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.

NIA Project Registration and PEA Document

Date of Submission

Aug 2026

Project Reference Number

NIA3_NESO006

Project Registration

Project Title

DC- Ride

Project Reference Number

NIA3_NESO006

Project Licensee(s)

National Energy System Operator

Project Start

September 2026

Project Duration

0 years and 8 months

Nominated Project Contact(s)

innovation@neso.energy

Project Budget

£232,500.00

Summary

DC-RIDE will assess whether large transmission-connected data centres can meet emerging grid requirements for fault ride-through, voltage disturbances and fast active power recovery.

As hyperscale data centres grow, the project will improve understanding of how these loads respond to faults and voltage dips, and whether they can remain connected and recover in a controlled manner without adversely affecting system stability.

The project will provide evidence on data centre behaviour during disturbances, identify whether current requirements can be met and what technical measures may be needed, and assess options for supporting grid stability while maintaining operational resilience. It is expected to develop a reusable modelling framework for future studies and connection assessments, provide evidence to inform future Grid Code and connection agreement development, and a Data Centre Accelerator to support ongoing collaboration, testing and solution development across industry.

Nominated Contact Email Address(es)

Innovation@neso.energy

Problem Being Solved

In the UK, currently there is limited, evidence-based understanding impacts associated with the rapid growth in hyperscale data centres, such as:

- Whether these large demand users can ride through realistic GB faults and voltage dips without tripping, especially given the number of different configurations they can have i.e. Uninterruptible Power Supply (UPS) specification, inverter types, inference versus training modes.
- How demand behaves during and immediately after a voltage dip.
- What technical measures are required to ensure fast but manageable active power recovery in line with NESO's target envelopes.
- The wider impact of demand fluctuations and dropouts on the GB network.

At present, FRT and recovery requirements for large newer demand types are not backed by a coherent body of technical evidence. Different data-centre designs (including varying combinations of Graphics Processing Units (GPUs), Tensor Processing Units (TPUs), UPS architectures and power-electronics interfaces) may exhibit very different behaviours. Developers and Original Equipment Manufacturers (OEMs) provide mixed messages on what is achievable.

Without clearer evidence and guidance, NESO faces challenges in:

- Defining large demand requirements in the Grid Code and Bilateral Connection Agreement.
- Assessing the impact of new data-centre connections on system security.
- Determining whether and how demand-side support for FRT and ramp-rate management should be treated as a mandatory technical requirement or a market-based service.

Method(s)

The project will used a Work packaged methodology to provide a solution to the problem. The activities for each work package are outlined below.

Work Package 1: Requirements Definition & Stakeholder Engagement

Work Package 1 will establish the evidence base and stakeholder landscape for large-demand FRT and active power recovery, oscillation and ramp rate limits. This will be achieved through a literature review and structured stakeholder engagement.

The literature review will enable the capture of current GB practice and international data including FRT and active power recovery, oscillation and ramp rate limits requirements for large demand.

Stakeholder engagement will enable the mapping of future key stakeholders and the capture of technical capability and constraints for FRT, proportional load behaviour and fast recovery, and will document developers' and OEMs' views on what is realistically achievable. Structured engagement with at least two external stakeholders per focus area will be engaged to provide a viable scope, specifically 10 GB data centre developers and operators and at least 2 UPS and Battery OEMs. Stakeholder map will be agreed with NESO to ensure proper coverage of variety of technical configurations and projects.

Work Package 1 Activities:

- Literature Review
- Stakeholder Engagement
- Model Requirements Definition
- Data Centre Accelerator Concept Development

Work Package 2: Model Development & Analysis

Work Package 2 will develop and apply a simplified technical modelling framework to test candidate solutions for FRT, active power recovery, ramp rate, and load profile oscillation.

Work package 2 Activities:

- Equivalent Network Model Development
- PSCAD Data Centre Model Development
- Scenario Definition & Simulation

Work Package 3: Reporting & Delivery

Work package 3 will translate technical and stakeholder findings into practical recommendations and a future collaboration framework.

Work package 3 includes the definition of FRT and active power recovery envelopes, achievable oscillation and ramp rate limits, development of a specification for RMS and EMT submissions models for large data centres supported by a cost-benefit analysis, and

the development of practical options for incorporating the recommended envelopes and model content in future Grid Code modifications and/or standard BCA clauses for large demand.

Work package 3 Activities:

- Fault Ride Through & Active Power Recovery Envelope Definition
- RMS/EMT Submission Model Specification Development
- Grid Code & BCA Integration Strategy

In line with the ENA's ENIP document, the risk rating is scored Low [5/6].

TRL Steps = 1 (2 TRL Steps)

Cost = 1 (£212,500.00)

Suppliers = 1 (2 suppliers)

Data Assumptions = 2/3 (Assumptions known but will be defined within project/Assumptions unknown to be explored and validated within project)

Total = 5/6

Measurement Quality Statement

The success measures for DC-RIDE are:

For Work Package 1:

- Breadth and diversity of stakeholder engagement, including engagement with at least two stakeholders per focus area to provide a viable scope, specifically 10 GB data centre developers and operators and at least 2 UPS and Battery OEMs. Stakeholder map will be agreed with NESO to ensure proper coverage of variety of technical configurations and projects.
- Quality and depth of technical insights gathered through stakeholder engagement.
- Robustness of evidence base, including literature review, stakeholder evidence and supporting data.
- Clarity, completeness and technical justification of modelling requirements and assumptions for Work Package 2.

For Work Package 2:

- Model reliability and usability: The data-centre electrical study model will be sufficient to capture FRT, proportional load behaviour and active power recovery for the purposes of this NIA project. The data centre model will be approved via review and agreed with stakeholder engagement.
- Clarity and usability of model documentation: submit clear model user guide along with the model and a workshop of model handling should be held to ensure the knowledge transfer.
- Breadth of scenario coverage: Scenarios will focus on balance and unbalanced faults and voltage dips at or near the Grid Entry Point, with durations and depth aligned to NESO's target FRT profile, and with pre-fault load levels reflecting both typical and high-stress operating conditions. In total, approximately 216 scenarios will be considered. This will consist of 6 fault types, 6 technology configurations, 3 connection strengths and voltages, and balanced and unbalanced faults.

For Work Package 3:

- Clarity, practicality and technical justification of recommendations on a variety of technical requirements including FRT and recovery, oscillation limits and ramp rate limits and modelling requirements.
- Stakeholder engagement, including engagement with at least 10 stakeholder organisations and documented feedback on draft recommendations.
- Completeness of outputs against the agreed project scope and objectives.
- Strength of the defined forward pathway, including clearly identified next steps, owners, dependencies and implementation considerations.

Data Quality Statement

The following data will be used in the project:

- IEEE models pertaining to UPS, Cooling Apparatus, data centre load objects,
- Thevenin equivalent enabling data, e.g. Electricity Ten Year Statement (ETYS) Appendix D,

- Data centre load profiles based on GPU architecture,
- Cooling power requirements,
- Variable Speed Drive (VSD) controllers
- FRT requirements

All the data above is available in the public domain.

Scope

The project focuses on demand-side behaviour of large data centres at the transmission connection point. It will use simplified, fit-for-purpose dynamic modelling to study FRT and active power recovery, but it will not develop full GB-standard RMS or EMT submission models. Instead, it will investigate and recommend what such models should consist of, based on the findings. The project will engage stakeholders to capture technical capability and constraints for FRT, proportional load behaviour and fast recovery, and to understand developers' and OEMs' views on what is realistically achievable.

Objective(s)

The DC-Ride project has five key objectives:

1. Assess industry capability and available technical solutions
2. Develop a standardised and representative data-centre modelling framework
3. Assess data-centre performance under GB-representative network conditions
4. Recommend fit-for-purpose performance envelopes for large demand connections
5. Define RMS and EMT modelling and submission requirements

Consumer Vulnerability Impact Assessment

DC-RIDE is not expected to have a direct impact on consumers in vulnerable situations during the project. However, it will improve understanding of how large data centres behave during faults and voltage disturbances and provide evidence to support appropriate technical requirements for future large-demand connections.

By supporting the secure integration of growing data-centre demand, the project has the potential to improve system resilience and security of supply. These benefits would be shared across all consumers, including those in vulnerable situations who may be disproportionately affected by supply interruptions.

No adverse technical, financial or wellbeing-related distributional impacts are anticipated. The project does not involve changes to consumer energy costs, tariffs or service provision.

Success Criteria

The key outputs of DC-RIDE are:

- Work Package 1 technical report covering current practice, stakeholder views, and gaps; a stakeholder map and DCA concept; modelling requirements.
- Work Package 2 technical report summarising the developed models, solution performance, limitations, and sensitivity to network strength and site design.
- PSCAD Data Centre Block Model with Configurable Technology Options and User Guide.
- Work Package 3 technical report including FRT envelopes and recommendations and a high-level specification for RMS and EMT submission models for large data centres.
- Final technical report collating and summarising the activities and findings from each Work package.
- A NIA closure report to disseminate project findings.

The success criteria for DC-RIDE are that:

- Stakeholder engagement and a literature review have been completed to a sufficient level such that data centre technical capabilities and constraints for FRT (including proportional load behaviour and fast recovery), oscillation and ramp rate limits are captured, and developers' and OEMs' views on what is realistically achievable is documented. Modelling inputs and assumptions are clearly defined to inform model development.
- A configurable PSCAD model has been developed that captures data-centre FRT, active power recovery, ramp rate, and load profile oscillation behaviour, and can differentiate the impacts of different data-centre configurations and solutions.
- FRT and active power recovery envelopes for large data centres have been recommended, and a high-level specification is provided for what RMS and EMT submission models for large data centres should contain. Outputs are directly usable for Grid Code/BCA updates with clear forward pathways.

Project Partners and External Funding

Project Partner: Frazer-Nash Consultancy Ltd

Potential for New Learning

The DC-RIDE project will generate new knowledge on the fault ride-through (FRT), proportional load response and active power recovery capabilities of large data centres under GB-representative conditions. It will investigate how UPS control strategies can support secure network operation during and following voltage disturbances.

The project will develop a reusable modelling framework to assess different data-centre configurations and support the design of 'Grid-Code-ready' solutions. It will also provide recommendations on future FRT requirements and the content of RMS and EMT submission models for large data centres.

Supported by stakeholder engagement, the project will also outline a Data Centre Accelerator concept to support future collaboration across the sector.

Findings will be shared through:

- Project closedown report published via the ENA Smarter Networks Portal;
- Stakeholder workshops and presentations;
- Industry conferences and events, where appropriate.

Scale of Project

The project will be primarily desk based. For complete mapping of key future stakeholders, engagement with international entities such as ERCOT and AEMO will be carried out.

Technology Readiness at Start

TRL2 Invention and Research

Technology Readiness at End

TRL4 Bench Scale Research

Geographical Area

The project is applicable across Great Britain and focuses on transmission-connected data centres connecting to the GB electricity network. The modelling, analysis and recommendations developed through the project are intended to inform future Grid Code requirements and connection arrangements for large-demand customers across GB. Stakeholder engagement will primarily involve GB network companies, data-centre developers, hyperscalers and OEMs, with selected engagement of international organisations to capture relevant experience and best practice from global data-centre markets.

Revenue Allowed for the RIIO Settlement

None

Indicative Total NIA Project Expenditure

Project spend broken down by Work Package:

· Work Package 1 – Requirements Definition & Stakeholder Engagement - £42,500.00

· Work Package 2 – Model Development & Analysis - £85,000.00

· Work Package 3 – Reporting & Delivery - £63,750.00

· Project Meetings & Workshops - £21,250.00

· Internal costs – £18,000.00

· Other internal costs – £2,000.00

Total estimated project cost £232,500.00

The costs presented by Work package reflect the direct project delivery activities. In accordance with the NIA Governance and Licence Condition requirements (including the provision for up to 25% of project costs for internal expenditure), the total reported project cost may differ from the sum of work package costs outlined above. All costs are reported to Ofgem in full through formal regulatory reporting at the end of each financial year.

Project Eligibility Assessment Part 1

Requirement 1

Facilitate the energy system transition and/or benefit consumers in vulnerable situations

Please answer **at least one** of the following:

How the Project has the potential to facilitate the energy system transition:

DCIRIDE has the potential to facilitate the energy system transition by enabling the secure integration of rapidly growing, large electricity demands into an increasingly lowIcarbon power system. As the GB moves toward a renewableIdominated grid, system stability becomes more sensitive to both supply variability and demand behaviour. Data centres, which can operate at hundreds of megawatts per site, represent a rapidly growing source of electricity demand with uncertain behaviour during faults and voltage disturbances.

The project addresses these challenges by improving understanding of how large data centres behave during disturbances and by identifying ways to ensure they remain connected and recover smoothly following faults. Through modelling and analysis, DCIRIDE will assess whether data centres can meet fault rideIthrough and fast active power recovery requirements, and what technical measures are needed to achieve this.

The project will generate the technical evidence needed to inform future Grid Code and connection requirements. By recommending realistic performance requirements and modelling approaches for large-demand connections, it will reduce uncertainty for system operators, developers and OEMs, enabling more efficient connection of new loads while maintaining system security and resilience.

Finally, DCIRIDE supports long-term innovation and coordination across the energy sector. Through stakeholder engagement and the proposed Data Centre Accelerator, it will create a platform for collaboration between operators, developers and technology providers, helping to accelerate the deployment of secure, Grid-Code-ready data-centre solutions.

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

DCIRIDE is not expected to deliver direct benefits specifically targeted at consumers in vulnerable situations. However, the project will improve understanding of how large data centres behave during faults and voltage disturbances and provide evidence to support appropriate technical requirements for future large-demand connections.

By supporting the secure integration of growing data-centre demand, the project has the potential to improve system resilience and security of supply. These benefits would be shared across all electricity consumers, including those in vulnerable situations who may be disproportionately affected by supply interruptions and power quality issues.

The project is not expected to result in any adverse technical, financial or wellbeing-related impacts on consumers in vulnerable situations. Any future benefits are expected to be broadly distributed through improved system planning, resilience and network operation.

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

n/a

Please provide a calculation and/or description of the expected benefits of the solution

No quantitative benefit calculation has been undertaken at this stage, as the expected benefits of DC RIDE are primarily technical and evidence-based. The project is intended to establish the evidence needed to inform future requirements and solutions

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

The project is highly replicable across GB as it focuses on generic technical requirements and representative modelling approaches for transmission-connected large data centres, rather than site-specific solutions.

The modelling framework, technical evidence and recommendations developed through DC-RIDE will be applicable to data-centre developers, hyperscalers, OEMs, NESO, Transmission Owners and Distribution Network Operators involved in assessing and connecting large-demand customers across Great Britain.

DC-RIDE will generate the technical evidence needed to inform future Grid Code and connection requirements, enabling the learnings to be applied consistently across future large-demand connections and supporting wider adoption of 'Grid-Code-ready' data-centre solutions.

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

DC-RIDE is a knowledge and evidence-generation project. Rollout across GB would primarily involve adoption of the project's recommendations through future Grid Code requirements, connection agreements and engineering practices. As implementation requirements will depend on the project's findings, rollout costs cannot be robustly quantified at this stage.

Requirement 3 / 1

Involve Research, Development or Demonstration

Projects 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

Involve Research, Development or Demonstration - Please select all that apply

☐ 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

This project will systematically assess whether hyperscale data centres can meet realistic fault ride-through (FRT) and active power recovery requirements under GB-representative conditions. The learning generated will provide NESO and network licensees with an evidence base to support the assessment and integration of large-demand connections, reducing current uncertainty regarding the behaviour of data centres during faults and voltage disturbances.

The findings will inform future Grid Code modifications, connection requirements and standard BCA clauses for large demand customers. The project will also provide recommendations on appropriate RMS and EMT model requirements, enabling more consistent connection assessments, system studies and network planning activities. This will support network licensees in maintaining system security and resilience as large data-centre demand continues to increase across GB.

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. Networks must explicitly mention similar projects that they have considered and how these differ.

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

DC-RIDE will not duplicate existing projects; instead, it will build on relevant international research and apply the learning to the GB electricity system. Relevant projects reviewed include:

· EPRI's Data Center Flexible Load Initiative (DCFlex) – US funded project studying common data centre capabilities but not for policy making and is not GB specific which makes it different to the proposed project.

· DESNZ Data Centre Growth & Energy Impact Study – National level modelling of AI driven data centre expansion, infrastructure impacts, cluster effects, and future reinforcement needs. This project is more about the system planning and growth impacts which make it different to the proposed project.

· NESO (NIA2_NESO098) – Data Centre Siting & System Value Analysis – Completed project assessing siting constraints, regional hosting capacity, connection challenges, and solutions such as dynamic connections and onsite storage. This project is about location and connection strategy, not detailed ride through behaviour hence makes it different from the proposed project.

· DCConnect (NIA2_NGET0092) – Project forecasting and visualising future data centre demand to support strategic grid planning, highlighting clustering pressures and transmission system impacts. This project focuses on demand forecasting and strategic planning; not technical disturbance performance hence makes it different from the proposed project.

Unlike these projects, DC-RIDE focuses on GB-specific fault ride-through, active power recovery and large-demand connection requirements, generating evidence to inform future Grid Code provisions, connection agreements and network planning. As such, the project complements rather than duplicates existing work.

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 is innovative in several specific ways:

GB-specific FRT and recovery assessment for large demand. Where existing work focuses mainly on generators, this will be the first GB-focused project to systematically test whether hyperscale data centres can meet realistic FRT and active power recovery envelopes under GB-representative conditions.

Use of data-centre UPS and related assets as FRT tools. UPS (Uninterruptible Power Supply) systems are traditionally designed only to protect IT equipment. This project will investigate how UPS control modes, potentially combined with devices such as STATCOMs, can be configured to maintain proportional load during dips and to support controlled, fast active power recovery, while respecting resilience requirements.

Generic, reusable modelling framework. Instead of relying on NESO's confidential GB master model, the project will develop a Thevenin-equivalent framework calibrated using ETYS fault-level data. This framework will be simple enough for data-centre developers and OEMs to use themselves to design 'Grid-Code-ready' solutions.

Investigation of fit-for-purpose RMS and EMT model requirements. There is currently no standard for what model detail NESO requires from data-centre developers. The project will not build these RMS/EMT submission models, but will use the study results to recommend what such models should contain, and identify areas where more detailed EMT or hardware-in-the-loop studies may be

needed in future projects.

Structured stakeholder and international engagement. The project will engage GB data-centre developers, hyperscalers, OEMs, TOs and DNOs, and will also draw on lessons from foreign TSOs such as ERCOT and AEMO. It will outline a concept for a Data Centre Accelerator (DCA) to provide a long-term collaboration mechanism similar to the Offshore Wind Accelerator.

Relevant Foreground IPR

1. A comprehensive literature review on viable options that allow data centres to support grid stability while maintaining operational resilience.
2. A simulation report providing robust evidence on how data centres behave during faults and disturbances, reducing current uncertainty around their system impact.
3. This project develops a reusable, configurable modelling framework to support system studies and connection assessments.

Data Access Details

Data for this project and all other projects funded under the Network Innovation Allowance (NIA), or 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
   Via our managed mailbox innovation@neso.energy

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 a part of it's business and usual activities

Network Licensees would not fund the DCIRIDE project as part of businessIasIusual activities because it addresses uncertain, emerging challenges that fall outside routine operational activities. There is currently limited evidence on how large data centres behave during faults and disturbances, and the associated Grid Code requirements are still evolving. As a result, the work carries a level of technical risk, innovation, and wholeIsystem scope that is not suitable for standard operational funding, making it more appropriate for innovation mechanisms such as the NIA.

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 DCIRIDE project can only be undertaken with support from the Network Innovation Allowance (NIA) because it sits firmly outside the scope of normal operational and capital activities, requiring innovation funding to address high uncertainty and system-wide challenges.

Its outputs are strategic and industry-wide, rather than delivering immediate operational improvements. Because of this uncertainty, innovation, and whole-system scope, the project carries risks that are not suitable for businessIasIusual funding.

As a result, NIA support is essential to de-risk these concepts, build evidence, and enable future deployment.

This project has been approved by a senior member of staff

☑ Yes