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

Oct 2026

Project Reference Number

NIA_UKPN0127

Project Registration

Project Title

Cross Factor

Project Reference Number

NIA_UKPN0127

Project Licensee(s)

UK Power Networks

Project Start

November 2026

Project Duration

1 year and 2 months

Nominated Project Contact(s)

Mubinur.zidan@ukpowernetworks.co.uk

Project Budget

£336,812.00

Summary

The project aims to reduce the time, cost and complexity of creating new connections onto the UK Power Networks 132kV network. It will assess whether a 145kV-rated branch joint, combined with a single-bay Gas Insulated Switchgear (GIS) substation, can provide a safe and reliable alternative to the current standard three-bay GIS arrangement. As part of the project, the branch joint will be tested, certified and, if successful, integrated into BAU operations.The project responds to growing connection demand driven by the energy transition, including low-carbon generation, emerging technologies and the electrification of heat, transport and industry. Existing connection methods can be intensive on time, costs and resources. A more efficient approach could reduce civil works, outage requirements and connection costs while supporting network growth, without compromising safety or reliability. This will help UK Power Networks deliver the infrastructure needed for the transition to Net Zero.

Third Party Collaborators

TE Connectivity

Nominated Contact Email Address(es)

innovation@ukpowernetworks.co.uk

Problem Being Solved

The electricity network is evolving rapidly as demand for new connections increases due to electrification, low-carbon technologies, distributed generation, and wider net zero commitments. UK Power Networks must continue to deliver faster, more flexible, and more resilient connections while supporting the objectives of RIIO-ED2 and preparing the network for ED3. This includes improving customer service, increasing network resilience, and enabling timely access to capacity for both urban and rural areas.

A key area of focus is the growing 132kV network and the need to accelerate providing network capacity. The current standard approach for creating a new connection onto a 132kV network is through the installation of a new three-bay GIS substation. This is a

proven and robust long-term solution that provides operational flexibility, protection integration, and future network extensibility. However, delivery of a new 132kV GIS site can be costly and time-intensive due to the need for additional switchgear, civil works, land requirements, outages, and commissioning activities. The approach also increases asset complexity and introduces additional points of failure onto the network.

As we transition into ED3 and ramp up the net-zero preparation, the volumes of projects delivered at 132kV are expected to increase significantly.

A potentially suitable solution would be to use a combination of a branch joint and single-bay GIS substation to establish such connections. This would significantly reduce the complexity, time and cost required to establish new connections compared with the current three-bay GIS methodology. However, such branch joints are only currently type tested at 110kV. The ability to raise the voltage rating to achieve a 145kV-rated branch joint would bring significant benefit to the network and customers.

Method(s)

The project will evaluate a branch joint manufactured by TE Connectivity for use at 145kV as a complementary connection solution for suitable applications on UK Power Networks' 132kV network. The assessment will determine whether the branch joint can provide a safe, reliable and cost-effective alternative to the conventional three-bay GIS connection arrangement (when installed alongside a single-bay GIS substation).

The project will be delivered through the following stages:

- Define the technical test specification, applicable standards and UK Power Networks' requirements.
- Review the supplier's proposed test programme and agree the required test sequence.
- Establish clear acceptance criteria, including the pass and fail requirements for each test.
- Complete the agreed electrical and mechanical tests at the 145kV voltage specification.
- Review the test results, certification and supporting technical evidence.
- Complete the UK Power Networks engineering assurance and technical approval process.
- Update the relevant engineering standards, design guidance and installation procedures.
- Capture learning from the project and support the transition of the branch joint into BAU use.

The work will be undertaken in collaboration with TE Connectivity at its testing facility in China. It will involve testing the supplier's existing 110kV branch joint design against the requirements necessary to demonstrate suitability for a 145kV-rated application on the UK Power Networks 132kV system. The detailed delivery plan and testing schedule will be agreed with the supplier.

Scope

The project will assess the technical suitability of a 145kV-rated branch joint for use on the UK Power Networks 132kV network. It will establish the technical evidence, certification, engineering documentation and internal approvals required to determine whether the design can be accepted for BAU application.

The scope includes:

- Preparing and agreeing the technical assessment requirements.
- Identifying the relevant industry standards and UK Power Networks' requirements.
- Reviewing and agreeing the supplier's proposed test programme.
- Witnessing the agreed electrical and mechanical testing activities.

- Reviewing the test results, certification and supporting technical documentation.
- Confirming that the design meets UK Power Networks' safety, operational, installation and performance requirements.
- Completing the relevant engineering assurance and technical approval processes.
- Developing or updating engineering standards, design guidance, installation procedures and other supporting documentation.
- Approving the branch joint for BAU use where all technical and assurance requirements have been satisfied.

Testing will focus on demonstrating the electrical and mechanical performance of the branch joint under conditions representative of installation and operation on the UK Power Networks electricity network. Successful completion of the project will provide UK Power Networks with the evidence and documentation required to introduce the branch joint as an approved connection solution for suitable 132kV applications.

Objective(s)

The project has the following objectives:

- Demonstrate the technical suitability of a 145kV-rated branch joint for application on the UK Power Networks 132kV network through an agreed programme of factory acceptance testing and engineering assessment;
- Establish the evidence, assurance, and approvals required to support acceptance of a new 132kV branch joint solution within UK Power Networks' standards and governance processes; and
- Improve network resilience, flexibility, and customer service outcomes by increasing the range of approved connection solutions available for constrained and time-critical connection projects, reducing connection delivery times and construction complexity.

Consumer Vulnerability Impact Assessment

The project has the potential to support all customers, including vulnerable customers, by enabling faster and more cost-efficient delivery of the network infrastructure required to support the energy transition. As the demand for LCTs increases, more efficient methods to expand and reinforce the network are required. If successful, the branch joint could be deployed on the network to help deliver new network connections more efficiently than current methods. Customers would benefit from faster LCT connections and will therefore be able to access the benefits of LCTs more quickly.

The project also has the potential to improve network resilience. The branch joint could provide an efficient method to restore customers' electricity supplies following certain network events, helping to reduce the duration of supply interruptions. Faster restoration times and increased flexibility in responding to network events would benefit all customers, particularly vulnerable customers who may be disproportionately affected by a loss of electricity supply.

Furthermore, the branch joint has the potential to lower the cost of delivering future network connections and reinforcement, therefore enabling more efficient delivery of network investment. The reduced delivery cost would ultimately reduce pressure on customer bills while supporting the transition to a resilient, low-carbon electricity network.

Success Criteria

The project will be considered successful upon:

- Completion of the agreed factory acceptance testing and engineering assessment, evaluating the branch joint's suitability for the UK Power Networks 132kV network.
- Completion of a report which assesses whether the branch joint solution can provide a cost-effective alternative to conventional 132kV three-bay GIS arrangements by reducing construction complexity, installation time, and overall project delivery costs while maintaining network resilience and customer service outcomes.

Project Partners and External Funding

N/A

Potential for New Learning

The project aims to generate learnings on the applicability, adoption and implementation of a 132kV branch joint on the network, and specifically an understanding of the improved efficiency that the branch joint enables over the current procedure, (e.g. the savings in time and cost).

Scale of Project

The proposed level of investment will support the development, testing, and validation of the branch joint at the manufacturer's facility, as well as the creation of all associated documentation, including operational standards and procedures required for deployment into UK Power Networks' BAU operations. The project has been carefully scoped to achieve the objectives while minimising the risks associated with introducing and evaluating new equipment on the network. The scale of investment is proportionate to the expected benefits and reflects the resources required to successfully deliver the project's outputs. Any reduction in scale would risk limiting the development, testing, certification, and documentation activities necessary to demonstrate the branch joint's suitability for 132kV applications, preventing the project from generating the evidence, learning, and operational outputs needed to support adoption into BAU operations.

Technology Readiness at Start

TRL7 Inactive Commissioning

Technology Readiness at End

TRL8 Active Commissioning

Geographical Area

Tests will be carried out at Kunshan, China in accordance with the relevant standards and procedures but the outputs would potentially be replicable across all three of UK Power Networks' networks.

Revenue Allowed for the RIIO Settlement

No funding was provided within the current RIIO settlement that will become surplus to requirements as a result of this project.

Indicative Total NIA Project Expenditure

The total project budget is £336,812, of which 90% (£303,131) will be recovered from NIA.

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 project has the potential to facilitate the energy system transition by reducing the time, cost and complexity associated with connecting new generation, energy storage and low-carbon demand to the 132kV network. As electrification accelerates and increasing volumes of renewable generation, battery storage, electric transport, heat and industrial demand seek to connect, UK Power Networks will need to deliver additional network capacity more quickly and efficiently.

The development of a 145kV-rated branch joint, used alongside a single-bay GIS substation, could provide a more efficient alternative to constructing a conventional three-bay GIS substation where technically appropriate. This approach could reduce the amount of switchgear, civil engineering, land, construction activity, outages and commissioning work required for a new connection. As a result, customers could connect to the network sooner, supporting faster deployment of low-carbon technologies and reducing the risk that connection times constrain progress towards net zero.

In addition, the reduced equipment, land and construction requirements could lower embodied carbon, minimise site disturbance and reduce the future inspection and maintenance burden associated with additional network assets.

Following successful testing, certification and integration into engineering standards, the project could establish a safe, scalable and cost-effective connection method that enables quicker access to network capacity while supporting a more resilient, flexible and efficient electricity system.

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

The project has the potential to benefit customers in vulnerable situations by supporting a more resilient, reliable and cost-efficient 132kV network. If successful, the branch joint could enable network connections to be delivered faster, helping to facilitate the uptake of LCTs. This will ensure that all customers, including those in vulnerable situations, can access the benefits of the energy transition.

The branch joint arrangement could also provide greater operational resilience and flexibility during network faults, potentially allowing supplies to be restored more quickly. Reduced restoration times would particularly benefit customers who are medically dependent on electricity, have limited mobility, live with long-term health conditions, or may otherwise find it difficult to cope with a loss of supply.

In addition, the branch joint has the potential to reduce network investment delivery costs and minimise disruption near homes and community facilities. More effective and cost-efficient network investment would help to reduce pressure on customer bills, which is especially important for customers experiencing financial vulnerability.

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.

The project has the potential to deliver net benefits to consumers by reducing the cost, time and complexity of connecting to and reinforcing the 132kV network. Replacing a conventional three-bay GIS substation with a 145kV-rated branch joint and single-bay GIS substation, where technically appropriate, could reduce equipment, civil works, land and construction requirements.

These efficiencies could enable faster customer connections, improve network resilience and allow investment to support more projects. If adopted at scale, the solution could lower whole-life network costs and reduce pressure on consumer bills while helping to deliver a reliable, flexible and net zero-ready electricity network.

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

As Cross Factor is focused on the technical assessment, testing, and approval of a 145kV-rated branch joint solution for application on the UK Power Networks 132kV network, it is not currently possible to accurately quantify the full financial and operational benefits. The scale of benefits will ultimately depend on the final approved design, deployment methodology, network application, and future commercial availability of the technology.

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

If the project is successful, GB DNOs that operate 132kV networks could use the learnings to develop their engineering standards and procedures and adopt the solution for use on their 132kV networks.

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

The project is investigating the applicability of a branch joint for the 132kV network. The cost to roll out and deploy the branch joint will differ depending on the chosen supplier and network.

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 learnings developed by this project could be used by other networks to assess the suitability of a 132kV branch joint for their respective 132kV networks. The learnings are intended to support the development of their own engineering standards and

operational procedures and support the adoption and wide-spread use of branch joints as an alternative option to deliver 132kV connections.

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.

Several projects have explored 132kV cabling and joints. However, no project has investigated the use of a branch joint at 132kV. Similar projects include:

Innovative 132kV Joint Development: Developed a transition joint between legacy 132kV gas-compression cable and XLPE cable. It focused on repairing and replacing obsolete cable systems rather than establishing a new branch connection.

132kV Trifurcating Joint: Developed a compact joint connecting three-core fluid-filled cable to three single-core polymeric cables, reducing the required joint-bay size. This was a cable-transition solution and did not create an additional network or customer connection.

Innovative Monitoring of GIS Cable Terminations: Investigated non-intrusive monitoring of 132kV cable terminations to detect mechanical movement and emerging defects. It concerned condition monitoring of existing GIS terminations rather than developing an alternative connection arrangement.

The proposed project will therefore not duplicate previous innovation activity. It will generate new learning by testing, certifying and approving a 145kV-rated branch joint specifically for branching from an existing 132kV cable circuit. Its intended use, when paired with a single-bay GIS substation, as a lower-cost, less complex alternative to a three-bay GIS connection arrangement is distinct from the repair, cable-transition, monitoring and overhead-line projects identified.

A review of projects published on the ENA Innovation Portal found no existing project investigating the testing and approval of a 145kV-rated branch joint for creating new connections from an existing 132kV cable circuit. As noted above, several related 132kV projects were identified, but their technical applications and intended outcomes differ from the proposed project.

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

The project is innovative because it will investigate the suitability of a 145kV-rated branch joint as an alternative to the conventional three-bay GIS substation (when installed alongside a single-bay GIS substation) for suitable connections to the 132kV network. Although the branch joint technology exists at 110kV, it has not been tested, certified or approved for this application on the UK Power Networks 132kV network.

The project will generate new technical evidence through testing at the higher voltage rating and develop the standards, acceptance criteria and procedures required for deployment. If successful, it will introduce a new connection method that could reduce construction complexity, delivery time, land requirements and cost while improving network flexibility and resilience.

Relevant Foreground IPR

The project will generate foreground IPR in the form of:

- New engineering standards and operational procedures relating to the deployment of the branch joint on the 132kV network.
- Other related documentation such as installation and commissioning requirements and training documentation.
- The test specification and acceptance criteria for the branch joint.

Any modifications to the design of the branch joint made as a result of the project will also fall under the foreground IPR.

Background IPR required to use the relevant foreground IPR will include TE Connectivity's current branch joint design and related specifications, documentation and knowledge. The background IPR will also include UK Power Networks' current engineering standards and procedures related to branch joints and the 132kV network.

Data Access Details

A description of how any data (de-sensitised where necessary) that are expected to be gathered in the course of the project can be requested by interested parties, and, if applicable, reasons why such data cannot be released to interested parties. This requirement may be met by including a link to the publicly available data sharing policy, which is required by virtue of paragraphs 2.13-2.16 of the RIIO-2 NIA Governance Document.

Where appropriate, de-sensitised data and non-confidential findings will be made available to interested parties in alignment with our Data Sharing Policy. UK Power Networks recognises that Innovation projects may produce network and consumption data, and that this data may be useful to others. This may be shared with interested parties, whenever it is practicable and legal to do so, and it is in the interest of GB electricity customers. In accordance with the Innovation Data Sharing Policy, UK Power Networks aims to make available all non-personal, non-confidential-sensitive data on request, so that interested parties can benefit from this data.

To view the UK Power Networks' Innovation Data Sharing Policy, please visit the website here:

UKPN Innovation Data Sharing Policy

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

The project cannot be funded through BAU activities because it involves the development and assessment of a novel 132kV branch joint that has not yet been proven for use on the network. Significant uncertainty remains over whether the solution will successfully complete design verification, type testing, certification, and engineering approval processes, and whether it will demonstrate the expected operational and economic benefits in a real-world network environment. Until these activities are completed, there is no certainty that the technology will be suitable for deployment or adopted at sufficient scale to justify the upfront investment required for its development and qualification. NIA funding is therefore required to manage these uncertainties, generate transferable learning and establish whether the solution can be safely adopted into BAU operations.

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 involves developing and testing an innovative application. Currently, there are no DNO-approved branch joints available for use on the 132kV network. The testing, certification and engineering assurance activities will generate learning for the wider industry, but there is no guaranteed deployment volume or commercial return for the supplier. Without NIA funding, the cost of testing and qualifying the solution cannot be justified, particularly while the technical feasibility

and future demand remain uncertain.

The project carries several risks that prevent it from being delivered through normal BAU investment:

· Technical risk: The existing branch joint has been tested at 110kV, but its suitability at the 145kV equipment rating has not been demonstrated. The joint may fail the agreed tests, require design modifications, or ultimately prove unsuitable for UK Power Networks' operational requirements.

· Commercial risk: The testing programme requires upfront investment without certainty that the product will achieve approval, be deployed at scale or generate sufficient future benefit to recover the development costs. Individual connection projects would not be able to fund development because they need proven, approved equipment within defined delivery timescales.

· Operational risk: Introducing a new joint configuration onto the 132kV network requires careful assessment of installation, protection, earthing, bonding, maintenance, fault response and restoration arrangements. Failure of a branch joint could affect multiple connected circuits or customers, so UK Power Networks must build appropriate evidence before authorising deployment.

· Delivery risk: Access to specialist testing facilities is limited, and the programme depends on the availability of TE Connectivity's facility in China. Unsuccessful testing could result in additional costs and programme delays.

· Regulatory and assurance risk: The solution must satisfy relevant standards and pass UK Power Networks' engineering assurance and approval processes before it can be used on the network. Successful testing does not automatically guarantee approval or adoption into BAU practice.

· Innovation and learning risk: The key outputs will include test evidence, acceptance criteria, standards, procedures and application guidance. These outputs provide wider network learning but do not create an immediate physical asset or guaranteed financial return.

NIA support enables UK Power Networks to manage these uncertainties, establish whether the solution is safe and technically viable, and disseminate the learning. If successful, the project could unlock a lower-cost and faster alternative to a conventional three-bay GIS arrangement. If unsuccessful, it will still produce valuable evidence on the limitations of branch joint technology at 145kV, preventing other network companies and consumers from incurring the cost of repeating the same investigation.

This project has been approved by a senior member of staff

☑ Yes