Energy Networks Innovation Process

Annual Project Progress Report Document

The voice of the networks

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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.

Project Title (*This cannot be changed once registered*)	Project Reference
Informed Lightning Protection	NIA_SSEN_0035

Funding Licensee(s)	Project Start Date
Scottish Hydro Electric Power Distribution Southern Electric Power Distribution	March 2019

Project Duration	Year
5 Years	2023

Nominated Project Contact(s)
SSEN NIA Programme Delivery Manager – Tim Sammon FNP.PMO@sse.com

1. Scope

- **Only 11kV and 33kV circuits will be protected.**
- **Protection will target lightning related faults only.**
- **Development of the lightning model is for analytical purposes only.**
- **Results will be reviewed over a four-year period, but this time scale can be shortened if objectives are met earlier.**

2. Objective(s)

1) Develop a 'point in time' lightning analysis tool that can be used to locate lightning protection equipment in the most optimal way i.e. integrate various data sets and update visual display as described in phase 1a and 1b in the PEA
2) Install lightning protection equipment in 'optimal' locations provided by the lightning analysis tool.
3) Monitor and analyse fault data to confirm effectiveness of lightning protection.
4) Update internal policies and procedures if the project is successful.
5) Share learnings with a wider audience.

3. Success Criteria

The project will be a success if:

1) A point in time analytical tool is sufficiently developed so that it can integrate the different data sources described in phase 1b (See PEA) of the Method and perform advanced analytics, so that it can be used for the purpose of deciding where to place lightning protection equipment down to the nearest pole.
2) We install lightning protection equipment safely, on time and within budget.
3) We prove the effectiveness of this methodology for protecting against lightning related faults from a cost and fault reduction point of view.

4. Performance compared to the original project aims, objectives and success criteria

Details of how the Project is investigating/solving the issue described in the NIA Project Registration Pro-forma. Details of how the Project is performing/performed relative to its aims, objectives and success criteria.

Project Background

Lightning strikes are believed to cause a significant number of supply interruptions to our customers. This project aims to investigate a new type of surge arrester that has the ability to disconnect and sacrifice itself in the event of a lightning strike. In addition, this new type of surge arrester will also make it easier for field staff to identify which ones have failed as it is possible to see the surge arresters earth lead when it is disconnected, which means they can be more easily replaced.

Project Progress

Develop a 'point in time' lightning analysis tool that can be used to locate lightning protection equipment in the most optimal way i.e. integrate various data sets and update visual display.

This has been met via the creation of an analytical tool that was able to analyse multiple data sets (i.e. lightning strike data, fault data, GIS data, soil resistance data) to identify the circuits most likely to be at risk of a fault caused by a lightning strike. We then utilised lightning strike location data relative to our assets from an existing internal lightning tracker tool to identify the location of lightning hot spots. Information from the combination of these two tools has then been used to identify the best locations to install lightning protection.

Install lightning protection equipment in 'optimal' locations provided by the lightning analysis tool.

This objective has now been met. Based upon the lightning strike location information generated by combining the two analytical tools, we were able to identify the top 10 most likely circuits to be struck by lightning in both of our network areas. The list of circuits was then narrowed down to ensure the field trial was conducted across a range of environments and installation challenges. We have installed approximately 150 surge arresters in our SEPD network across six circuits and 300 surge arresters have been installed across five circuits in our SHEPD network. These circuits are now undergoing more frequent line inspections to ensure the surge arresters are not experiencing unforeseen issues and IIS (Interruption Incentive Scheme) performance is also being monitored against lightning strike data.

Additional Work

We have also tested streamer devices in our Training Facility as a potential alternative to Surge Arresters. They have the potential to provide similar levels of lightning protection, but over a longer period, with fewer maintenance issues. Testing was successful and we now have plans to do a trial installation on our network.

5. Required modifications to the planned approach during the course of the project

The Network Licensee should state any changes to its planned methodology and describe why the planned approach proved to be inappropriate. Please confirm if no changes are required.

The project has been extended by one year to test additional lightning protection equipment called streamers.

6. Lessons learnt for future projects

Recommendations on how the learning from the Project could be exploited further. This may include recommendations on what form of trialling will be required to move the Method to the next TRL. The Network Licensee should also state if the Project discovered significant problems with the trialled Methods. The Network Licensee should comment on the likelihood that the Method will be deployed on a large scale in future. The Network Licensee should discuss the effectiveness of any Research, Development or Demonstration undertaken.

An interesting early finding was that the circuits deemed highest risk of experiencing lightning faults by the data analytics phase were significantly different from those circuits that historically have been recorded as experiencing lightning faults in our fault database. This could possibly mean:

1) Labelling of faults as being caused by lightning may be incorrect. It may be that extreme weather and water ingress is the problem rather than lightning, therefore it may be more prudent to alter maintenance/replacement cycles associated with overhead circuit assets rather than protect circuits against lightning.
2) The analytics algorithm could be incorrect and therefore not be correctly identifying the highest risk circuits.

With the course of the project entering monitoring phase, more certainty will be gained as to whether point 1 or 2 is correct, as we will be able to track whether lighting caused a fault with a greater level of certainty through additional monitoring.

7. The outcomes of the project

When available, comprehensive details of the Project's outcomes are to be reported. Where quantitative data is available to describe these outcomes it should be included in the report. Wherever possible, the performance improvement attributable to the Project should be described. If the TRL of the Method has changed as a result of the Project this should be reported. The Network Licensee should highlight any opportunities for future Projects to develop learning further.

Circuits that have had lightning surge arresters installed on them have experienced a 42% improvement in IIS costs due to lightning vs the previous three years where no lightning protection has been installed and a 76% improvement when comparing against the previous 10 years. This has been calculated by measuring lightning related IIS costs for the years before and after lightning protection devices were installed. However, even with a 42% improvement in IIS costs, the payback period is 19 years, which is longer than the expected lifespan of the surge arresters. It is probably unfair to compare IIS costs to the previous 10 years as many circuits have been changed over the time e.g. back-fed to reduce IIS impact. It is clear that lightning protection can play a role for reducing IIS costs, but it needs to be cheaper or longer lasting to have a cost benefit. This is one of the key reasons for trialling the streamer devices as part of this project.

8. Data Access & Quality Details

A description of how any network or consumption data (anonymised where necessary) gathered in the course of the Project can be requested by interested parties. This requirement may be met by including a link to the publicly available data sharing policy.

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/.

9. Foreground IPR

A description of any foreground IPR that have been developed by the project and how this will be owned.

N/A