present and future), best practices from other countries, solutions already in use and potential solutions to minimise strain on the grid. A geospatial analysis of GB data centres and future plans will feed into network and system planning, such as the Future Energy Scenarios (FES) and Strategic Spatial Energy Plan (SSEP).

Nominated Contact Email Address(es)

box.so.innovation@nationalgrid.com

Problem Being Solved

Data centres make up 1-2% of GB electricity consumption and are classified as Critical National Infrastructure. The Department of Science, Innovation and Technology consider data centres to be of fundamental importance and want to encourage investment into the sector, allowing growth and continued innovation. Data centres of different sizes and with different requirements (for example, high vs low latency) are considered essential for the UK's future and represent significant international investment.

There are a range of factors that data centres consider when deciding where to locate (such as fibre connectivity, availability of labour for construction and water access) but the impact on the grid varies. The forecast rise in electricity consumption raises concerns

around:

- the environmental impact
- strain in electricity network
- grid connections
- cost of power on data centre operators and other consumers.

The energy system needs to be able to work with data centres and enable, not block or delay, different growth scenarios.

Method(s)

This project will take place through a series of workstreams:

- Workstream 1 - Benchmarking and best practices: Produce a data-driven model benchmarking GB data centres, identify efficiency gaps and assess best practices.
- Workstream 2 – Optimised grid solutions: Define demand forecasts and compare grid capacities against demand forecasts.
- Workstream 3 – Geospatial analysis & locational models: Build scenarios and detailed geospatial analysis with insights into how location affects energy efficiency and grid connectivity.

In line with the ENA's ENIP document, the risk rating is scored Low.

TRL Steps = 1

Cost = 2 (£530k)

Suppliers = 1 (1 supplier)

Data Assumptions = 2 (low)

Total = 6 (Low)

Scope

This project seeks to understand:

1. The current view of data centres in GB in terms of their energy consumption, sustainability, efficiency and grid connectivity.
2. The potential for data centre growth in GB and whether the current grid could accommodate these demand projections.

The project will map GB data centres projects and future demand to reveal how location impacts the network and grid connectivity.

Objective(s)

This project will deliver a summary document, which will outline:

- 1) Energy consumption patterns across a variety of GB data centres, including new and legacy installations.
- 2) A geospatial analysis of GB data centres and future plans, providing insights into how location affects grid connectivity and network impacts.
- 3) The current factors that data developers use to choose data centre locations and a view of the benefits of relocation of data centres.
- 4) Benchmarking and best practices considering grid connection challenges, opportunities, and current solutions used by data

centres, identifying potential enhancements to minimise strain on the national grid.

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

NESO does not have a direct connection to consumers, and therefore is unable to differentiate the impact on consumers and those in vulnerable situations.

Success Criteria

This project will be considered a success in the production of a summary document, which will outline:

- 1) Energy consumption patterns across a variety of GB data centres, including new and legacy installations.
- 2) A geospatial analysis of GB data centres and future plans, providing insights into how location affects grid connectivity and network impacts.
- 3) The current factors that data developers use to choose data centre locations and a view of the benefits of relocation of data centres.
- 4) Benchmarking and best practices considering grid connection challenges, opportunities, and current solutions used by data centres, identifying potential enhancements to minimise strain on the national grid.

Project Partners and External Funding

This is a project partnered with McKinsey, no external funding is required.

Potential for New Learning

This project will drive understanding of drivers of different growth scenarios, highlighting the opportunities and challenges they present to NESO, network owners and other stakeholders. It will provide a holistic view of data centres beyond their electricity demand.

Learning will be disseminated through internal channels into NESO’s future planning work (SSEP- Strategic Spatial Energy Plan and FES- Future Energy Scenarios). An Executive Summary will be published on the Smarter Networks portal to share learnings across the industry.

Scale of Project

This project will span 2 months with 1 project partner. It will be a desk-based assessment with stakeholder engagement with a small number of key stakeholders.

Technology Readiness at Start

TRL3 Proof of Concept

Technology Readiness at End

TRL5 Pilot Scale

Geographical Area

This project will be conducted within GB.

Revenue Allowed for the RIIO Settlement

N/A

Indicative Total NIA Project Expenditure

An indication of the Total NIA Expenditure that the Funding Licensee expects to reclaim for the whole of the Project (RIIO2) is £530,000

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 has the potential to facilitate the energy system transition in several ways:

Energy Consumption Analysis: The project aims to analyse and understand energy consumption patterns across various GB data centres, including both new and legacy installations. This will help NESO plan for future data centre scenarios.

Geospatial Analysis: The project will conduct a geospatial analysis of GB data centres and future plans, providing insights into how location affects grid connectivity and network impacts. These scenarios will reflect the current factors that data centre operators use to locate data centres vs relocation scenarios (e.g. if data centres were relocated to minimise network impact). These scenarios will aid NESO future planning.

Benchmarking and best practices: By evaluating grid connection challenges, opportunities and current solutions, the project will enable potential enhancements to minimise strain on the network, ensuring data centre growth aligns with Clean Power 30 and net-zero objectives.

Enhanced Infrastructure Resilience: By improving grid connections and adopting energy storage and backup systems, there will be increased resilience of data centres to fluctuations in grid supply, ensuring business continuity and reducing downtime risks during grid disruptions.

Reduced Carbon Footprint: Optimising energy use and integrating renewable energy solutions will contribute to a reduction in carbon emissions, supporting the UK's net-zero goals.

Overall, the project aims to facilitate the energy system transition by improving energy efficiency, enhancing grid connections, and reducing the environmental impact of data centres.

How the Project has potential to benefit consumer in vulnerable situations:

Avoiding increases in grid constraints and efficient use of existing assets should provide best value for all consumers and minimise any risk to security of supply. This project will not benefit vulnerable consumers directly.

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

N/A - research project

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

The method is suitable for other desk-based research projects seeking a holistic view of defined topic across GB.

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

The costs of methodology in future projects will depend on the time and resources required. At this given time we are unable to provide an outline of the costs as this is desk-based research project.

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

Understanding of data centre requirements and knowledge of potential solutions around grid optimisation and efficient use of the national grid will allow more effective network planning, more cost-effective use of existing network and encourage growth of GB within the data centre sector without negatively impacting other consumers and the system.

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.

There are other projects such as those found on the ENA Innovation Portal which focus on specific aspects like fault detection, AI-

driven solutions, or attracting data science talent. While these projects are valuable, they do not offer the same approach as this project.

The key differences are the detailed geospatial analysis, international benchmarking and focus on infrastructure resilience.

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

This project looks at demand from a holistic viewpoint, specifically including non-energy related needs of data centres whereas the current process around network planning and connections considers only electrical concerns and impacts on the grid.

Relevant Foreground IPR

A final executive summary report will be produced.

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 Energy System Operator 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 our Innovation website at <https://www.neso.energy/about/innovation>
3. Via our managed mailbox innovation@nationalenergyso.com

Details on the terms on which such data will be made available by National Energy System Operator can be found on our website:

[Data Sharing Approach | National Energy System Operator](#).

Please identify why the Network Licensees will not fund the project as apart of it's business and usual activities

This project goes beyond areas NESO have previously considered, such as fibre infrastructure and land costs. These are factors not considered within BAU.

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 TRL of the overall framework is relatively low. Therefore, innovation funding is more suitable for exploring the project's potential and increasing the TRL before transferring into BAU activities.

There are increased risks associated with the availability of required data and a high level of assumptions, which makes this project better suited to NIA.

Conducting this project with NIA funding will ensure that the project findings can be shared more widely with other interested network licensees.

This project has been approved by a senior member of staff

☒ Yes