

# Energy Networks Innovation Process NIA Project Registration and PEA Document



Date of Submission: 24/04/2025

# NIA Project Registration and PEA Document

Notes on Completion: Please refer to the NIA Governance Document to assist in the completion of this form. Please use the default font (Calibri font size 10) in your submission. Please ensure all content is contained within the boundaries of the text areas. The full-completed submission should not exceed 12 pages in total.

## 1. Project Registration

Project Title ( <i>This cannot be changed once registered</i> )	Project Reference
Voltmetric	NIA_SSEN_0080
Funding Licensee(s)	Project Start Date
Scottish Hydro Electric Power Distribution plc	April 2025
Nominated Project Contact(s)	Project Duration
Tim Sammon, Innovation Programme Delivery Manager at SSEN	18 months
Contact Email Address	Project Budget
fnp.pmo@sse.com	£996,000

### Project Summary (125 words limit)

This project will explore combining and analysing data from Smart Meters and LV monitors with information from the HV and EHV networks and DFES to produce an index of voltage and power quality health, and how this could be used to inform the deployment of voltage and power quality management techniques and policies to improve strategic network investment.

### Lead Sector

Electricity Distribution <input checked="" type="checkbox"/>	Gas Distribution <input type="checkbox"/>
Electricity Transmission <input type="checkbox"/>	Gas Transmission <input type="checkbox"/>

### Other Sectors

Electricity Distribution <input type="checkbox"/>	Gas Distribution <input type="checkbox"/>
Electricity Transmission <input type="checkbox"/>	Gas Transmission <input type="checkbox"/>

### Research Area

Net zero and the energy system transition <input checked="" type="checkbox"/>	Optimised assets and practices <input type="checkbox"/>
Flexibility and Commercial Evolution <input type="checkbox"/>	Whole Energy System <input type="checkbox"/>
Consumer Vulnerability <input type="checkbox"/>	Energy System Transition <input type="checkbox"/>

### Development steps

Technology Readiness Level (TRL) at Start <input type="text" value="2"/>	TRL at Completion <input type="text" value="4"/>
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## 2. Project Details

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### 2.1. Problem(s)

*This should outline the Problem(s) which is/are being addressed by the Project. This cannot be changed once registered.*

#### **Background and Problem**

Scottish and Southern Electricity Networks Distribution (SSEN) have always managed its networks with the aim of accommodating the maximum amount of demand possible while remaining within the Statutory Limits specified in the ESQCR at the consumers' terminals.

However, more recently, the connection of renewable generation and other Low Carbon Technologies, such as electric vehicle (EV) chargers, has started to cause issues with maintaining distribution voltages within the statutory limits. New approaches to both voltage and power quality management are required before the forecast proliferation of these devices cause significant problems on the network.

Innovation projects and deployments in the last decade have explored a range of techniques and resulting policies which can be applied to managing voltage to deliver specific benefits including:

- Reactive Support for the NESO
- Maximising the ability to connect Low Carbon Technologies and generation to the network
- Voltage derived demand response for ESO markets
- Minimisation of losses on the network
- Minimisation of losses in customers' properties

These policies have benefits but potentially conflict with each other meaning they cannot be delivered concurrently in the same location. Project QUEST, led by ENWL, is working on how these objectives can be built into an overall voltage management policy.

Voltage management is also closely linked with management of power quality, especially on networks with high penetrations of LCT and renewable generation. In many cases voltage and power quality issues are leading indicators that issues will arise relating to exceeding limits especially on the lower voltage network.

#### **Opportunity**

The increased availability of more granular network data from LV monitoring devices, smart meters and other sensors gives the opportunity to understand voltage and power quality at scale across the network for the first time.

This project will explore the analysis of these datasets, with information from the HV and EHV networks and DFES, to produce an index of voltage and power quality health, and how this could be used to inform the deployment of voltage and power quality management techniques and policies via network strategic investment planning

The project aims to learn from and build on the existing health and load indices which provide a standardised methodology for the assessment of network assets, and a common and calibrated means of quantifying the value of a load and condition-based investment. A Health Index is a method used to assess the condition and criticality of assets consistently across the industry. It provides a common view of asset health, allowing comparison with similar assets. Applied uniformly by all DNOs, it offers clarity to stakeholders and regulators and helps DNOs prioritise investment in network health.

In the same way that health and load Indices provide a means of measuring the need for and impact of large volume investments, this project will create an Index, considering both Voltage and Power Quality, allowing similar assessments to be made for investment to improve voltage and power quality

#### **Benefit**

When combined with the cost of the interventions that are driving this performance, the Voltage and Power Quality index will allow whole system investment decisions to be made in an informed manner across a large population of sites in the same way that Load and Health indices currently do. This should facilitate further LCT connections by allowing networks to make proactive interventions to avoid voltage driven constraints.

## 2.2. Method(s)

*This section should set out the Method or Methods that will be used in order to provide a Solution to the Problem. The type of Method should be identified where possible, e.g. technical or commercial.*

*For RIIO-2 projects, apart from projects involving specific novel commercial arrangement(s), this section should also include a Measurement Quality Statement and Data Quality Statement.*

This project will:

- Identify the data required to determine a Voltage and Power Quality index:
  - Understand the methodologies used for LI and HI to inform the construction of a VI methodology
  - Consider data relating to connectivity, load flow, smart meter, network monitoring and power quality
- Implement a data collection method and frequency:
  - Considerations given to use of both historical and real-time data
  - Data sets that would be reasonable for all DNOs to be able to access with the appropriate investment e.g. Smart Meter Voltage data, LV monitoring, Tap Changer Status information etc
- Determine the calculation method(s) of voltage indices for a variety of scenarios:
  - Scenarios may include networks under different conditions
  - Perform the calculations of indices at an appropriate frequency and granularity
- Consider and assess the impact (performance and cost) of applying different network interventions
- Run test cases to verify the approach:
  - At different network locations
  - For different network types (e.g. rural/urban, high/low embedded generation, high/low load)
- Review the impact that the Voltage and Power Quality index have in relation to the existing Load index and Health index
- Revise, update and provide a verified design for a Voltage and Power Quality index

### **Data Quality Statement (DQS): -**

The project will be delivered under the NIA framework in line with Ofgem, ENA and SSEN internal policies. Data produced as part of this project will be subject to quality assurance to ensure that the information produced with each deliverable is accurate to the best of our knowledge and sources of information are appropriately documented. All deliverables and project outputs will be stored in our internal systems with appropriate backup and version management. Relevant project documentation and reports will also be made available on the ENA Smarter Networks Portal and dissemination material will be shared with the relevant stakeholders.

### **Measurement Quality Statement (MQS): -**

The methodology used in this project will be subject to supplier quality assurance regimes and the source of data, measurement process and equipment as well as data processing will be clearly documented and verifiable. The measurements, designs and assessments will also be clearly documented in the relevant deliverables and final project report made available for review.

## 2.3. Scope

*The scope and objectives of the Project should be clearly defined including the net benefits for consumers (eg financial, environmental, etc). This section should also detail the financial benefits which would directly accrue to the GB Gas Transportation System and/or electricity transmission or distribution.*

The project will identify a new methodology for the identification of a Voltage and Power Quality index that could be applicable for use by all DNOs and could be recognised by Ofgem as a basis for regulatory investment. The Voltage and Power Quality Index should:

- Allow regulators and network operators visibility to compare the relative performance of networks in relation to Voltage and Power Quality Management
- Be applicable at all Distribution levels, from EHV to LV.

The benefit calculation is based on the National Infrastructure Commission - Report [Electricity-Distribution-Networks-report-21-Feb-2025.pdf](#). Cumulative profile of load related expenditure from now up to 2050 from the core scenarios in the national modelling shows around £37-£50 billion of investment in the distribution network is required to ensure the efficient transition to net zero.

The CBA is based on 0.25% deferment of the load related expenditure detailed in the NIC report. The net benefit is valued at £5.4m in RIIO-ED3 for GB. It should be noted that one of focus of the project is to refine and further develop the benefits use case.

## 2.4. Objectives

*This cannot be changed once registered.*

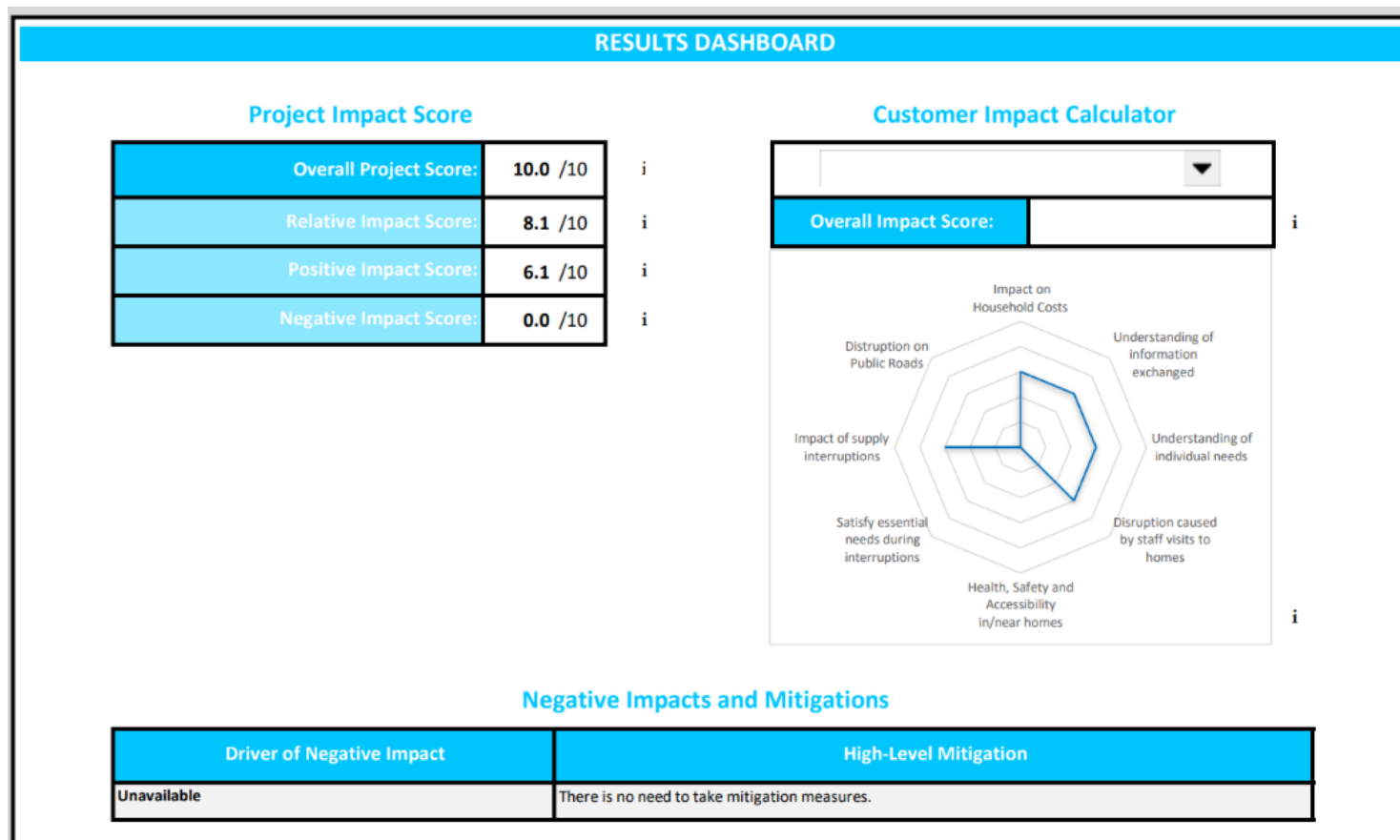
The project objective is to develop a Voltage and Power Quality index to be used as an investment driver and to:

- Define an industry standard following engagement with ENA, on the reporting and visualisation of Voltage and Power Quality index that is applicable and could be used by all DNOs
- Synergise with existing Load and Health indices
- Define consumer improvements Ensure the model is applicable across our industry by engaging early in the design stage with another DNO
- Engage with Ofgem to demonstrate that provision of a voltage indexing model could identify areas of the network where voltage performance could be improved with investment for the benefit of customers
- Enable DNOs to move to an approach where Voltage and Power Quality is managed in a more active manner, applying the most appropriate voltage policy on a spatio-temporal and real time basis

## 2.5. Consumer Vulnerability Impact Assessment (RIIO-2 projects only)

*Details of the expected effects of the Method(s) and Solution(s) upon consumers in vulnerable situations. This must include an assessment of distributional impacts (technical, financial and wellbeing-related). For RIIO-1 projects please add "Not Applicable"*

This project will identify opportunities to improve power quality, reduce costs and improve reliability for all network consumers including those in vulnerable situations. Please see below the results dashboard:



## 2.6. Success Criteria

*Details of how the Funding Licensee will evaluate whether the Project has been successful. This cannot be changed once registered.*

For the project to be considered a success it will have defined a Voltage and Power Quality index that is replicable and supported by SSEN Distribution along with full consultation and engagement with all DNOs, Ofgem and ENA. This approach will de risk and enable the success of the future approval and rollout of an index.

## 2.7. Project Partners and External Funding

*Details of actual or potential Project Partners and external funding support as appropriate.*

Not applicable

## 2.8. Potential for New Learning

*Details of what the parties expect to learn and how the learning will be disseminated.*

All learning will be captured and disseminated through industry events and NIA closure reports.

New learnings will include a Voltage and Power Quality Index that can be applied consistently as a standard used by all DNOs and provide stakeholders and Regulators with clarity of prioritisation of network investment.

## 2.9. Scale of Project

*The Funding Licensee should justify the scale of the Project – including the scale of the investment relative to the potential benefits. In particular, it should explain why there would be less potential for new learning if the Project were of a smaller scale.*

The project scale has been kept as small as reasonably practicable in terms of developing a voltage index that could be used by other DNOs. Also, the scale of the project in terms of duration has been carefully considered to allow for the creation and sharing of the outputs to help inform RIIO-ED3 which will maximise the potential benefits. To help us ensure we achieve this we will engage early with another DNO so that we can identify improvements on the applicability of the proposed voltage index model across our industry, which will then be applied across GB.

## 2.10. Geographical Area

*Details of where the Project will take place. If the Project is a collaboration, the Funding Licensee area(s) in which the Project will take place should be identified.*

As the project intends to create a new Voltage and Power Quality methodology the first phase of the project will have no trial sites in the distribution network. However, as the Voltage and Power Quality index evolves consideration will be given to running trials to verify the accuracy and suitability of the method, using either/both SEPD and SHEPD licence areas.

## 2.11. Relevant Foreground IPR

*Details of expected Relevant Foreground IPR which will be generated in the Project. If applicable, this must also explain if Background IPR will be required to use the Relevant Foreground IPR.*

The project will generate a new engineering voltage and power quality index methodology. As this is intended to benefit all DNOs, should their deployment be justified, the methods will be freely available to all DNOs as part of the dissemination activities.

It is unlikely that any Background IPR will be required to use the new models.

## 2.12. 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.*

For information how to request data gathered in the course of this project, see Network Innovation Competition (NIC) and Network Innovation Allowance (NIA) Data Sharing Procedure at <https://ssen-innovation.co.uk/innovation-strategy/>

## 2.13. Revenue allowed for in the current RIIO settlement

*An indication of the funding provided to the network licensee within the current RIIO settlement that is likely to be surplus to requirements as a result of the Project.*

No revenue has been provided in the RIIO-ED2 allowance for this work.

## 2.14. Indicative Total NIA Project Expenditure

*An indication of the total Allowable NIA Expenditure that the Funding Licensee expects to reclaim for the whole of the Project (RIIO1).*

*An indication of the Total NIA Expenditure that the Funding Licensee expects to reclaim for the whole of the Project (RIIO2).*

The total project expenditure is expected to be £996,000

## 3. Project Eligibility Assessment

*There are slightly differing requirements for RIIO-1 and RIIO-2 NIA projects. This is noted in each case, with the requirement numbers listed for both where they differ (shown as RIIO-2 / RIIO-1).*

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### 3.1. Requirement 1 - facilitate the energy system transition and/or benefit consumers in vulnerable situations (Please complete sections 3.1.1 and 3.1.2 for RIIO-2 projects only)

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

#### 3.1.1. How the Project has the potential to facilitate the energy system transition:

This project is aimed at helping to facilitate a just transition to a low carbon energy system. Whole system investment decisions made in an informed manner will allow further LCT connections by allowing networks to make interventions to avoid voltage driven constraints.

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

Not applicable

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### 3.2. 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.*

#### 3.2.1. Please provide an estimate of the saving if the Problem is solved (RIIO-1 projects only)

Not applicable as this is not a RIIO-1 project.

#### 3.2.2. Please provide a calculation of the expected benefits the Solution

*This is for Development or Demonstration Projects, not required for Research Projects. It should be (Base Cost – Method Cost, Against Agreed Baseline) and include a description of the recipients of the benefits.*

The benefit calculation is based on the National Infrastructure Commission - Report [Electricity-Distribution-Networks-report-21-Feb-2025.pdf](#)

Cumulative profile of load related expenditure from now up to 2050 from the core scenarios in the national modelling shows around £37-£50 billion of investment in the distribution network is required to ensure the efficient transition to net zero.

The option chosen for the CBA is based on 0.25% deferment of load related expenditure, which is valued at £5.4m in RIIO-ED3 for GB. It should be noted that one focus of the project is to refine and further develop the benefits use case.

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

*This must be in terms of the number of sites, the sort of site the Method could be applied to, or the percentage of the Network Licensees system where it could be rolled-out.*

Aim is to replicate the method across all GB DNO licensees' systems.

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

Data requirements will differ for each DNO. An estimate of the roll out costs will be provided as part of the project outcomes.

### 3.3. Requirement 3 / 1 – involve Research, Development or Demonstration

#### 3.3.1. RIIO-1 Projects

A RIIO-1 NIA Project **must have the potential to have a Direct Impact on a Network Licensee's network or the operations of the System Operator and involve the Research, Development, or Demonstration of at least one of the following (please tick which applies):**

A specific piece of new (i.e. unproven in GB, or where a Method has been trialled outside GB the Network Licensee must justify repeating it as part of a Project) equipment (including control and communications systems and software)	<input type="checkbox"/>
A specific novel arrangement or application of existing licensee equipment (including control and/or communications systems and/or software)	<input type="checkbox"/>
A specific novel operational practice directly related to the operation of the GB electricity transmission or distribution systems	<input type="checkbox"/>
A specific novel commercial arrangement	<input type="checkbox"/>

#### 3.3.2. RIIO-2 Projects

A RIIO-2 Project must involve the Research, Development or Demonstration of at least one of the following:

A specific piece of new equipment (including monitoring, control and communications systems and software)	<input type="checkbox"/>
A specific piece of new technology (including analysis and modelling systems or software), in relation to which the Method is unproven	<input type="checkbox"/>
A new methodology (including the identification of specific new procedures or techniques used to identify, select, process, and analyse information)	<input checked="" type="checkbox"/>
A specific novel arrangement or application of existing gas transportation, electricity transmission or electricity distribution equipment, technology or methodology	<input type="checkbox"/>
A specific novel operational practice directly related to the operation of the GB Gas Transportation System, electricity transmission or electricity distribution	<input type="checkbox"/>
A specific novel commercial arrangement	<input type="checkbox"/>

### 3.4. Requirement 4 / 2a – develop new learning

A Project must develop new learning that can be applied by Gas Transporter and/or Electricity Transmission or Electricity Distribution licensees. For RIIO-1 Network Licensees may wish to address challenges specific to their network.

Please answer one of the following:

#### 3.4.1. Please explain how the learning that will be generated could be used by relevant Network Licenses

The learning that will be generated could be used by all DNO licensees to better understand how well their networks are performing and this will enable them to manage and deliver targeted investments based on the voltage and power quality of their networks. Regulatory investment resulting from this new metric could ensure improved customer experience in being able to operate their LCT equipment without voltage or power quality issues.

3.4.2. Or, please describe what specific challenge identified in the Network Licensee's innovation strategy is being addressed by the Project (RIIO-1 only)

Not applicable

3.4.3. Is the default intellectual Property Rights (IPR) position being applied?

*This cannot be changed once registered.*

Yes <input checked="" type="checkbox"/>	No <input type="checkbox"/>
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*If "no", the following questions must be answered:*

3.4.4. Demonstrate how the learning from the Project can be successfully disseminated to Network Licensees and other interested parties:

Not applicable

3.4.5. Describe how any potential constraints or costs caused, or resulting from, the imposed IPR arrangements

Not applicable

3.4.6. Justify why the proposed IPR arrangements provide value for money for customers:

Not applicable

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### 3.5. Requirement 5 / 2c – be innovative

*A Project must be innovative (ie not a business as usual activity) and have an unproven business case entailing a degree of risk warranting a limited Research, Development or Demonstration Project to demonstrate its effectiveness. This could include Projects which are untested at scale, or in relation to which there are risks, which might prevent the widespread deployment of the equipment, technology or methodology.*

3.5.1. Why is the project innovative?

*RIIO-1 projects must include description of why they have not been tried before.*

The increased availability of more granular network data from LV monitoring devices, smart meters and other sensors gives the opportunity to understand voltage and power quality at scale across the network for the first time.

This project will explore analysis of this data with information from the HV and EHV networks and DFES to produce an index of voltage and power quality health, and how this could be used to inform the deployment of voltage and power quality management techniques and policies via network strategic investment planning.

3.5.2. Why is the Network Licensee not funding the Project as part of its business as usual activities?

No BaU funding exists for this type of work. The problem is only beginning to emerge as more LCTs connect to the network. The methodologies being considered in the project have yet to be fully proven and their suitability has never been fully demonstrated.

3.5.3. Why can the Project only be undertaken with the support of NIA?

*This must include a description of the specific risks (e.g. commercial, technical, operational or regulatory) associated with the Project*

This project requires collaboration between DNOs and the industry to be successful, as well as performing trials on a DNO network. Therefore, the funding provided via NIA is suited for this type of project for it to progress into BaU. The methodology being considered is yet to be proven.

### 3.6. Requirement 6 / 2d – 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.*

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

Work has been done to date under other innovation projects, e.g. ENWL delivering QUEST and CLASS (more broadly to develop a voltage management policy) and our project is leveraging the learning outcomes from these projects. In addition, this project will be leveraging the learnings from the ongoing BEET project by Northern Powergrid.

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

Not applicable as no other project to date has sought to develop a Voltage and Power Quality index to use as an investment driver.

## 4. PEA approval

*The senior person (RIIO-1) or senior network manager (RIIO-2) responsible for implementing RIIO-2 NIA Projects must approve the PEA. It must then be published on the Project Registration page of the Smarter Networks Portal.*

<b>Please confirm this project has been approved by a senior member of staff</b>	<input checked="" type="checkbox"/>
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