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

Feb 2024

Project Reference Number

NIA_SHET_0043

Project Registration

Project Title

Proof of Concept of Digitised Condition Monitoring

Project Reference Number

NIA_SHET_0043

Project Licensee(s)

Scottish and Southern Electricity Networks Transmission

Project Start

March 2024

Project Duration

1 year and 6 months

Nominated Project Contact(s)

Brant Wilson - Innovation Portfolio Manager (transmissioninnovation@sse.com)

Project Budget

£360,000.00

Summary

Currently, when operators are on site, they conduct inspections of components in our substations using thermal cameras. Operators use cameras to identify ‘points of interest’ using prior knowledge of substations to predict expected faults and capture images accordingly. There is no prescribed technique or structure to conducting inspections and the approach varies from each site. This leads to random, unstructured data collection with no data value and does not allow for repeatability.

The proposed solution is to develop a structured, easily repeatable approach to on-site data collection which builds upon present Electricity Safety, Quality and Continuity Regulations 2002 (ESQC) requirements and documentation. This would be established by building a visual aid routine (scripting) on the operative’s handheld device to be followed when undertaking site surveys.

Third Party Collaborators

i4 Asset Management

Nominated Contact Email Address(es)

transmissioninnovation@sse.com

Problem Being Solved

SSEN Transmission adheres to the Electricity Safety, Quality, and Continuity Regulations 2002 (ESQC) which forms the basis of equipment inspection frequencies performed by asset management. We also adhere to internal policies which further outlines how inspection tools should be used in general terms, defines the aims of surveys, and provides instruction on where to record observations. One of our Asset Management's focuses are on leveraging technology to improve the quality and quantity of information

gathered presently from site for value within the business.

Currently, when operators are on site, they conduct inspections of components in our substations using thermal cameras. Operators use thermal cameras to identify 'points of interest' using prior knowledge of substations to predict expected faults and capture images accordingly. There is no prescribed technique or structure for conducting inspections and the approach varies from site to site. This leads to random, unstructured data collection with no true data benefit and does not allow for repeatability which also gives rise to loss of experience within the business with no help for inexperienced staff in understanding the procedures. When operators re-visit a site and take a secondary set of images, there is no reference point to compare images from a previous visit or build up a data set/identify trends for components and locations.

This is currently leading to a loss of information which does not lend to the preventative maintenance approach aim to reduce the number of outages on our network. There is also currently no established process for capturing, accessing, and analysing the recorded data. Using current methods, it is understood that a considerable amount of recorded site data is of no or limited value.

Method(s)

There is an opportunity to increase the quantity and quality of recorded site data to enhance the decision support associated with the health and well-being of our assets. The proposed solution is to develop a more structured approach to on-site data collection which builds upon present ESQC requirements and documentation. This would be established by building a visual aid routine (scripting) on the operative's handheld device to be followed when undertaking site surveys. Having the data collection routine on the hand-held device creates a repeatable framework for site surveys that can be followed easily and allows the data collected to be geo-tagged allowing for location confirmation.

The aspiration of this project is to improve productivity during an operator's time on-site, increasing the quality and volume of site data collected and storing it in a location where, in future it could be used agilely for AI or mining capabilities. This approach has been selected as the most appropriate as it is closest to current practices and should allow for a seamless transition into this more robust surveying process to drive consistency for asset condition maintenance and the value they deliver to the consumer.

Data Quality Statement (DQS):

The project will be delivered under the NIA framework in line with OFGEM, ENA and SSEN Transmission internal policy. 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 on our internal SharePoint platform ensuring access control, backup, and version management. Deliverables will be shared with other network licensees through the closedown reports on the Smarter Networks Portal.

Measurement Quality Statement (MQS):

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

In line with ENA's ENIP document, the cumulative risk score is scored as 5 = LOW from the sum of the risk thresholds below:

TRL Steps – 1 TRL Step – Low (Score 1)
Cost – <£500,000 – Low (Score 1)
Number of suppliers – 1 – Low (Score 1)
Data – Assumptions known but will be defined within project – Medium (Score 2)

Scope

The scope of the project is the development of a visual aid script routine broken down to stages to identify the following:

- Capture existing knowledge of assets within innovation scope from available sources (people, documentation, formal knowledge sources (CIGRE, IEEE, etc).
- Develop a solution isolated from SSEN's infrastructure.
- Develop a user-friendly efficient means of capturing any unstructured data.
- Identify missing data and define requirements.
- Develop a database to store and validate data.

- Validation process to reduce transfer errors and provide an audit trail of measurements.

Identify specification requirements for condition monitoring, data capture and storage.

- Develop a platform that is user friendly that standardises:

- Asset data quality validation.
- Survey visual script that can be tailored for each asset type.
- Transfers data from Condition Monitoring device and merge with metadata (time, location).
- Capture and annotate data from surveyors and other data sources.
- View previous surveys.

- Capture and retain unstructured data (emails, pictures, drawings, and readings) with associated defects.
- Capture and analysis of the data already in-house.
- Develop a web dashboard to show alerts, track issues and owners, and filter to show previous relevant defects.
- Develop a report and insights of project and how to expand capability to other asset types and Condition Monitoring devices beyond defined scope and into a full deployment.

This NIA project will focus only on monitoring of cable sealing ends (CSE) within a substation. Initially, the script will be developed to survey CSE only with the intention for the same process to be repeated for other component types, and to be transferrable to all substations, however, this will be out of scope of the NIA project.

Financial benefits can be found in section 3.2.2.

Objective(s)

This aim of this project is to build a visual aid routine (scripting) that can be used by operative's when undertaking site surveys to provide high quality, repeatable and comparable data to support condition monitoring operations and aid efficient maintenance planning.

Consumer Vulnerability Impact Assessment

An assessment of distributional impacts (technical, financial and wellbeing related) for this project has been conducted using a bespoke assessment tool, which assesses the project as having a positive, negative, or neutral effect on consumers in vulnerable situations. To help inform the assessment, this tool considers the categories of consumers identified in the Priority Services Register.

This project has been assessed as having an overall positive impact on consumers in vulnerable situations. The assessment has identified that this project will look to reduce the costs for households and reduce the occurrence and duration of supply interruptions. Other considerations including the projects impact on supply, immediate health and safety in the home have been made in conducting this assessment.

Success Criteria

The project will be deemed as successful if all items in the scope, objectives and learnings are achieved. It is expected that, if successful, the trial will lead to the same process being repeated for other suitable component types and to be transferrable to all substations.

Project Partners and External Funding

SSEN Transmission will partner with i4 Asset Management Limited to deliver Condition Monitoring Tool for Site Surveys using NIA funding.

Potential for New Learning

The outcome of this project will provide us with the structure and opportunity to capture increased quality and quantity of data to build up a picture of the condition of assets in our substations over time. This will allow decisions to be taken to conduct preventative maintenance activities to prevent outages from being required due to unforeseen faults. The script developed in this project will be a first step towards having a tried and tested script that can then be further developed and transferred to business as usual for the majority of assets. The project will offer learnings to other networks on improved methods for data collection, such as creating and implementing a visual script. This ultimately will drive consistency within our business and make a huge step towards treating assets based on their condition and the value they deliver to the consumer. The learnings from this project will also be considered when rolling this method out to other components beyond CSE.

Learnings from the project will be disseminated via internal and external stakeholder events which will be conducted during the project. The learnings will also be shared within the annual project report and at relevant dissemination events such as the Energy Networks Summit Conference.

Scale of Project

The project is designed to get maximum learning for minimal cost; if successful, the potential overall cost benefits are estimated to be £86k savings for one trial site for CSE. The project is focused on monitoring of CSE only but will serve as a baseline in developing a process to create normal surveying behaviours of assets to identify any outliers enabling optimised maintenance and end of life strategies. Once this approach is successfully adopted for firstly one component type, then multiple component types across all substations can be developed in the future. This will in turn provide the potential for earlier detection of defects and proactive intervention, reducing failures, avoidable costs, and indirect reactive planning impacts to the Network Operators, the environment, and ultimately the consumer. Any smaller scale project would not allow the learning outcomes to be achieved.

Technology Readiness at Start

TRL5 Pilot Scale

Technology Readiness at End

TRL6 Large Scale

Geographical Area

The project will take place in the Scottish Hydro Electric Transmission license area in Scotland.

Revenue Allowed for the RIIO Settlement

No allowance has been made for this type of development within the RIIO-T2 settlement. No savings are expected during project implementation; future savings may be possible depending on the outcomes of the project and the future adoption of the learnings.

Indicative Total NIA Project Expenditure

The total NIA Expenditure for the project is £360,000, 90% (£324,000) is allowable NIA expenditure.

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:

As our network grows with the transition to net zero, additional substations will be established or as required, replaced, or upgraded. With the additional number of substations, there is a risk of this problem compounding. The more data and information we have available as to the health/condition of the components within our current substations will help support efficient future upgrade or replacement decisions to avoid unnecessary replacement of assets/components based on time rather than condition. This will ultimately help with the movement of renewable energy around the network, by having a clearer picture of the health of our substations to support the energy system transition.

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

The primary impact of this project on consumers in vulnerable situations is its potential to reduce the cost of electricity transmission in the North of Scotland while also reducing the occurrence and duration of supply interruptions.

Requirement 2 / 2b

Has the potential to deliver net benefits to consumers

Project must have the potential to deliver a Solution that delivers a net benefit to consumers of the Gas Transporter and/or Electricity Transmission or Electricity Distribution licensee, as the context requires. This could include delivering a Solution at a lower cost than the most efficient Method currently in use on the GB Gas Transportation System, the Gas Transporter's and/or Electricity Transmission or Electricity Distribution licensee's network, or wider benefits, such as social or environmental.

Please provide an estimate of the saving if the Problem is solved

Not applicable.

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

Successful development and rollout of the structured approach to on-site data collection using the visual script on the operative's handheld device will lead to time and quality-based efficiencies as only useful images will be collected. Having the data collection routine on the hand-held device creates a repeatable framework for site surveys that can be followed easily and allows the data collected to be geo-tagged allowing for location confirmation. This will in turn provide an opportunity to intervene with preventative measures simplifying the inspection process and reducing the number of unplanned outages required to conduct maintenance. Ultimately the reduction in transmission costs can lead to an indirect cost benefit to consumers bills along with ensuring business security and reliability for our network.

There are approximately 100 CSE in total across all our substations. Last year there were two significant incidents related to CSE reported in the control room, this is consistent with the other transmission networks. The cost comparison of the current case against the proposed innovative visual script development examined the benefits from the application of thermal imaging surveys on CSE only. CSE account for approximately 20% of the eligible substation parts that require thermal imaging surveys. The summary of the benefits is highlighted below.

<u>Trial phase</u>
The analysis focuses on the trial development for CSE surveys with potential after the successful trial to apply the tool to other parts of the substation.
- There is a £304,000 net lifetime cost saving (22%) at 2018 real values.
- Cost savings from the reduction of unplanned outages will kick start at the year 2032.

<u>Deployment phase</u>
As an initial, conservative, estimation there are a total of 36 sites that will benefit from the CSE scripting innovation.
- There is an estimated 31% constant cost saving from the use of the Condition Monitoring Tool script for CSE at any additional site this innovation is implemented at compared to the current practice.

- The lifetime cost saving can reach £426,000 for any extra site. For 36 extra sites, this cost-saving can reach £14.5 million in asset life at 2018 real prices.
- Cost savings from the reduction of unplanned outages will kick start from the first year of tool implementation, which is the year 2025.

Based on the above, the total net benefits from both trial and deployment phase are summed up and risk adjusted to reflect the risks identified as part of the project, so the total risk-adjusted net benefit is estimate to £10.3 million.

This innovation offers a scalable opportunity, and this analysis shows only a portion of the benefits received as this has the potential to improve the quality of our data supporting asset health, reduce survey times, and develop a more tailored O&M plan for each asset based on historical data.

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

High potential to replicate the same method on building scripts for different parts of the substation and apply this to all our assets. This is a scalable opportunity and has the potential to improve the quality of our data supporting asset health, reduce survey times and develop a more tailored O&M plan for each asset based on historical data. Opportunity for other networks to utilise improved methods for data collection following this tested approach. Opportunity to better quantify and assess assets by treating on their condition and the value they deliver to the consumer.

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

The costs of replicating the condition monitoring solution across the rest of GB are not fully defined. Although the test case has been identified for CSE, this solution, if proven, can showcase a structured and repeatable approach to data capture within our substations. The costs would be dependent on the on-site data collection requirements.

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 project will offer learnings to other networks on improved methods for data collection such as creating and implementing a visual script. They will be able to take the output and pair it up with their or other innovation projects that look at remote or robotic methods for data collection.

Not applicable.

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.

Although there have been projects looking at data capture within substations, this project is focused solely on the development and testing of a visual script that can be followed during site surveys. This process will be a vast improvement to the way in which surveys are currently conducted at our substations. This will provide a trialled and tested method for improving data capture – quality and quantity – building up a picture of the health of our substations enabling decisions to be taken to conduct preventative maintenance activities and move away from reactive maintenance that requires outages to be taken. To date, no other similar projects have been identified through the ENA SNP.

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

Not applicable.

Additional Governance And Document Upload

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

There is a significant need to move away from time-based maintenance approaches and over to condition-based assessments of our assets to avoid unnecessary replacement of assets and to reduce or avoid the number of outages required for maintenance. This project will develop a structured and repeatable approach to data capture within our substations. The current process for capturing data is random, unstructured and does not foster repeatability to build up the necessary data required for decision-making. The proposed solution would result in a significant improvement. It is understood that this project would be an initial step in fully scripting the inspection process for all components within our substations. Later, with further development and learnings from other projects, we would look to automate the data capture process using automation/robotics. The quality of the data obtained from the scripting will directly impact the asset for the next 40 years. This is a huge culture change in the operations world and will enable assets to be treated on their condition and ensure consistency in a digitised way so that the data is not only collected but stored, accessible and can be used for future analytics.

Relevant Foreground IPR

Any new intellectual property which are created as part of the NIA project will be made available to other relevant networks licensees. The suppliers historical and current background IP may be used or referenced as part of the project.

Data Access Details

For information on how to request data gathered in the course of this project, see Strategic Innovation Fund (SIF) and Network Innovation Allowance (NIA) Data Sharing Procedure at https://www.ssen-transmission.co.uk/about-us/innovation/

Additionally, data from this project and all other projects funded under the Network Innovation Allowance (NIA), Network Innovation Competition (NIC) or the Strategic Innovation Fund (SIF) can be found or requested in the ways listed below:

- Via the Smarter Networks Portal at: https://smarter.energynetworks.org. To contact select a project and click ‘Contact Lead Network.’ SSEN Transmission already publishes much of the data arising from our innovation projects here so you may wish to check this website before making an application.
- Via our Innovation website at: Innovation - SSEN Transmission (ssen-transmission.co.uk)
- Via our managed mailbox: transmissioninnovation@sse.com

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

This project will include the development of a script with a third-party supplier that can be loaded onto handheld tablets. Upon completion of the script, it will be demonstrated and tested on site as part of the evaluation. The on-site data collection needs to be better developed and validated before it can be introduced as business as usual. Due to the TRL and risks associated with the techniques in the scope of the project, NIA funding is the correct mechanism rather than BAU delivery. As a business this is the first step to drive a level of consistency in a digitised way, doing it right the first time is innovation as this is a culture change to the operations business.

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

As noted in the NIA guidance, certain projects are speculative in nature and yield uncertain commercial returns. This is the case with this project. There is a commercial risk that the solution trialled in the project is not adopted at the end of the project. This could be because the scripting created does not offer improvement and efficiencies, or meet the project objective. If the project is successful, it will have proven a technical solution that can be adopted in existing and future design reducing the need for unplanned maintenance and cost to customers. From a consumer perspective, we can give an improved degree of confidence that the assets maintained have been maximised for their value based on their condition following this scripting.

This project has been approved by a senior member of staff

☑ Yes