

NIA Project Registration and PEA Document

Date of Submission

Oct 2026

Project Reference Number

NGED_NIA_092

Project Registration

Project Title

GRIDLOCK (Generation Resource Impact Diagnostics for Low voltage Operational Circuit Knowledge)

Project Reference Number

NGED_NIA_092

Project Licensee(s)

National Grid Electricity Distribution

Project Start

October 2026

Project Duration

1 year and 3 months

Nominated Project Contact(s)

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Project Budget

£708,000.00

Summary

GRIDLOCK project is an NGED led project delivered in partnership with the PNDC and the University of Strathclyde. The project will investigate the impact of DC injection from inverter-based LCTs, including solar, battery storage and Vehicle-to-Grid, on LV distribution network assets. Through a staged programme of research, laboratory testing and real-time simulation, the project will assess potential impacts on transformers, cables, protection systems and power quality. The project aims to develop an evidence base to support future engineering standards, network planning and asset management decisions, whilst determining whether current UK DC injection limits remain appropriate under DFES scenarios. Harmonising the standards, would provide benefits to customers by reducing inverter costs for all LCTs, this is a direct result of reducing testing and certification requirements.

Third Party Collaborators

PNDC

Problem Being Solved

The rapid deployment of inverter-based Distributed Energy Resources (DERs), including solar PV, battery energy storage systems (BESS) and Vehicle-to-Grid (V2G) technologies, is increasing the level of direct current (DC) injection onto low-voltage (LV) distribution networks. Current United Kingdom (UK) standard Energy Networks Association (ENA) Engineering Recommendation G99 limits DC injection to less than 0.25% of the inverter's Alternating Current (AC) output rating, whilst equivalent international standards, including CENELEC EN 50549-1 and IEEE 1547, permit up to 0.5%.

There is currently limited evidence regarding the cumulative impact of DC injection from increasing numbers of inverter-based technologies on LV network assets, including transformers, underground cables, protection systems, monitoring equipment and power quality. The current UK limit is precautionary in nature and was established when DER penetration was significantly lower than current and forecast levels.

Without a robust evidence base, Distribution Network Operators (DNOs), manufacturers, standards bodies and regulators cannot

determine whether existing UK limits remain appropriate, whether harmonisation with international standards can be achieved safely, or whether additional mitigation measures may be required in future networks with higher DER penetration. Harmonisation with international standards would provide one set of standards where manufacturers of inverters would not need to provide evidence of additional testing and conformity to the UK market. This reduces the cost of current inverter technologies and allows more competition for other manufacturers that would not have normally carried out these extra certification requirements, ultimately reducing the cost for DER installations for customers.

Method(s)

Generation Resource Impact Diagnostics for Low voltage Operational Circuit Knowledge (GRIDLOCK) will utilise a technical research, testing and simulation methodology delivered through three stages with a stage gate in place between each.

Phase 1 – Research and Review

Phase 1 will document the current understanding of DC injection from inverters and its potential impact on the LV network. It will review existing research, manufacturer information, UK and international standards, inverter compensation techniques and the various factors that influence DC injection. Potentially affected network components, including transformers, Underground (UG) cables, protection devices and Current Transformer (CT) based monitoring equipment will be assessed and prioritised. The research will identify knowledge gaps, potential long-term effects and the areas that require further investigation.

The findings will be used to select up to six components for laboratory testing and develop the phase 2 test plan. Stage Gate 1 will determine whether laboratory testing is required and define the scope, objectives and success criteria.

Deliverables:

- D1: Phase 1 Final Report detailing the findings and learning from the research.
- D2: Online Workshop to disseminate Phase 1 findings to key internal stakeholders.
- D3: Phase 2 Test Plan identifying the components, scenarios and tests to be undertaken.

Phase 2 – Laboratory Testing

Phase 2 will undertake controlled laboratory testing of the key risks and uncertainties identified in Phase 1. Testing will investigate how DC injection varies under different network conditions, including changing harmonic levels, existing DC components and the connection of multiple inverters.

Testing will also investigate the effects of DC injection on selected LV equipment, potentially including transformers, protection devices, monitoring equipment, cables and consumer equipment. Where required, simulations will be undertaken before physical testing to ensure tests remain within safe equipment operating limits.

The results will determine whether DC injection presents a significant risk to network performance, equipment reliability, protection or monitoring. Stage Gate 2 will assess whether remaining questions require wider network simulation and define the scope of Phase 3.

Deliverables:

- D4: Phase 2 Report detailing the findings and learning from laboratory testing.
- D5: Workshop to disseminate and discuss the Phase 2 findings.
- D6: Phase 3 Test Plan identifying the simulations, network conditions and scenarios requiring further investigation.

Phase 3 – Simulation and Modelling

Phase 3 will investigate network conditions and scenarios that cannot be fully replicated through laboratory testing. Real-Time Digital Simulation (RTDS), and where appropriate Power Hardware-in-the-Loop (PHIL), will be used to model relevant LV network configurations, inverter behaviours and DC injection scenarios.

The simulations will build directly on the findings from Phases 1 and 2, providing a wider assessment of the potential impact of DC injection across the LV network. The combined findings will provide evidence to support policy, engineering requirements and potential changes to relevant industry standards and recommendations such as G99.

Deliverables:

- D7: Phase 3 Report detailing the findings and learning from simulation and modelling.
- D8: In-person Workshop at PNDC to disseminate the final project findings to key stakeholders.

Scope

GRIDLOCK will investigate the effects of DC injection from inverter-based DER technologies on LV distribution network assets and performance.

The project will:

- Assess existing knowledge, standards and technologies.
- Identify network assets most susceptible to DC injection.
- Quantify impacts through laboratory testing.
- Evaluate cumulative impacts through simulation and modelling.
- Develop evidence-based recommendations relating to future engineering standards and network planning approaches.

Expected benefits include:

- Improved asset management decisions.
- Reduced uncertainty regarding future DER deployment.
- Potential reduction in inverter compliance and certification costs.
- Potential acceleration of low-carbon technology adoption.
- Increased flexibility participation.
- Potential deferral of network reinforcement and associated customer costs.
- Potential direct benefits to electricity distribution businesses include improved network planning, enhanced understanding of asset health impacts, improved engineering policies and evidence-based assessment of future standards changes.

Objective(s)

- Improve understanding of DC injection behaviour from inverters on LV distribution networks.
- Identify and quantify the impact of DC injection on distribution network assets and operational performance.
- Determine whether current UK DC injection limits set out in G99 of 0.25% of the generation output capacity remains appropriate.
- Provide evidence to support future engineering standards, asset management and network planning decisions.

Consumer Vulnerability Impact Assessment

An assessment of distributional impacts (technical, financial and wellbeing related) for this project has been carried out. The outputs of this project have been assessed as having an overall positive impact on consumers in vulnerable situations. The assessment has identified that this project will look to reduce the costs for households, while reducing the number of disruptions to them in the home. Other considerations including the project's impact on supply, immediate health and safety in the home have been made in carrying out this assessment.

The delivery of the project itself will have no impact on customers as it is being carried out as desktop research, controlled environment testing and modelling.

No mitigation measures were generated by the tool for this project.

Success Criteria

Technical Baseline Established: Current industry understanding of DC injection, inverter technologies, standards and existing evidence documented and reviewed.

Asset and Network Risks Identified: Potential impacts on network assets and representative network operating conditions assessed, including identification of which assets are most at risk.

Testing: Representative DER technologies such as Solar and V2G tested under a range of operating conditions.

DC Injection Impacts Understood: Impacts on network assets, power quality and system operation quantified.

Evidence Base Established: DC injection thresholds, key risks and industry assessment methodologies identified.

Network Impact Assessment Completed: Representative network modelling and simulation completed to assess the cumulative impact of DC injection under current and future DER deployment scenarios.

Evidence-Based Findings Valid: Laboratory and simulation results combined to validate key findings and improve understanding of DC injection impacts on LV networks and assets.

Industry Recommendations Developed: Evidence-based recommendations produced regarding DC injection limits, monitoring requirements, mitigation measures and future industry actions, supported by stakeholder engagement.

Project Partners and External Funding

Project Partners - Power Networks Demonstration Centre (PNDC) - University of Strathclyde

PNDC is well suited due to its combination of academic expertise, power-system modelling capability and specialist network testing facilities. PNDC is an industry-facing innovation centre established by the University of Strathclyde and provides a controlled, real-world environment specifically designed for the research, testing, demonstration and de-risking of emerging energy technologies. Its facilities include operational HV and LV demonstration networks alongside communications and monitoring equipment, making it particularly relevant to investigating the behaviour of inverter-connected technologies and their interaction with distribution network equipment

Funding Licensee - National Grid Electricity Distribution (NGED)

The project addresses a potential issue directly relevant to the operation, planning and future development of the electricity distribution network.

External Funding - No external funding is currently anticipated beyond NIA funding mechanisms with a 10% contribution from NGED.

Potential for New Learning

The project will generate new technical learning on the behaviour and potential impacts of unintended DC injection from inverter-connected technologies on LV distribution networks. The learning will be developed progressively through the research, laboratory testing and, where required, simulation phases, allowing findings from each stage to inform the next.

Key areas of learning will include:

- **Cumulative impacts of DC injection on LV network assets:**

Establish whether low levels of DC injection from multiple inverter-connected devices can combine or interact across an LV network, and whether this could result in impacts that may not be apparent when individual devices are considered in isolation.

- **Transformer susceptibility to DC bias:**

Improve understanding of how distribution transformers respond to DC components superimposed on the AC waveform, including potential effects on temperature, vibration and general operating behaviour. The project will investigate the conditions and DC injection levels at which effects become measurable, while ensuring physical testing remains within appropriate safe operating limits.

- **Effects on protection systems and monitoring equipment:**

Assess whether DC injection can influence the accuracy, sensitivity or operation of protection and monitoring equipment, particularly devices that rely on current transformers (CTs). This will help establish whether DC injection could affect network visibility, measurement accuracy, fault detection or protection performance.

- **Interaction between increasing DER penetration and DC injection:**

Investigate whether increasing numbers of inverter-connected Distributed Energy Resources (DER), such as solar PV and battery systems, could change the characteristics or cumulative level of DC injection experienced by the LV network. This will include considering interactions between multiple inverters and the influence of different network conditions.

- **DC injection limits:**

Use the evidence generated through research, testing and simulation to assess whether existing DC injection requirements remain appropriate as inverter-connected generation increases. The project will identify where the evidence supports existing limits and where further consideration by NGED or relevant standards bodies may be appropriate.

Dissemination

A structured dissemination approach will ensure that learning is captured throughout the project and made available to relevant internal

and external stakeholders. This will include:

• **Phase reports :**

Each project phase will produce a detailed technical report documenting the methodology, evidence, results, conclusions and recommendations. These reports will also provide the evidence required to inform subsequent stage-gate decisions.

• **Technical workshops:**

Workshops will be held at key stages to present findings, discuss their implications and gather feedback from relevant technical and operational stakeholders. These will help translate detailed research and testing results into practical engineering learning.

• **NIA reporting:**

In addition to reporting mentioned above, project progress and key learning will be captured through annual Network Innovation Allowance reporting processes, providing visibility of the project's development and emerging outcomes. At project completion, the overall findings from the research, laboratory testing and any simulation activities will be consolidated to provide a clear record of the learning generated, conclusions reached and potential next steps.

• **Smarter Networks Portal and NGED website publications:**

Project outputs and learning will be published through the Smarter Networks Portal and the NGED website, supporting knowledge sharing across electricity network operators and the wider energy sector.

Scale of Project

This project is split into three distinct phases with a stage gate in between each.

The first phase is desktop-based research to further define the problem and approach to later phases. The second phase consists of laboratory-based testing, where representative inverter technologies and network components will be tested under controlled conditions. The third phase will focus on network modelling and simulation studies, using findings from the research and laboratory phases to assess the cumulative impact of DC injection across representative low-voltage networks under a range of future DER deployment scenarios.

All project activities will be undertaken by PNDC at its facilities in Glasgow, utilising its low-voltage demonstration network and specialist research facilities.

Technology Readiness at Start

TRL4 Bench Scale Research

Technology Readiness at End

TRL6 Large Scale

Geographical Area

The project will be undertaken primarily at the Power Networks Demonstration Centre (PNDC) facilities in Glasgow, Scotland.

Project outputs and learning will be applicable across all distribution network licence areas. Representative NGED network and asset data will be used to support testing and modelling activities.

Revenue Allowed for the RIIO Settlement

N/A

Indicative Total NIA Project Expenditure

Total Project Cost: £707,799.10

NIA Funding Requested: £637,019.19

NGED Contribution: £70,779.91

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:

The transition to a Net Zero energy system is expected to significantly increase the deployment of inverter-based Distributed Energy Resources (DERs), including solar photovoltaic (PV) systems, battery energy storage systems (BESS) and Vehicle-to-Grid (V2G) technologies. These technologies rely on power electronic inverters which may introduce small quantities of direct current (DC) onto low-voltage distribution networks.

The GRIDLOCK project will develop an evidence-based understanding of the impact of DC injection on electricity distribution networks and network assets. The project will investigate whether current UK requirements remain appropriate under future DER deployment scenarios and whether alignment with international standards can be achieved without adversely affecting network safety, reliability or asset health.

By reducing uncertainty surrounding future DER integration and informing future engineering standards, network planning and asset management decisions, the project has the potential to support the accelerated deployment of low-carbon technologies and facilitate the transition to a smarter, more flexible and lower-carbon energy system.

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

N/A

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

GRIDLOCK is classified as a research project and therefore the primary benefit is the generation of new knowledge and evidence. The project will improve understanding of the impact of DC injection on low-voltage distribution networks and associated assets, including transformers, underground cables, protection systems and monitoring equipment.

Benefits expected from this project include:

- Reduced uncertainty for future engineering standards and network planning decisions.
- Improved asset management and evidence-based investment decisions.
- Reduced inverter compliance and certification costs if harmonisation with international standards is demonstrated to be technically feasible.
- Increased deployment of low-carbon technologies.
- Increased flexibility participation.
- Potential deferral of conventional network reinforcement.
- The recipients of these benefits would include electricity customers, Distribution Network Operators, equipment manufacturers, DER installers, standards bodies and regulators.

These benefits will be dependant on successfully harmonising standards, this would therefore reduce inverter costs for installation of LCTs.

Based on NGED's Future Energy Scenarios (DFES), rooftop solar deployment across NGED licence areas is forecast to increase by an average of approximately 7.5% per annum through to 2050. Starting from a baseline of around 600,000 domestic solar installations by the end of ED2, derived from approximately 6GW of installed solar generation and an assumed average domestic installation size of 5kW, the number of connected solar customers is expected to grow significantly over the coming decades.

The project has the potential to reduce the cost of solar inverter deployment by harmonising standards and reducing UK-specific certification and testing requirements. A conservative saving of £300 per inverter installation has been assumed. Applying this saving to the forecast uptake of domestic solar installations across NGED's licence areas results in a cumulative customer benefit of approximately £714 million by 2050.

In addition to the direct benefits realised by NGED customers, harmonisation of UK inverter standards and certification requirements will enable the same cost reductions to be realised across other UK distribution network operators. As manufacturers and installers adopt a common set of requirements, customers throughout Great Britain will benefit from lower inverter costs, reduced certification burdens, and more efficient deployment of domestic solar generation, increasing the overall customer value delivered by the project.

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

The learning generated by GRIDLOCK is expected to be highly replicable across Great Britain because all electricity distribution network operators face increasing levels of inverter-based DER deployment and are subject to the same UK engineering standards relating to DC injection.

The methodologies developed through the project, including research approaches, laboratory testing procedures and simulation techniques, have the potential to be applied across all GB electricity distribution licence areas.

The findings are expected to be relevant to:

- All UK Distribution Network Operators.
- Distribution System Operators.
- Inverter manufacturers.
- Standards development organisations including the ENA.
- Regulatory stakeholders including Ofgem.

The learning therefore has the potential to be applied across 100% of GB electricity distribution networks where inverter-connected DER technologies are present

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

GRIDLOCK is a research project and therefore no direct rollout costs are associated with implementation of the project methodology itself.

Should the project identify opportunities for changes to engineering standards, testing methodologies or network planning approaches, implementation costs would be assessed following completion of the project and would depend on the nature of the recommendations produced.

Potential future implementation activities may include:

- Updates to engineering standards and guidance documents.
- Modifications to inverter certification requirements.
- Updates to asset management and network planning processes.
- Adoption of testing and assessment methodologies developed through the project.
- At this stage, insufficient evidence exists to accurately quantify any future implementation costs, and one of the objectives of the project is to generate the information required to support such future assessments.

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

The learning generated through the GRIDLOCK project will be applicable to all Electricity DNOs across Great Britain due to the increasing deployment of inverter-based DERs, including PV, BESS and V2G technologies. These technologies are connected under common UK engineering standards and therefore present a shared challenge for all network licensees.

The project will develop a better understanding of how DC injection from inverter-based technologies affects LV network assets, including distribution transformers, UG cables, protection systems, monitoring equipment and power quality. The evidence generated will help network licensees understand whether current DC injection limits remain appropriate and identify any asset-specific thresholds or mitigation requirements.

The learning can be used by network licensees to:

- Improve asset management strategies by understanding the long-term effects of DC injection on network assets.
- Support network planning and forecasting activities as DER penetration continues to increase across GB distribution networks.
- Inform future engineering standards, including potential updates to ENA Engineering Recommendation G99 and related guidance documents.
- Develop evidence-based policies relating to inverter connections, monitoring requirements and asset protection measures.
- Establish repeatable testing and assessment methodologies that can be adopted by other network licensees when evaluating DC injection impacts on their own networks.
- Improve understanding of the relationship between increasing DER deployment, network flexibility and asset performance.

The project will also generate learning for standards bodies, manufacturers and regulators by providing a robust technical evidence base to support future decisions regarding DC injection limits and the integration of low-carbon technologies. If the project demonstrates that harmonisation with international standards can be achieved safely, the learning could facilitate reduced equipment compliance costs, increased DER deployment and improved flexibility opportunities across all UK distribution networks.

Project findings will be disseminated through technical reports, stakeholder workshops, NIA reporting and publication of project outputs on our website, ensuring that learning is available to all relevant network licensees and industry stakeholders.

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.

The purpose of GRIDLOCK is to investigate the cumulative impact of DC injection from modern inverter-based DERs on LV distribution network assets through a combination of laboratory testing, Power Hardware-in-the-Loop (PHIL) testing and network modelling.

Whilst National Grid Electricity Transmission (NGET) NIA2_NGET0074 (CODA: Coordinated design and control of multi-infeed HVDC integrated power systems) is undertaking innovation relating to power electronics and inverter-dominated power systems, this work focuses on transmission networks, system operability and HVDC applications rather than DC injection impacts on distribution assets. As a result, this project was assessed and confirmed no duplication is taking place.

Similarly, SP Energy Networks project NIA_SPEN_0028 – Transition to Low Voltage DC Distribution Networks (Phase 1) assessed the feasibility of intentionally operating LV distribution networks using DC and examined associated network design, safety and efficiency considerations. However, it did not investigate the cumulative effects of unintentional DC injection on conventional AC networks, including impacts on transformers, protection systems, power quality or asset health. GRIDLOCK therefore addresses a distinct knowledge gap.

GRIDLOCK will build on earlier research into DC injection by University of Strathclyde while updating the evidence base to reflect modern inverter technologies and anticipated future uptake of solar PV, battery storage and vehicle-to-grid technologies. The project will develop understanding of cumulative DC injection impacts on network assets, assess the suitability of existing DC injection limits, and create methodologies that can be adopted by electricity distribution licensees across Great Britain.

The primary aim of GRIDLOCK is to address a recognised knowledge gap relating to:

- The cumulative impact of multiple inverter-based technologies operating on low-voltage networks.
- The effects of DC injection on network assets, including transformers, underground cables, protection systems and monitoring equipment.
- The suitability of existing UK DC injection limits under future network conditions.
- The development of repeatable assessment methodologies that can be used by electricity distribution licensees throughout Great Britain.

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

National Grid Electricity Distribution is not aware of any active or completed innovation projects that specifically investigate the cumulative impacts of DC injection from inverter-based Distributed Energy Resources (DERs) on low-voltage distribution network assets and operation. NIA2_NGET0074 and NIA_SPEN_0028 were assessed, no duplication will be carried out.

Additional Governance And Document Upload

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

The GRIDLOCK project is innovative because it will deliver the first comprehensive assessment of the cumulative impacts of DC injection from large populations of inverter-based DERs on GB LV DNOs. While existing standards place limits on DC injection from individual devices, there is currently insufficient evidence to understand whether these limits remain appropriate as solar PV, battery storage, heat pumps and electric vehicles are deployed at scale. This uncertainty creates a challenge for network operators, manufacturers and standards bodies seeking to support the transition to a low-carbon energy system.

The project will generate new evidence on how cumulative DC injection affects network assets and operation, including transformers, underground cables, protection systems, monitoring equipment and power quality. By quantifying these impacts under both current and future DER deployment scenarios, the project will establish whether existing engineering assumptions and standards remain fit for purpose or require revision.

The innovation lies in moving the industry from a position of limited evidence and conservative assumptions to one based on quantified network impacts and validated engineering understanding. This will enable more informed decisions on inverter requirements, network planning, asset management and future standards development. The project therefore has the potential to unlock more cost-effective integration of low-carbon technologies, avoiding unnecessary constraints or over-specification while maintaining network safety and

reliability.

Although previous studies have investigated DC injection, including work undertaken by the University of Strathclyde in 2005, the impacts associated with modern inverter technologies and high levels of DER deployment have never been comprehensively assessed across representative GB distribution networks. GRIDLOCK will address this gap by providing the evidence base required to support future network operation in increasingly inverter-dominated energy systems

Relevant Foreground IPR

The project will generate Relevant Foreground IPR relating to:

- Laboratory testing methodologies.
- DC injection assessment methodologies.
- Simulation models.
- Technical recommendations.
- Asset threshold and performance datasets.
- Analytical techniques for assessing cumulative DC injection impacts.

All relevant foreground IPR will be treated in line with the standards NIA requirements.

Data Access Details

Project data will be shared with interested parties in line with RII0-2 NIA requirements and NGED's innovation data-sharing arrangements. Requests for project data can be made through NGED's innovation team by contacting nged.innovation@nationalgrid.co.uk.

Where possible, shareable outputs will include de-sensitised or aggregated datasets, test and simulation results, methodologies, technical reports and summary findings to support wider industry learning and replication.

Data that cannot be shared due to commercial confidentiality, intellectual property, data protection or network security considerations will be anonymised or aggregated where appropriate to enable key learning to be shared without compromising sensitive information.

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

The project is not considered Business as Usual because its primary purpose is research and the generation of new industry learning rather than the delivery of an established operational activity or network investment. The project seeks to investigate a technical uncertainty that currently has no proven solution and where the outcomes are not known in advance.

There is currently insufficient evidence available for NGED to determine whether existing DC injection limits remain appropriate, whether network assets are materially affected by increasing levels of inverter-based technologies, or whether harmonisation with international standards can be achieved safely. The project is therefore exploratory in nature and involves activities that sit outside normal network planning, operational and asset management processes.

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 project can only be undertaken with NIA support because it seeks to address an industry-wide uncertainty where the benefits, outcomes and future application of the learning cannot be fully quantified before the research is completed. The project involves a range of technical, commercial and regulatory risks that would not normally justify investment through Business-as-Usual funding routes.

Technical risks include uncertainty regarding the existence and magnitude of cumulative DC injection impacts, uncertainty regarding the susceptibility of network assets, uncertainty regarding future DER deployment scenarios, and uncertainty regarding whether laboratory and simulation studies will identify material impacts that warrant changes to current engineering standards.

Commercial risks include the possibility that the project may conclude current standards remain appropriate, meaning there may be limited direct financial benefit despite successful delivery of the research. There is also uncertainty regarding the future adoption of any project recommendations by standards bodies, manufacturers or regulators.

Operational risks include the availability of specialist equipment, procurement lead times, access to manufacturer data, and dependencies on laboratory testing and simulation activities. The project also requires specialist facilities and expertise provided by

PNDC and the University of Strathclyde.

Regulatory risks include uncertainty regarding whether project findings will support future changes to engineering standards such as ENA Engineering Recommendation G99. Any standards changes would require separate industry consultation, review and approval processes.

This project has been approved by a senior member of staff

☒ Yes