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

Jul 2025

Project Reference Number

NIA_SPEN_0115

Project Registration

Project Title

Substation Criticality POC project

Project Reference Number

NIA_SPEN_0115

Project Licensee(s)

SP Energy Networks Distribution

Project Start

July 2025

Project Duration

0 years and 6 months

Nominated Project Contact(s)

Mikaelle Lopes Diniz

Project Budget

£120,000.00

Summary

Asset criticality in this context refers to the process of evaluating and ranking In-Scope Assets based on their importance to an organisation's operations and the potential consequences of their failures. The goal of this project is to develop a 'Substation Criticality' Assessment Tool that assigns an overall score to each substation based on multiple criticality factors such as but not limited to:

- Design configurations
- Operation & Maintenance
- Network & customer impact
- Physical security
- Cyber security
- Network security
- Source capacity limitations
- Climate / flooding zones
- Known data confidence

This tool will enable the ability to prioritise maintenance and capital investment effectively while ensuring operational efficiency and reliability. At this Proof of Concept stage, the tool will be an excel based PowerBi Dashboard.

Third Party Collaborators

Capgemini

Nominated Contact Email Address(es)

innovate@spenergynetworks.co.uk

Problem Being Solved

The maintenance of 33kV and 11kV substations has faced several challenges, particularly in establishing a centralised view of substation criticality across various key metrics. There have been previous attempts to address this issue within SPEN, however the tools have been developed in silo and did not have a holistic view of all the different criticality factors that should be considered.

Method(s)

The criticality scoring criteria should include the following parameters (in no particular order) as a minimum:

- Design Configuration: the architectural layout and design of the substation, specifically the redundancy features.
- Operation and Maintenance: the existing procedures for maintaining the equipment in the substation.
- Physical Security: the risk of physical damage to the equipment, due to vandalism or theft, and the measures in place to protect the substation.
- Environmental factor: the asset's compliance to our sustainability policies and the risk it is facing from experiencing damage due to environmental factors, such as natural disasters or storms.
- Cyber / Network Security: the risk of cyber threats or attacks on the equipment, and the safeguards in place to protect the substation's control and communications from threat actors.
- Network Restoration: whether the substation is part of a Distributed Restoration Zone (DRZ) and how critical it is for the restoration pathway.
- Number of Customers: the total number of customers that are connected to the substation.
- Type of Customers: the nature of customers that are connected to the substation, e.g residential or industrial, and if there are any vulnerable customers connected, such as hospital.

The chosen partner(s) may suggest additional scoring criteria or alternative definitions. Once the list of criticality parameters has been approved, the partner(s) would create the scoring definitions and develop a PoC Substation Criticality Assessment Tool. Following the completion of Stage 1, SPEN will review the outputs and the business case, and decide if they would like to proceed onto Stage 2. The proposed scope is as follows:

1. **Desktop study of existing substation assessment tools**
    1. Review the tools that already exist and are being implemented by other networks globally.
2. **Create scoring definitions**
    1. Identify and define key metrics for evaluating substation criticality, including the ones identified in the Objectives section.
    2. Produce scoring definitions for each parameter.
3. **Stakeholder interviews**
    1. Engage with key stakeholders within SPEN to ensure the criteria and metrics used in the criticality index matrix are comprehensive and agreed upon.
4. **Develop criticality assessment tool PoC.**
    1. Assign appropriate weights to each metric to reflect their relative importance.
    2. Create a matrix that integrates these metrics to produce an overall criticality score for each 33/11kV primary substation.
5. **Curate a set of data requirements for BaU transition**
    1. Produce a set of requirements to integrate the tool into SPEN's BaU systems, with the aim to have an accessible, real-time substation assessment tool.
6. **Final workshop**
    1. Share the project outcomes with key SPEN stakeholders and provide them with training on the use of the tool.
    2. Gather feedback from users on what is required to refine and improve the tool ahead of BaU integration.

Scope

1. **Enhanced network resilience**
    1. Reduction in unplanned outages (number of outages per year)
    2. Improved fault detection time (average time to detect faults in minutes)
    3. Reduction in single points of failure (number of substations with no redundancy options)
2. **Improved CI/CML performance**
    1. Reduction in customer interruptions (average interruptions per customer per year)
    2. Faster response to critical failures (average response time in minutes)
    3. Faster power restoration in high-priority zones (average restoration time for critical areas)
3. **Reduced emergency maintenance costs**
    1. Reduction in FTE from maintenance costs (£ saved per year)
    2. Lower spend on emergency callouts (£ per year)
    3. Extended asset lifespan (average age of assets before replacement)

4. **More efficient resource allocation.**
    1. Increase in planned vs unplanned work (% of total maintenance activities that are planned)
    2. Increase in remote diagnostics use (% of faults detected remotely before field dispatch)
    3. Better predictive maintenance accuracy (percentage of accurately predicted failures vs actual failures)

Objective(s)

The goal of Stage 1 is to develop an overall 'Substation Criticality' Assessment Tool that assigns an overall score to each substation based on multiple criticality factors. The tool will be underpinned by a newly defined assessment criteria and CNAIM concepts such as Consequences of Failure (CoF) and Criticality Index (CI). This tool should allow you to prioritise maintenance and capital investment effectively while ensuring operational efficiency and reliability.

The assessment criteria could include:

- Design configurations (as developed by Future Network)
- Operation & Maintenance (as developed by Future Network)
- Network & customer impact
- Physical security
- Cyber security
- Network security
- Source capacity limitations (NG distribution location capacity)
- Climate / flooding zones
- Known data confidence
- Any other criteria not covered above

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

The project offers tangible benefits to consumers in vulnerable situations by enabling more targeted and equitable investment decisions across the substation network. By incorporating factors such as physical security, cyber resilience, and network configuration into the Criticality Index, the tool helps identify substations whose failure would disproportionately impact communities with limited resilience or access to alternative services. This includes rural areas, low-income urban zones, and regions with high concentrations of medically dependent or elderly populations. The project's emphasis on stakeholder interviews ensures that lived experiences and local vulnerabilities are captured in the assessment criteria. Moreover, the integration of failure data and usage patterns allows SPEN to prioritise upgrades and maintenance in areas where outages would pose the greatest risk to health, safety, and wellbeing. By aligning asset management with social impact, the project supports SPEN's broader commitment to inclusive energy transition and regulatory obligations under the Vulnerability Strategy.

Success Criteria

1. Delivery of an internally validated methodology and assessment criteria to use to assess Substation asset criticality
2. The delivery of a Proof of Concept dashboard visualizing Substation Criticality across SPEN assets and using SPEN data.
3. Final report in MS Word including method, outputs, stakeholders consulted, final PoC tool details and next steps

Project Partners and External Funding

Capgemini- Supporting the development of the criticality assessment methodology and proof of concept tool. Not providing any funding.

Potential for New Learning

An expanded understanding of Criticality assessment beyond CNAIM

The project introduces a broader set of criticality criteria that go beyond the standard CNAIM Consequence of Failure (CoF) categories including but not limited to;

- Cyber security
- Physical security
- Climate and flooding risk
- Network configuration and customer impact
- Data confidence levels

This allows SPEN to capture a more holistic view of substation risk, enabling prioritisation that reflects operational realities more

accurately.

Quantitative Scoring with Visualised Insights

The tool introduces a Criticality Index (CI) that:

- Scores substations across multiple weighted dimensions.
- Visualises risk distribution across SPEN's regions and asset types.
- Highlights top 10 substations by CI score and CoF by asset type (e.g. transformers, switchgear)

This enables SPEN to:

- Rapidly identify high-risk areas.
- Justify investment decisions with data-backed evidence.
- Shift from reactive to proactive asset management.

Tool Integration and Future System Vision

The project outlines a roadmap for integrating the tool into SPEN's existing systems (e.g. INVEST tool), with a future vision of:

- A fully integrated, AI-driven Enterprise Asset Management (EAM) and Asset Investment Planning (AIP) platform.
- Real-time risk monitoring and failure prediction using telemetry

This positions SPEN to modernise its asset strategy and align with digital transformation goals.

Stakeholder-Centric Design

The methodology is built around:

- Early and continuous stakeholder interviews.
- Validation of scoring definitions with SMEs.
- Iterative development with feedback loops

This ensures the tool is not only technically sound but also usable and trusted by end users across the business.

Cost-Benefit Analysis (CBA)

The project includes a structured approach to:

- Quantify the benefits of the tool (e.g. reduced maintenance costs, improved resilience).
- Align outputs with regulatory expectations and investment planning

This supports SPEN in building a compelling business case for broader rollout and potential innovation funding.

Scale of Project

The project's scale enables a consistent, data-driven methodology to be applied across the entire network, ensuring that investment decisions are equitable, transparent, and aligned with both CNAIM and SPEN-specific priorities. It also supports integration with future digital asset management systems, allowing for scalable automation, real-time risk monitoring, and long-term resilience planning. A smaller-scale approach would risk overlooking critical substations or asset types that, while not immediately visible as high-risk, could pose significant operational, safety, or regulatory consequences if not assessed comprehensively.

Technology Readiness at Start

TRL2 Invention and Research

Technology Readiness at End

TRL5 Pilot Scale

Geographical Area

SPD License Area

Revenue Allowed for the RIIO Settlement

N/A

Indicative Total NIA Project Expenditure

Total Expenditure on Capgemini Services- £89,672

Project Eligibility Assessment Part 1

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).

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:

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

The project is a enabler for the energy system transition, as it equips SPEN with a data-driven, scalable framework to prioritise investment and operational decisions across its substation network. By integrating a broad set of risk factors—including climate resilience, cyber and physical security, and network configuration—into a unified Criticality Index, the project supports more agile, transparent, and forward-looking asset management. This is essential for adapting to the increasing complexity of a decarbonised, decentralised grid. The tool's alignment with CNAIM ensures regulatory compliance, while its integration roadmap with SPEN's business-as-usual systems (e.g. INVEST) positions it to drive long-term digital transformation. Ultimately, the project enables SPEN to target interventions that maximise system resilience, reduce emissions, and support the reliable integration of low-carbon technologies —key pillars of the UK's net zero ambition

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

The project offers tangible benefits to consumers in vulnerable situations by enabling more targeted and equitable investment decisions across the substation network. By incorporating factors such as physical security, cyber resilience, and network configuration into the Criticality Index, the tool helps identify substations whose failure would disproportionately impact communities with limited resilience or access to alternative services. This includes rural areas, low-income urban zones, and regions with high concentrations of medically dependent or elderly populations. The project's emphasis on stakeholder interviews ensures that lived experiences and local vulnerabilities are captured in the assessment criteria. Moreover, the integration of failure data and usage patterns allows SPEN to prioritise upgrades and maintenance in areas where outages would pose the greatest risk to health, safety, and wellbeing. By aligning asset management with social impact, the project supports SPEN's broader commitment to inclusive energy transition and regulatory obligations under the Vulnerability Strategy.

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 (RIIO-1 projects only)

N/A

Please provide a calculation of the expected benefits the Solution

The SPEN Criticality Project has the potential to deliver substantial net benefits to consumers by enabling more efficient, targeted, and transparent investment decisions across the electricity distribution network. By replacing fragmented and siloed tools with a centralised, data-driven Criticality Assessment Tool, SPEN can better identify and prioritise high-risk substations whose failure would have significant operational, safety, and financial consequences. This approach reduces unnecessary expenditure on low-impact assets and ensures that limited resources are directed where they will deliver the greatest consumer value. The tool also supports long-term resilience and reliability, helping to minimise service disruptions and associated costs for consumers. Additionally, by incorporating broader risk factors—such as climate vulnerability, cyber security, and social impact—the project aligns with regulatory expectations and enhances SPEN's ability to support vulnerable communities and the energy system transition. These benefits go beyond cost efficiency, contributing to a fairer, more sustainable and inclusive electricity network.

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

The method developed through the project is highly replicable across Great Britain. It is built on a modular, CNAIM-aligned framework that can be adapted to different network configurations, asset types, and regional priorities. Its use of standardised scoring logic, stakeholder-informed criteria, and integration-ready architecture makes it suitable for adoption by other Distribution and Transmission Network Licensees seeking to enhance risk-based investment planning and resilience.

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

N/A - Project is currently in Research

Requirement 3 / 1

Involve Research, Development or Demonstration

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 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

RIIO-2 Projects

☐ 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 the project can be readily applied by other Network Licensees to improve how they assess and prioritise asset risk. The project's methodology—built on a flexible, multi-factor scoring model aligned with CNAIM—can be adapted to different asset types and regional contexts. Its business-led design, integration roadmap, and visualisation tools offer a replicable framework for embedding criticality into investment planning, helping other licensees deliver more efficient, resilient, and consumer-focused networks.

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

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.

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

This project focuses on the development and of a substations criticality tool specific to SPEN's needs. A review of existing innovation projects under IFI, LCNF, NIA, NIC, and SIF shows no current initiatives addressing this to the extent proposed by this 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

A Holistic, Multi-Factor Criticality Model

Unlike legacy tools that focus narrowly on technical or financial risk, this project introduces a multi-dimensional Criticality Index that integrates safety, environmental, cyber, operational, and social impact factors. This enables a more comprehensive and equitable view of asset risk across SPEN's network 1 2.

Integration with Business-as-Usual Systems

The project is designed for seamless integration with SPEN's existing tools like INVEST, SCADA, GIS, and asset monitoring platforms. This ensures that insights from the new tool can be operationalised quickly and at scale, supporting real-time decision-making 3.

Agile, Stakeholder-Led Development

The tool is being developed through an agile, iterative process with continuous input from SPEN stakeholders and SMEs. This ensures the solution is not only technically robust but also aligned with real-world operational needs 4.

Visualisation and Decision Support

The tool includes interactive dashboards that allow users to filter by region, asset type, or risk category, and visualise top critical assets and failure cost distributions. This supports transparent, data-driven investment planning 5.

Transferable Methodology

The approach is designed to be replicable across other DNOs and Transmission Operators, with alignment to CNAIM and a clear roadmap for integration and reporting

Relevant Foreground IPR

N/A

Data Access Details

The SP Energy Networks Data access policy can be found here.

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

This project involves advanced analysis of methodologies as well as a development of a proof of concept tool, beyond business-as-usual activities and since this is intended for use by all DNOs and, it is appropriate that it forms part of the NIA programme. It aligns with NIA objectives by delivering value across the sector while keeping costs low for stakeholders.

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

Commercial

The upfront costs for developing and building the proof of concept tool exceed SPEN's business-as-usual funding. NIA support

ensures these innovations, which benefit all DNOs, are feasible.

Technical

The tool will rely on advanced dashboarding and data skills, which carry risks in scalability and interoperability. NIA funding enables rigorous testing to mitigate these risks.

Operational

Building of the assessment approach and tool will require support from a wide-range of stakeholders. NIA funding minimises time required from operational teams.

Regulatory

The project aligns with RIIO-ED3 objectives but requires validated, scalable solutions to meet regulatory requirements. NIA funding ensures these standards are achieved.

This project has been approved by a senior member of staff

☑ Yes