Scottish and Southern Energy Power Distribution

Date of Submission

July 2016

Network Innovation Allowance Progress Report

Notes on Completion: Please refer to the appropriate NIA Governance Document to assist in the completion of this form.

Network Licensees must publish the required Project Progress information on the Smarter Networks Portal by 31st July 2014 and each year thereafter. The Network Licensee(s) must publish Project Progress information for each NIA Project that has developed new learning in the preceding relevant year.

Project Progress

Project Title

Network Optimisation Project (NOP)

Project Reference

NIA_SSEPD_0024

Project Licensee(s)

Scottish Hydro Electric Power Distribution, Southern Electric Power Distribution

Project Start Date

Jan 2016

Project Duration

9 Months

Nominated Project Contact(s)

David MacLeman

Scope

The project aims to utilise an optimisation tool in order to address the undergrounding of overhead lines within the test site. The anticipated benefit includes the reduction of the cost for the undergrounding of overhead lines through the design of optimal routes.
The scope of the project is outlined below:
• Definition of Input. SSEPD along with the selected supplier will define the requirements and inputs of the optimisation tool that will be used for the project.
• Data Collection & Analysis. SSEPD will undertake the required data analysis in order to provide to the selected supplier the data required for the optimisation exercise. The selected supplier will also prepare the data in a format that will be used by their optimisation algorithm.
• SSEPD will select an external network planner in order to undertake the traditional network planning approach, define the design criterions of the optimisation assessment and support the project in reaching its goal.
• Design, Mapping and Testing. The selected supplier will undertake the mapping of SSEPD input in their existing optimisation tool, run the optimisation process and test the outcome. SSEPD will be involved in the stage by providing continuous support and steering the process.
• Results Evaluation. SSEPD will undertake the network planning process and determine the route for the proposed underground work using traditional processes. The outcome of the traditional process will be used as the baseline for the comparison with the outcome of the optimisation tool undertaken by the selected supplier. Within this stage, and if the method is successful, SSEPD will scope the follow on steps.
• Project Close Out. SSEPD will develop and produce a project close out report.

Objective(s)

The project will determine whether the optimisation tool offered by the selected supplier can result in more cost effective options for the undergrounding of overhead lines, in comparison to traditional network planning approaches.

Success Criteria

The project will be considered a success if it can determine whether the optimisation tool offered by the selected supplier can result in more cost effective options for the undergrounding of overhead lines, in comparison to traditional network planning approaches.

Performance Compared to the Original Project Aims, Objectives and Success Criteria

The project has completed the following activities in relation to the scope and there is high confidence that the project objectives will be met and the success criteria of the project will be satisfied.

• Definition of input to the optimisation algorithm has been completed. A range of workshops with internal SSEPD stakeholders and the selected vendor of the optimisation tool have been held and the input layers (i.e. ecological layer), functions (i.e. treatment of water crossings) and respective values have been established. The defined input governs how the algorithm needs to treat certain occurrences (i.e. rivers) and what decisions could be made in respect to the undergrounding (i.e. river crossing with directional drilling techniques or selecting a more lengthy route that does not involve water crossing).

• Data Collection and Analysis has been completed. The data collected and analysed reflected the required input in the optimisation algorithm. The data has been retrieved through desktop surveys which spanned ecological constraints, archeological items, identification of historical faults, street work restrictions, asset costs, as well as other items. All of the data were collected either directly from SSEPD or through contractors of SSEPD (i.e. ecological items) or through the contracted optimisation vendor. The latter also prepared all data in a format acceptable by the optimisation algorithm. All of the data collected and input in the algorithm reflect the different inputs that are required within the development phase of an undergrounding project, spanning network planning, network design and construction monitoring. The algorithm can take all of these data into account when making decisions related to underground existing overhead lines.

• An external company offering network planning and network design expertise has been selected via a competitive tender that ran in Q1 2016. The selected company developed the network planning and contributed to the network design rules of the project, which have been reviewed and baselined by internal SSEPD stakeholders. Further to the defined rules, the selected company is continuously supporting SSEPD and the optimisation vendor in reaching the project goals and will undertake the testing of the optimisation algorithm. Finally, the external company is preparing the baseline route of underground cable that will be used as the reflection of the traditional approach in order to drive the comparison with the outcome of the optimisation algorithm.

• Design, mapping and testing of the algorithm is in progress. The selected optimisation vendor has associated inputs and data with the algorithm and has progressed with the development of the algorithm in order to satisfy the use case of the undergrounding. The agile project management approach adopted supported the development work required in order to satisfy the use case. The final delivery of this stage is planned for summer 2016 and will feed the results evaluation and conclusions of the project.

Objective 1: The project will determine whether the optimisation tool offered by the selected supplier can result in more cost effective options for the undergrounding of overhead lines, in comparison to traditional network planning approaches.

The project is progressing towards the baselining of the optimised route as a result of the optimisation algorithm and also from the selected network planning/ network design company. Post the baselining, a comparison of the produced routes will take place and determine whether the optimisation tool could offer more cost effective options for undergrounding of overhead lines, in comparison to traditional network planning approaches. There is high confidence that the project objective will be met.

Success Criteria: The project will be considered a success if it can determine whether the optimisation tool offered by the selected supplier can result in more cost effective options for the undergrounding of overhead lines, in comparison to traditional network planning approaches.

As described earlier the project is progressing in this direction and there is high confidence that the project objective will be met and the success criteria will be satisfied. The project outcomes will be reported within the project close down report.

Required Modifications to the Planned Approach During the Course of the Project

No changes to the planned approach as declared in the NIA registration document are required.

As part of the development process it became apparent that the optimisation algorithm could also answer the question whether we need to underground the entire section of the target overhead network or only parts that are more cost effective to do. Considering that there was no additional computational effort to answer this question, the project decided to proceed with this question as well and generate additional learning without additional effort.

The project also captured the opportunity to investigate whether the optimisation algorithm provided could be used in order to increase the resilience of the network, while resolving the use case of undergrounding existing overhead line. This additional question is expected to be answered by the algorithm vendor without an impact on cost or timeline and thus the project will generate additional learning within the current project constraints.

Lessons Learnt for Future Projects

The project is currently underway with the final outcome of the optimisation algorithm pending. Post this step, the comparison between the route of undergrounding of overhead lines as produced by the optimisation algorithm and the one produced through traditional network planning and design approaches will take place. The outcome of the comparison will drive the project objective and will be reported within the project close down report. Lessons learnt that were gathered within the progress to date are reported below.

Lesson Learnt 1: Development Phase
The optimisation algorithm offered by the selected vendor had been used in a variety of applications, ranging from optimisation of logistic operations to electric vehicles mobility patterns. However, it is the first time that this algorithm is used in the use case of optimizing the undergrounding of overhead lines. As it was expected the appropriate interface between the SSEPD input and the algorithm need to be developed. What was evident is the fact that the development phase lasted longer in comparison to what was initially forecasted in order to model all required input. The lesson learnt is that an agile project management approach is best suited in this type of projects, where each sprint results in an outcome that satisfies a certain number of requirements.

Lesson Learnt 2: Input Databases
The optimisation algorithm relies heavily on the accuracy of the data used as input. Considering the large area under consideration for undergrounding (33km of overhead lines investigated within approximately 58 sq. km), the data needs to rely on statutory databases for derivation of appropriate input (i.e. ecological constraints), as it would not be time or cost effective to undertake surveys over the entire area under consideration. The project has used a range of databases to derive certain data inputs and these databases will be reported within the project close down report.

Lesson Learnt 3: Internal Stakeholders
The current use case analysed by the project spans across network planning, network design and construction delivery teams within SSEPD. In order for the optimisation algorithm to work effectively and produce meaningful outcomes, input from all these teams is required. The lesson learnt is that in order for the optimisation to work cooperation of the three different teams is required.

The suitability of the algorithm for BAU roll out will be confirmed at the close of the project.