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

Apr 2026

Project Reference Number

NGED_NIA_088

Project Registration

Project Title

Quantum Leap

Project Reference Number

NGED_NIA_088

Project Licensee(s)

National Grid Electricity Distribution

Project Start

May 2026

Project Duration

0 years and 5 months

Nominated Project Contact(s)

Daniel Clements

Project Budget

£331,270.00

Summary

Quantum Leap, is a feasibility study aimed at exploring the potential of quantum sensing technology within the electricity distribution sector. As networks move to a net zero operation, with a high penetration of low carbon technologies, network assets will need to be pushed harder. Quantum Leap by assessing its applications for asset health monitoring and reducing intrusive testing, the project seeks to enhance network operational efficiency and reliability. The study will identify high-impact use cases, evaluate the technology's readiness, and provide a roadmap for adoption and integration. With a focus on innovation, the project addresses the unique challenges of adopting unproven technology against a selection of use cases, ensuring that insights gained can inform future networks adoption. Ultimately, the project aims to lay a solid foundation for the successful deployment of quantum sensing solutions in the energy industry.

Third Party Collaborators

PA Consulting

Problem Being Solved

Quantum Leap aims to address several significant problems associated with current intrusive testing methods in electrical asset management. These traditional methods often lead to service disruptions, which can result in outages and increased operational costs due to the logistics of planned outages. Additionally, intrusive testing poses safety risks to workers and the public, and can potentially damage assets, shortening their lifespan and necessitating costly repairs.

Furthermore, these methods provide limited data points, hindering proactive maintenance and optimization efforts. As a result, energy networks may face reliability concerns and financial burdens from higher operational costs, ultimately affecting the overall efficiency and effectiveness of energy supply management.

The project seeks to mitigate these issues by exploring advanced quantum sensing technology that can enhance monitoring and maintenance without causing disruptions. By conducting a comprehensive feasibility study, the project aims to lay the foundation for the integration of quantum sensors within the electricity industry. This study will assess the technology readiness levels of quantum sensors

and investigate their viability as a realistic solution to the challenges faced in energy asset management. Ultimately, the project aspires to provide valuable insights that will inform decision-making and guide future developments in the use of quantum sensors to improve operational efficiency and reliability in the energy sector

One example use case: the traditional method of intrusive testing on wooden poles involves asset inspectors striking the poles with a hammer at multiple locations to listen for signs of rot or decay. This approach not only relies on subjective interpretation but also poses significant risks to the integrity of the asset. If a pole is deemed to be rotten, a technique, known as resi-drilling, is employed, which further compromises the structural integrity of the pole and can lead to future asset degradation. Additionally, asset inspectors can only assess the condition of the pole above ground, while most wood rot occurs below the surface, leaving the true quality of the asset unknown. This invasive testing method can result in unnecessary damage, increased maintenance costs, and reduced asset lifespan, ultimately impacting the reliability of the electricity distribution network. The need for a more effective and non-intrusive testing solution is critical to ensure the longevity and safety of wooden poles in the energy infrastructure.

Method(s)

The methodology for the Quantum Sensor Project will employ a combination of technical and commercial methods to provide effective solutions to the identified opportunities in electricity asset management. The project will be structured into several work packages, each focusing on specific aspects of quantum sensing technology and its integration into existing systems.

Technical Methods

The technical approach will involve a comprehensive assessment of quantum sensing technologies, including their operational principles, sensitivity limits, and potential applications within the electricity industry. This will be achieved through a series of workshops and stakeholder engagements aimed at identifying high-impact use cases. The project will also include a detailed mapping exercise to evaluate the most suitable quantum sensors for each identified use case, ensuring that the technology aligns with operational requirements and constraints.

Commercial Methods

On the commercial side, the project will focus on understanding the market landscape for quantum sensing technologies, including cost-benefit analyses and potential return on investment for various applications. This will involve gathering data on existing market trends, stakeholder feedback, and regulatory considerations to inform the development of a robust business case for the adoption of quantum sensors. The feasibility study will culminate in a comprehensive report that outlines the viability of quantum sensing solutions, providing a roadmap for future deployment and ensuring that subsequent innovation projects are built on a solid foundation of knowledge.

Measurement Quality Statement

To ensure the integrity of the data collected during the project, a Measurement Quality Statement will be established. This statement will outline the protocols for data collection, analysis, and validation, ensuring that all measurements taken during the desktop study meet industry standards for accuracy and reliability.

Data Quality Statement

A Data Quality Statement will also be included, detailing the processes for managing and maintaining data quality throughout the project. This will encompass data governance practices, including data validation, storage, and access controls, to ensure that all data used in the feasibility study is accurate, complete, and secure. By implementing these quality measures, the project aims to provide reliable insights that will guide the future integration of quantum sensing technology into the electricity sector

Scope

The Quantum Sensor project, titled "Quantum Leap," aims to explore the feasibility of integrating quantum sensing technology into the electricity distribution network. The primary objectives of the project include:

Assessment of Quantum Sensing Technologies

Conduct a comprehensive evaluation of various quantum sensing modalities to identify their operational principles, sensitivity limits, and potential applications within the electricity sector.

Identification of High-Impact Use Cases

Engage with stakeholders through workshops and interviews to identify and prioritise 4 to 6 high-impact use cases where quantum

sensing can enhance monitoring and maintenance of energy assets.

Development of a Feasibility Report

Produce a detailed feasibility report that outlines the viability of quantum sensing solutions, including a roadmap for future deployment and recommendations for subsequent innovation projects.

Cost-Benefit Analysis

Perform a thorough cost-benefit analysis to quantify the financial benefits that could accrue from the adoption of quantum sensors. This analysis will consider potential operational cost savings, reduced maintenance expenses, and improved asset management efficiency.

Environmental Impact Assessment

Evaluate the environmental benefits associated with the implementation of quantum sensing technology, such as reduced carbon emissions from improved energy efficiency and enhanced reliability of the electricity supply.

Net Benefits for Consumers

Financial Benefits

By optimising asset management and reducing operational costs, the project aims to lower electricity prices for consumers. Enhanced monitoring capabilities can lead to fewer outages and disruptions, resulting in cost savings for both the utility and its customers.

Environmental Benefits

The integration of quantum sensors could facilitate a more efficient energy distribution system, contributing to the reduction of carbon emissions and supporting the transition to a sustainable energy future. Improved asset health monitoring can also lead to longer asset lifespans, reducing the need for new infrastructure and its associated environmental impact.

Enhanced Reliability

With better monitoring and maintenance practices enabled by quantum sensing, consumers can expect a more reliable electricity supply, reducing the frequency and duration of outages.

Overall, the Quantum Sensor Project aims to provide a solid foundation for the future integration of quantum sensing technology into the electricity distribution network, ensuring that both financial and environmental benefits are realised for consumers and the broader community

Objective(s)

These objectives aim to ensure that the Quantum Sensor project not only addresses the challenges in energy asset management but also serves as a foundational project that will enable the future integration of quantum sensing technology into the electricity industry, paving the way for innovative solutions and enhanced operational performance.

Evaluate Quantum Sensing Technologies

Conduct a comprehensive assessment of various quantum sensing modalities to understand their operational principles, sensitivity limits, and potential applications within the electricity distribution sector.

Identify High-Impact Use Cases

Engage with stakeholders to identify and prioritise 4 to 6 high-impact use cases where quantum sensing can enhance the monitoring and maintenance of energy assets.

Conduct a Feasibility Study

Develop a detailed feasibility report that assesses the viability of integrating quantum sensing solutions into existing systems, including a roadmap for future deployment.

Perform a High-Level Cost-Benefit Analysis

Quantify the financial benefits associated with the adoption of quantum sensors, including potential operational cost savings, reduced maintenance expenses, and improved asset management efficiency.

Develop a Measurement Quality Statement

Establish protocols for data collection, analysis, and validation to ensure the integrity and accuracy of the data gathered during the feasibility study.

Create a Data Quality Statement

Outline processes for managing and maintaining data quality throughout the project, including data governance practices and validation measures.

Provide Recommendations for Future Innovation Projects

Use insights gained from the feasibility study to inform and guide subsequent innovation projects, ensuring that resources are allocated effectively and reducing the risk of costly missteps.

Support the Transition to a Sustainable Energy System

Contribute to the broader goal of transitioning to a sustainable energy system by leveraging advanced technology to improve the reliability and efficiency of energy distribution

Consumer Vulnerability Impact Assessment

The feasibility study for the Quantum Leap is expected to have positive effects on consumers as a whole also help protect consumers in vulnerable situations by enhancing the reliability and efficiency of the electricity distribution network. By identifying high-impact use cases for quantum sensing technology, the project aims to reduce the frequency and duration of outages, which can affect vulnerable consumers who rely on a stable power supply for essential services. The implementation of advanced monitoring capabilities is likely to lead to lower operational costs, which can translate into reduced energy prices for consumers. Additionally, improved asset management can enhance overall wellbeing by ensuring that vulnerable populations have consistent access to electricity, thereby alleviating stress and uncertainty associated with power disruptions.

Success Criteria

Quantum Sensor Horizon Scan

- A thorough assessment of technology readiness, offering a comprehensive overview of the viability of quantum sensor technology and its anticipated future developments.

Potential Use Case application within NGED

- Identifying and evaluating potential applications for quantum sensors within our operational framework.
- Identification of High-Impact Use Cases - atleast 4 to 6 high-impact use cases for quantum sensing are identified and prioritised based on stakeholder engagement and technical feasibility.

Quantum Sensors Road Map to Deployment

- Conducting a detailed mapping exercise to identify and assess the most suitable quantum sensors for specific business use cases.
- Providing insights into the digital ecosystem necessary to support and enhance quantum sensor technology.
- Exploring complementary technologies and sensors that could be integrated with quantum sensors to achieve the proposed use cases.
- Delivering a high-level cost-benefit analysis to evaluate the commercial viability of developing quantum sensing technology and the associated digital ecosystem against the five most relevant use cases. A high-level cost-benefit analysis is conducted, demonstrating clear financial benefits associated with the adoption of quantum sensors, including potential operational cost savings and improved asset management efficiency.
- Foundation for Future Innovation. The project lays a solid foundation for future innovation projects, providing valuable insights and knowledge that can guide subsequent initiatives in the electricity sector.

Completion of Feasibility Study

- The project successfully completes the feasibility study within the established timeline and budget, delivering a comprehensive

report that assesses the viability of quantum sensing technologies.

Stakeholder Engagement

- Effective engagement with stakeholders is achieved, with positive feedback indicating that their insights and needs have been incorporated into the project.

Measurement and Data Quality Statements

- Both the Measurement Quality Statement and Data Quality Statement are developed and implemented, ensuring that data collection and analysis meet industry standards for accuracy and reliability.

Positive Impact Assessment

- An assessment of the expected effects of the project on consumers, particularly those in vulnerable situations, indicates improved reliability, reduced outages, and enhanced wellbeing.

Documentation and Reporting

- All project documentation is completed, including detailed reports and presentations, and is shared with relevant stakeholders for review and feedback.
- Regulatory Compliance. The project adheres to all relevant regulatory requirements and standards, ensuring that the findings and recommendations are compliant with industry regulations.

Project Partners and External Funding

PA consulting are partnering on this project.

No external funding has been sought for this phase of work.

Potential for New Learning

Quantum Leap presents significant potential for new learning regarding the application of quantum sensing technology within the electricity distribution sector. The parties involved expect to gain insights into the operational principles, capabilities, and limitations of various quantum sensors, as well as their practical applications in enhancing asset management and monitoring. This learning will be disseminated through a structured approach, including the publication of a comprehensive feasibility report that outlines findings, methodologies, and recommendations. Additionally, workshops and presentations will be organised to share insights with stakeholders, ensuring that the knowledge gained is accessible to all relevant parties. By effectively disseminating this learning, the project aims to contribute to the broader understanding of quantum technologies and their potential to transform electricity distribution systems.

Scale of Project

Quantum Leap is structured as a feasibility desktop study, which justifies its scale of investment relative to the potential benefits it aims to deliver. The project requires a dedicated investment to comprehensively assess the readiness and applicability of quantum sensing technologies within the electricity distribution sector. By undertaking a larger-scale feasibility study, the project can explore multiple high-impact use cases and gather extensive data on the operational principles and performance of various quantum sensors. A smaller-scale project would limit the scope of investigation, potentially overlooking critical insights and applications that could arise from a broader analysis.

This comprehensive approach not only enhances the likelihood of identifying viable solutions but also maximises the potential for new learning, ensuring that the findings can effectively inform future innovation projects. Additionally, the feasibility study will provide a crucial "go/no-go" platform at this point in time for development of sensor technology, allowing stakeholders to make informed decisions about further investments. By establishing a clear understanding of the technology's capabilities and limitations, the project can potentially save money on future development efforts, reducing the risk of investing in unproven or ineffective solutions. Ultimately, the scale of this feasibility study is essential to fully understand the transformative potential of quantum sensing technology and to lay a solid foundation for its integration into the electricity industry.

Technology Readiness at Start

TRL3 Proof of Concept

Technology Readiness at End

TRL4 Bench Scale Research

Geographical Area

Quantum Leap is designed as a desktop study, focusing on the theoretical assessment and analysis of quantum sensing technologies without the need for physical testing in the field. This approach allows for a comprehensive evaluation of potential use cases, operational principles, and market readiness, enabling stakeholders to make informed decisions based on data and insights gathered from existing literature and stakeholder engagement. The study will specifically take place within the licensed areas of National Grid Electricity Distribution (NGED), which include various regions across England and Wales, ensuring that the findings are relevant to the specific operational contexts of these areas.

Revenue Allowed for the RIIO Settlement

None

Indicative Total NIA Project Expenditure

Total project budget : £331,270

10% NGED Contribution: £33,127

Funding from NIA: £298,143

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:

Quantum Leap has the potential to facilitate the energy system transition by enhancing the monitoring and management of energy assets through advanced quantum sensing technology. By providing more accurate and real-time data on the health and performance of electrical infrastructure, the project can enable proactive maintenance and optimisation of energy distribution systems. This improved visibility will support the integration of renewable energy sources, enhance grid resilience, and contribute to the overall efficiency of the energy network. As the electricity sector moves towards a more sustainable and flexible energy system, the insights gained from this project will be crucial in informing future innovations and potential enhancing current technologies and processes. This will enable adaptability to infrastructure when changing network demands and environmental goals.

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

Not required

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

Not applicable - RIIO-ED2 funded project.

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

Not applicable – Project is desktop feasibility project.

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

Outputs from this project will provide 4-5 use cases for quantum sensing technology development, this will provide roadmaps for deployable solutions that will fall under industry standard commercial arrangements. We expect that these deployable solutions could be utilised and picked up by any other network operator. But at this time costs are not in a position to be defined however the CBA will help determine commercial viability.

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

At this stage we are unable to outline the cost to roll out the method, the outcome of this project is a signal to market for development of quantum sensing technology. The selected 4-5 use cases will identify the most appropriate for quantum sensing application.

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 from Quantum Leap will serve as a strategic roadmap for future innovation activity within the energy sector. By providing a comprehensive understanding of quantum sensing technology, its operational principles, and potential applications. Network Licensees can utilise this knowledge to identify specific areas where quantum sensing can enhance asset management, improve monitoring capabilities, and optimise maintenance strategies. This foundational learning will not only inform the design and implementation of future projects but also facilitate the adoption of innovative solutions that align with the evolving needs of the electricity distribution network, ultimately driving progress towards a more efficient and resilient energy system. To embed this learning within networks and wider industry we host a webinar to showcase outcomes.

The learning from Quantum Leap will be successfully disseminated to Network Licensees and other interested parties through the publication of a comprehensive final report that details the findings, methodologies, and recommendations derived from the feasibility study. This report will serve as a key resource, providing foundational knowledge on quantum sensing technology and its potential applications within the energy sector. To further facilitate the sharing of insights, closedown workshops will be held with internal and external stakeholders, allowing for in-depth discussions and feedback on the project outcomes. These workshops will ensure that the knowledge gained is effectively communicated and understood, fostering collaboration and encouraging the integration of quantum sensing solutions into future innovation projects.

Not applicable - RIIO-ED2 funded project.

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.

Quantum Leap is focused on exploring the potential of quantum sensing technology, which is an emerging field with relatively low technology readiness levels (TRL). This feasibility study aims to assess how quantum sensing can be integrated into the electricity industry, specifically for applications related to asset health monitoring and reducing the need for intrusive testing methods. Given the nascent stage of quantum sensing technology, there are currently no existing projects that we can see within the electricity networks that directly address the specific applications and benefits being investigated in this project. As such, the unique focus on understanding the capabilities and implications of quantum sensing for the electricity sector ensures that no unnecessary duplication will occur, allowing for the development of innovative solutions that can enhance operational efficiency and reliability in energy distribution.

There are other quantum technology projects being explored by networks but these are not focused on quantum sensing but other quantum technologies such as computing, navigation and networking. We have looked at these learnings to understand the quantum landscape more broadly.

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

Not applicable – this is innovative in nature

Additional Governance And Document Upload

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

Quantum Leap is innovative because it explores the application of quantum sensing technology within the electricity distribution sector, a field that remains largely untested and underutilised. Quantum sensing represents a significant advancement over traditional sensing methods, offering enhanced sensitivity and precision for monitoring asset health. This technology has not been widely explored in the energy sector due to its emerging status and the complexities associated with its integration into existing systems. As such, the project aims to investigate its potential benefits and applications, paving the way for future innovations that could transform asset management practices.

Relevant Foreground IPR

It is not expected background IPR to be required to utilise foreground IPR.

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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 several ways:

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 Grid Electricity Distribution already publishes much of the data arising from our innovation projects here so you may wish to check this website before making an application.

- Via our Innovation website at https://www.nationalgrid.co.uk/innovation/
- Via our managed mailbox nged.innovation@nationalgrid.co.uk

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

The project involves a high degree of uncertainty and risk associated with the adoption of an unproven technology. Traditional funding mechanisms are typically reserved for established practices and technologies that have demonstrated effectiveness and reliability. Given that quantum sensing is still in the early stages of development, the project requires dedicated research and development funding to explore its feasibility and potential applications without the constraints of standard operational budgets.

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

Quantum Leap can only be undertaken with the support of the Network Innovation Allowance (NIA) due to the specific risks associated with its implementation, including commercial, technical, operational, and regulatory challenges. The unproven nature of quantum sensing technology presents technical risks related to its integration into existing systems and the need for further validation of its effectiveness in real-world applications. Additionally, there are commercial risks associated with the potential market acceptance of this new technology and its economic viability. The NIA funding provides the necessary resources to conduct this feasibility study, allowing for a thorough exploration of these risks and the development of strategies to mitigate them, ultimately enabling informed decision-making for future deployment.

This project has been approved by a senior member of staff

☑ Yes