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

Sep 2024

Project Reference Number

0111011

Project Registration

Project Title

ORION

Project Reference Number

0111011

Project Licensee(s)

SP Energy Networks Transmission

Project Start

January 2025

Project Duration

1 year and 1 month

Nominated Project Contact(s)

Parham Momeni

Project Budget

£442,000.00

Summary

The current method of testing and analyzing transformer health is inefficient and inconsistent, leading to potential delays and manual labor in critical asset management decisions. The proposed solution is a new digital platform that centralizes data management, integrating all information related to transformer health. Utilizing AI and machine learning, this platform aims to enhance decision-making, maintenance activities, and safety. It will provide a comprehensive view of transformer health and performance by combining multiple data streams, thereby offering valuable insights for asset managers and field operatives. This innovative approach promises to optimize transformer asset failure mitigation and streamline the overall process.

Third Party Collaborators

Minsait

Nominated Contact Email Address(es)

innovate@spenergynetworks.co.uk

Problem Being Solved

To address this issue, we propose the creation of a new digital platform to provide a centralised system for the management of these data points. This platform will seamlessly merge all information relating to transformer health, with the help of AI machine learning will enable improved decision-making, streamlined maintenance activity and enhanced safety by functions such as condition monitoring, analysing asset health and optimising transformer asset failure mitigation measures. This digital tool will use these multiple

data streams containing critical transformer asset data to provide a single overview of overall unit health and performance, exploiting the combined dataset to deliver new insights, for asset managers and field operatives alike.

The solution will be designed considering the following requisites:

· Universal Approach: Solution can be applied to any other asset (not only transformers) as far as they have suitable data.

· Flexibility: Tool will be designed so that new algorithms can be added to complement or replace the ones being used, keeping the solution always up to the state of art.

· Scalability: Scale seamlessly as data volumes grow. Adapting to changing business needs.

· Security & Compliance: Robust security measures protect sensitive data, ensuring compliance with industry standards and regulations.

Proof of Value (Experimental development).

A POV will be developed to test the use of predictive analytics applied to the main asset data sources available by means of AI/ML algorithms. This POV will address anomaly detection (Early warning of impending failures based on deviation from normal behaviour) and prognosis (Forecast failure progress and estimation of RUL), delving into the available data sources to build models that can provide early warning of failures and estimate their progression and the remaining useful life of the asset.

A limited number of assets of one type of transformer will be selected to work with. The selection will be based on criticality, availability, completeness, quality of the historical data to be used as inputs, and availability of registered failures.

This solution will improve transformer maintenance by:

Enhanced Reliability: Enables real-time monitoring and maintenance of transformer parameters which facilitates early detection of anomalies, enabling us to intervene before failures occur and improve overall reliability. · Predictive Maintenance: By analysing historical data and trends, platform can forecast maintenance requirements, enabling a predictive approach that ensures asset lifetimes are maximised. · Efficient Resource Allocation: Platform helps allocate resources efficiently by prioritising maintenance tasks based on criticality leading to maintenance efforts being focused where they matter most. · Compliance with ISO Standards: This digital solution will be aligned to ISO 18095:2018 which provides guidelines for condition monitoring and diagnostics of power transformers. It covers parameters such as oil condition, oil contamination, dielectric condition, temperature, power and more. The standard emphasises the importance of effective condition monitoring and maintenance to enhance reliability, predict maintenance needs, and allocate resources efficiently.

Method(s)

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· Security & Compliance: Robust security measures protect sensitive data, ensuring compliance with industry standards and regulations.

Scope

This project aims to develop an all-in-one asset management tool for SPEN's transformer fleet. This tool would combine all SPENs transformer related asset data with AI machine learning to allow predictive forecast models to determine overall asset health, maintenance needs and replacement schedules.

Analytics to enhance operations, improve efficiency and ensure reliability can be divided in four different stages, represented in the following diagram:

§ Descriptive Analytics: What happened?

§ Diagnostic Analytics: Why happened?

§ Predictive Analytics: What is going to happen?

§ Prescriptive Analytics: What should we do?

Objective(s)

Capital Expenditure Reduction Efficient management of data without the need for extensive physical infrastructure, lead to cost savings in long term.

Data Accessibility & Collaboration Real-time access to oil sample data from anywhere, facilitating collaboration among teams, suppliers.

Efficient Data Collection & Storage Digital platforms streamline data collection, storage, and retrieval processes, reducing manual effort and minimizing errors.

Analytics & Insights Provide data visualization, trend analysis, and predictive insights, aiding decision-making and performance optimization.

Scalability & Flexibility Scale seamlessly as data volumes grow, adapting to changing business needs.

Security & Compliance Robust security measures protect sensitive data, ensuring compliance with industry standards and regulations.

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

The overview of this project is to help define a tool for transformer maintenance, which can play a significant role in facilitating the energy system transition and benefiting consumer - particularly those in vulnerable situations. It does this by predictive maintenance, enhanced reliability, efficient resource allocation and compliance with ISO standards – all leading to increased lifetime of assets.
1. Optimisation of maintenance: Digital tools can help reduce transformer maintenance costs by optimizing transformer asset management. They focus on high-risk transformers and can extend their life with properly focused preventive maintenance programs. This results in cost savings that can be passed on to consumers, especially those in vulnerable situations aiding fuel poverty.
2. Enhanced reliability: Implementing digital monitoring systems for transformers provides asset reliability and availability. Real time monitoring and maintenance of transformer parameters, in conjunction with early detection of anomalies can prevent unexpected failures and improve the asset reliability - this is completed with descriptive analytics to gains insights into historical data, using dashboard reporting, irregular detection and data forecasts. As a result, this prevents outages leading to more reliable services for consumers.
3. Benefiting vulnerable consumers: The platform helps allocate resources efficiently, by prioritising maintenance tasks based on criticality. It ensures that maintenance efforts are focused where they matter most. This means resources can be allocated before failures occur leading to less congestion of resources, minimising costs associated with reactive repairs and potential cost saving lowering the consumer bill.
Digitalisation has a crucial role to play in the transition to net zero, this means that assets, supply chain will start to heavily rely on digital tools. As a result, more systems infrastructure will be required to ensure smooth operations, but more cyber evaluations and implementation will need to be considered to protect against any threats.

Success Criteria

1) A virtual representation of SPEN transformers based on ISO 18095:2018.

2) A roadmap for next phase of platform development.

Ø Enhanced Reliability: Enables real-time monitoring and maintenance of transformer parameters (such as oil condition, temperature, partial discharge, and dissolved gas analysis). Facilitates early detection of anomalies, enabling us to intervene before failures occur and improve overall reliability.

Ø Predictive Maintenance: By analysing historical data and trends, the digital platform can forecast maintenance requirements, enabling a predictive approach that ensures asset lifetimes are maximised to achieve value-for-money for our customers. This proactive approach minimises downtime and reduces costs associated with reactive repairs.

Ø Efficient Resource Allocation: The platform helps allocate resources effectively by prioritising maintenance tasks based on criticality. It ensures that maintenance efforts are focused where they matter most.

Ø Compliance with ISO Standards: ISO 18095:2018 recommends specific monitoring and diagnostic techniques. Digital platform will align with these guidelines, ensuring compliance and adherence to industry best practices.

The digital tool would use multiple data streams containing critical transformer asset data to provide a single overview of overall unit health and performance. Unifying the wealth of asset data we already collect across disparate sources; the proposed solution will provide a single view of transformer health, exploiting the combined dataset to deliver new insights, for asset managers and field operatives alike.

Project Partners and External Funding

Minsait

Potential for New Learning

Implementing a digital platform for transformer maintenance can significantly benefit a Distribution Network Operator (DNO) like SP Energy Networks (SPEN) in several ways:

1. Enhanced predictive maintenance: By continuously monitoring transformer health through real-time data collection and advanced analytics, SPEN can predict potential failures before they occur. This proactive approach reduces unplanned downtime and extends the lifespan of transformers.

2. Data driven decision making: A digital platform provides comprehensive insights into the operational status of transformers. This data helps prioritise maintenance activities, optimise resource allocation, and make informed decisions about asset replacement.

3. Improved Safety and Reliability: Monitoring systems can detect anomalies and potential issues early, ensuring timely interventions. This enhances the overall safety and reliability of the power grid, reducing the risk of catastrophic failures taking effect on all consumers and its operator.

4. Knowledge Retention and Sharing: Digital platforms can store historical data and maintenance records, preserving valuable knowledge that can be accessed by new engineers. This helps mitigate the loss of expertise due to retirements and supports continuous learning and training. In addition help tackle and open doors for solutions of skill job shortage from which we all are facing.

5. Cost Efficiency: By optimising maintenance schedules and reducing the frequency of unexpected failures, SPEN can lower operational expenses and capital expenditures. This efficiency translates into cost savings and improved financial performance.

Overall, a digital platform for transformer maintenance can transform how SPEN manages its assets, leading to improved performance, safety, and cost-effectiveness.

Scale of Project

Across SP Energy Networks distribution licence areas: SP Distribution and SP Manweb. This will allow us to test across sites with known challenges and demonstrate applicability beyond a single licence area.

Technology Readiness at Start

TRL4 Bench Scale Research

Technology Readiness at End

TRL6 Large Scale

Geographical Area

SPD & SPM

Revenue Allowed for the RIIO Settlement

RIIO-ED2

Indicative Total NIA Project Expenditure

£442000

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 overview of this project is to help define a tool for transformer maintenance, which can play a significant role in facilitating the energy system transition and benefiting consumer - particularly those in vulnerable situations. It does this by predictive maintenance, enhanced reliability, efficient resource allocation and compliance with ISO standards – all leading to increased lifetime of assets.
1. Optimisation of maintenance: Digital tools can help reduce transformer maintenance costs by optimizing transformer asset management. They focus on high-risk transformers and can extend their life with properly focused preventive maintenance programs. This results in cost savings that can be passed on to consumers, especially those in vulnerable situations aiding fuel poverty.
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Digitalisation has a crucial role to play in the transition to net zero, this means that assets, supply chain will start to heavily rely on digital tools. As a result, more systems infrastructure will be required to ensure smooth operations, but more cyber evaluations and implementation will need to be considered to protect against any threats.

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

This project can deliver a net benefit to consumers in several ways:

1. Cost efficiency: By using digital tools to predict asset failure, resource optimisation, recommendations of maintenance scheduling all helping improve the lifetime of assets. These characteristics all lead to significant cost saving – from which can be passed on to consumers in the form of lower energy bills.

2. Service consistency: This project can improve the reliability of the services provided by system operators, by detecting faults early and reducing their likelihood of power outages. This means a reduction in logistic delays for skilled work force in districts working on brownfield and greenfield sites upgrading and putting new infrastructure in place. Lowering the chances in penalties for project delays all contributing to more funding which could be used for setting up initiatives for consumers in extreme fuel poverty or in the form of lowering energy bills.

3. Environmental Sustainability: Facilitating the transition to net zero with more sustainable generation, improving environmental sustainability. It does not only benefit consumers with cleaner energy, lower bill but also contributes to the broader societal benefit of combating climate change.

4. Improved customer service: Digital tools can provide integrated customer services, improving the overall customer experience. This includes faster response times to issues with enhanced maintenance freeing up resources, better communication, and more personalised services aiding with vulnerable consumers.

In summary, the project has the potential to deliver a net benefit to consumers by improving service reliability, reducing costs, supporting environmental sustainability, and enhancing customer service. These benefits can significantly improve the quality of life for all consumers, particularly those in vulnerable situations.

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

- Streamlined Asset Data Analytics for transformers and the maintenance.
- Operational Efficiency.
- Moving towards online/Smart monitoring in future as a roadmap

Benefits
Description
Capital Expenditure Reduction
Efficient management of data without the need for extensive physical infrastructure, lead to cost savings in long term.
Data Accessibility & Collaboration
Real-time access to oil sample data from anywhere, facilitating collaboration among teams, suppliers.
Efficient Data Collection & Storage
Digital platforms streamline data collection, storage, and retrieval processes, reducing manual effort and minimizing errors.
Analytics & Insights
Provide data visualization, trend analysis, and predictive insights, aiding decision-making and performance optimization.
Scalability & Flexibility
Scale seamlessly as data volumes grow, adapting to changing business needs.
Security & Compliance
Robust security measures protect sensitive data, ensuring compliance with industry standards and regulations.

In addition to these benefits, the solution will be designed considering the following requisites:

Requisite
Description
Universal approach
The solution can be applied to any other the of asset, not only transformers, as far as they have suitable data.
Flexibility
The tool will be designed so that new algorithms can be added to complement or replace the ones being used, keeping the solution always up to the state of the art.
Scalability
Scale seamlessly as data volumes grow, adapting to changing business needs.
Security & Compliance
Robust security measures protect sensitive data, ensuring compliance with industry standards and regulations.

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§ Predictive Analytics: What is going to happen?

§ Prescriptive Analytics: What should we do?

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

It can be replicable for any transformer, but the focus at this stage would be on distribuition.

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

TBD

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

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5. Cost Efficiency: By optimising maintenance schedules and reducing the frequency of unexpected failures, SPEN can lower operational expenses and capital expenditures. This efficiency translates into cost savings and improved financial performance.

Overall, a digital platform for transformer maintenance can transform how SPEN manages its assets, leading to improved performance, safety, and cost-effectiveness.

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

Please demonstrate how the learning from the project can be successfully disseminated to Network Licensees and other interested parties.

TBD

Please describe how many potential constraints or costs caused, or resulting from the imposed IPR arrangements.<

TBD

Please justify why the proposed IPR arrangements provide value for money for customers.

TBD

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.

To avoid unnecessary duplication when implementing a digital platform for transformer maintenance, SPEN can adopt several strategies:

1. Centralised Data Repository: Ensure all data is stored in a single, centralised database. This prevents multiple versions of the same data from being created and ensures everyone has access to the most up-to-date information.

2. Standardised Data Entry: Implement standardised procedures for data entry and maintenance. This includes using consistent formats, terminologies, and protocols across the organisation to avoid discrepancies.

3. Integration with Existing Systems: Integrate the digital platform with existing systems and tools used by SPEN. This ensures seamless data flow and reduces the need for manual data entry, which can lead to duplication.

4. Automated Data Validation: Use automated tools to validate data as it is entered into the system. This can help identify and eliminate duplicate entries in real-time.

5. Clear Roles and Responsibilities: Define clear roles and responsibilities for data management. Ensure that each team member knows their specific tasks and how they contribute to the overall data management process.

6. Regular Audits and Reviews: Conduct regular audits and reviews of the data to identify and address any duplication issues. This helps maintain data integrity and accuracy over time.

7. Training and Awareness: Provide training to all users on the importance of avoiding data duplication and the best practices for data management. Awareness and education can significantly reduce the chances of duplication.

By implementing these strategies, SPEN can ensure that their digital platform for transformer maintenance is efficient and free from unnecessary duplication.

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

plementing a digital platform for transformer maintenance can drive innovation for SPEN in several ways:
1. Advanced Analytics and AI: Leveraging machine learning algorithms and AI can uncover patterns and insights from vast amounts of data. This can lead to the development of new predictive models and maintenance strategies that are more efficient and effective.

2. Integration: By integrating Internet devices, SPEN can gather real-time data from transformers. This continuous stream of data can be used to innovate new monitoring techniques and improve the accuracy of fault detection.

3. Enhanced Collaboration: A digital platform can facilitate better collaboration between different teams and departments. Sharing data and insights across the organisation can lead to innovative solutions and improvements in maintenance practices.

4. Customisable Dashboards and Reports: Developing customisable dashboards and reports can provide tailored insights for different stakeholders. This can help in identifying unique challenges and opportunities, fostering a culture of continuous improvement and innovation.

5. Simulation and Modelling: Digital platforms can enable the use of simulation and modelling tools to test different maintenance scenarios and strategies. This can help SPEN innovate by identifying the most effective approaches without the risk of real-world testing and saving cost needed to carry out real life scenarios.

6. Customer Engagement: Innovative digital platforms can also enhance customer engagement by providing transparent and real-time updates on maintenance activities and transformer health. This can improve customer satisfaction and trust that consumers money is being spent on upgrading and innovating the network for their benefit, representing a better imagine of the operator.

By embracing these innovative approaches, SPEN and other operators can stay ahead of the curve and continuously improve its operations.

Relevant Foreground IPR

TBD

Data Access Details

To be evaluated during the course of the project.

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

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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

Because it is a new modelling technology and we need to try it first and to de-risk.

This project has been approved by a senior member of staff

☑ Yes