Scottish & Southern Electricity Networks

Date of Submission

July 2017

Network Innovation Allowance Closedown 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 Closedown

Project Title

Underground Cable Overlay Cost Reduction

Project Reference

NIA_SSEPD_0014

Project Licensee(s)

Scottish Hydro Electric Power Distribution, Southern Electric Power Distribution

Project Start Date

Sep 2015

Project Duration

17 Months

Nominated Project Contact(s)

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Scope

The project aims to investigate whether the two identified cable overlay methods could reduce the cost and disturbance caused to the customers due to the cable overlay activity. The scope of the project includes:
• Undertake a 'horizon scanning' exercise aiming to identify and gather information on cable overlay methodologies/ technologies, the environmental factors and circumstances where they could effectively be applied
• Agree commercial terms and conditions with involved suppliers
• Gather requirements and select candidate sites for testing the methodologies from two suppliers
• Submitting a customer engagement plan and data privacy strategy governing potential interactions with customers about wayleaves or easements required in order to utilise their land, potential interaction with customers affected from the street works, interactions with customers in order to undertake the focus group(s) planned as part of the project.
• Undertake surveys in the selected sites in order to baseline costs of traditional open-cut trench methods and innovative methods.
• Implement project trials in two stages, with a decision point after trial 1 on whether to proceed to next stage or not. The decision will depend on the performance of the methodologies (assessed individually) up to this point and the confidence of coping with the second trial stage.
• Trial Stage 1: The identified overlay methods will be applied in an environment without many complexities (i.e. limited number of nearby underground assets). The selected circuits will be of 33kV, 11kV in each case, and the newly installed cable will be of greater cross section compared to the previous one. The length of the cable that will be overlaid will be between 50 – 100m, depending on the availability of a suitable circuit.
• Trial Stage 2: The identified extraction methods will be applied in an environment with increased complexity, (i.e. greater number of nearby underground assets). The characteristics of the methods will be similar to these of stage 1.
• Analysis in order to identify whether there are financial benefits from the tested cable overlay methods and evaluation of the applicability of the tested cable overlay methods.
• Focus group(s) will be undertaken with a range of stakeholders in order to obtain qualitative information on the disturbance caused by the tested cable overlay methods.
• If the identified cable overlay methods prove to be beneficial, a decision will be taken whether to transition to 'business as usual' operation. If the decision is positive, the appropriate arrangements will be made including the training of identified SSEPD departments and the lessons learned will be reported within the close out report.

Objective(s)

• The project will determine if the identified innovative cable overlay methods can reduce the current cost of cable overlay (quantitative information).
• The project will determine if the identified innovative cable overlay methods can reduce the disturbance to stakeholders through qualitative information collected from focus groups.
• The project will determine if the identified innovative cable overlay methods can reduce the environmental impact of the cable overlay process (qualitative and/ or quantitative)

Success Criteria

The project will be considered a success if it can determine the effectiveness (positive or negative) of the innovative cable overlay methods in comparison to the traditional open-cut trench approach.
The effectiveness will be measured through variation of the unit cost of cable overlay (quantitative information), variation of the disturbance caused due to the innovative cable overlay method (qualitative information) and variation in the environmental impact of the cable overlay process (qualitative and/ or quantitative information).

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

High level summary:
The Underground Cable Overlay Cost Reduction Project aimed to trial two innovative cable overlay methods and investigate their financial, social and environmental benefits in comparison to traditional open-cut methods for cable laying. The project was structured to include two stages of field trials with a gate review in between them in order to assess performance continuously within the project. The purpose of the gate review was to assess the learning from the field trial 1, its impact on the benefits case and determine whether the project should progress to field trial stage 2. This plan was followed and the learning from field trial stage 1 demonstrated that the technology and its application require further development in order to allow the network operators and the customers to realise benefits from its adoption. As a result it has been decided not to proceed to the next stage of field trials and instead focus the innovation efforts to other technologies with higher potential to deliver benefits to the network operators and the customers. Consequently, the project did not progress to field trial stage 2. The present project close down report reflects the work completed, outcomes and key lessons learnt.
Problem:
Underground cable overlay is the activity through which a certain part of the underground network is replaced or reinforced. The traditional methods of cable overlay commonly involve open-cut trenches where the initial cable is decommissioned and the new cable is laid. Once the laying of the new cable is completed, a switch of connection between the former and the latter cable is performed and commonly the decommissioned/ redundant cable remains in the ground. The traditional method involves open cut trenches which is a costly operation and causes disturbance to the public and businesses due to site activities.

Performance against scope):
• Task 1: Horizon Scanning (100% Completed):
A 'Horizon Scanning' exercise has been completed. The exercise demonstrated that the cable overlay topic is being looked at by a number of different suppliers, two are the dominant methods of overlay (cable extraction and cable core extraction) and that the Technology Readiness Level (TRL) of the available solutions varies significantly per supplier.

• Task 2: Commercial Terms & Conditions (100% Completed):
Commercial terms and conditions have been agreed with the identified cable overlay suppliers and project suppliers that undertake project specific tasks (i.e. evaluation work such as Cost Benefit Analysis, Quantity Surveying work, etc.).

• Task 3: Requirements Gathering and Site Selection (65%Completed)
The requirements of internal Scottish & Southern Electricity Networks (SSEN) stakeholders have been gathered, analysed and documented. The requirements document informed the site selection process, the testing schedule and had been used as a guideline for internal reviews.

The site selection of trial stage 1 was completed and the selected sites satisfied the requirements of internal stakeholders. The site selection for trial stage 2 was ongoing, but considering the lessons learnt from trial stage 1 and the decision to not progress to trial stage 2, the site selection for the trial stage 2 had been halted.

• Task 4: Customer Engagement Plan and Data Privacy Strategy (100 Completed):
A customer engagement plan and data privacy strategy have been submitted and approved by Ofgem on the 22nd of February 2016. These documents along with the approval decision document by Ofgem governed the project communications with project

stakeholders and the data related items.

• Task 5: Benchmark Cost (50% Completed):
Quantity surveying activities have been undertaken and baselined for the sites participating in trial stage 1 and for a percentage of sites participating in trial stage 2. Considering that it was undertaken only for trial stage 1 (as trial stage 2 was not carried out), 50% of the scope is considered completed.

• Task 6: Trial Stage 1 (100% Completed):
The trial stage 1 has been completed with 4 field trials having been delivered. The performance of the innovative cable overlay methods was thoroughly evaluated and the technical feasibility and financial viability of the solutions derived. The social and environmental impact of the innovative solutions has also been analysed. The sites over which field work was carried out within trial stage 1 are described below:

• Trial T1.1 undertaken between 24/02/2016 and 08/03/2016. The cable to be overlaid was a redundant 33kV cable (0.15 Cu TLS) which was laid on grass land in Southampton. The total length of the target circuit was approximately 94m. The extracted cable had a cross section of 95mm Outer Diameter (OD) and was replaced with duct of 225mm OD.

• Trial T1.2 undertaken between 14/03/2016 and 25/03/2016. The cable to be overlaid was a redundant 11kV cable (95 Aluminum CAS, non-oil filled) which was laid on unmade land near a pig farm in Salisbury. The total length of the target circuit was approximately 85m. The extracted cable had a cross section of 55mm OD and was replaced with duct of 180mm OD.

• Trial T1.3 undertaken between 29/02/2016 and 11/03/2016. The T1.3 was a replication of T1.2, as the same redundant cable on the same ground conditions spanned for another 100m section which was the target section to be overlaid. Similarly to Trial T1.2, the extracted cable had a cross section of 55mm OD and was replaced with duct of 180mm OD.

• Trial T1.4 undertaken between 03/05/2016 and 27/05/2016. The cable to be overlaid was a redundant 33kV cable (0.1 Copper oil filled) in carriageway in Weymouth. The total length of the circuit to be overlaid was roughly 80.5m (with the main cable section being 72m). The extracted cable had a cross section of 60mm OD and was replaced with duct of 225mm OD.

• Task 7: Gate Review and Decision to progress or not. (100% Completed):
Quantity surveying activities have been undertaken and baselined for the sites participating in trial stage 1 and were used in the assessment of the financial viability of the innovative solutions. The financial analysis and the lessons learnt from the trial undertaken were the primary drivers in deciding that the innovative technologies and their application require further development ahead of being able to cope with complex sites (as the ones that would participate in trial stage 2) or be considered for BAU adoption. Therefore, the decision was taken not to proceed with stage 2.

• Task 8: Trial Stage 2 (0% Completed):
Considering the decision to not progress to trial stage 2, this scope item could not be satisfied.

• Task 9: Financial Analysis (50% completed):
Quantity Surveys were undertaken in order to provide the benchmark cost. The cost incurred within the project in respect to the innovative solutions was the innovative method cost. Following the baseline of the benchmark and innovative cost, financial analysis was carried out in order to determine the financial viability of the solutions. Considering that it was undertaken only for trial stage 1 (as trial stage 2 was not carried out), 50% of the scope is considered completed.

• Task 10: Focus Groups (50% Completed):
Two focus groups have been undertaken with local residents that were affected by the field trials (Trial T1.1 and Trial T1.4). Considering that it was undertaken only for trial stage 1 (as trial stage 2 was not carried out), 50% of the scope is considered completed.

• Task 11: BAU Adoption (100% Completed):
Considering that the innovative solutions did not progress to trial stage 2 on the basis that further development is required, it has been decided that the solutions are not yet ready to be considered for BAU adoption and implementation.

Performance against the project plan:
The project was on target for being completed on time. Due to the decision to not progress to trial stage 2, the project is closing prematurely.

Performance against the project budget:
The initial NIA allowed budget of the project was £960,000. At the change request submitted to Ofgem on 28/10/2016, the updated budget was £540,000 to account for the premature closure of the project. The actual cost incurred within the project was £508,251.50. The project has therefore been delivered within budget.

Performance against the project objective (100% Satisfied):
Objective 1: The project will determine if the identified innovative cable overlay methods can reduce the current cost of cable overlay (quantitative information).

The project has completed trial stage 1 where 4 field trials were undertaken. The actual cost of the innovative methods constitutes the method cost. For the base cost, quantity surveys have taken place and provided the cost that would have been incurred using traditional methods. Financial analysis carried out addressed the question whether the innovative cable overlay methods trialed can reduce the current cost of cable overlay.

The project trials have been undertaken on target circuits up to 100m. However, the cost difference between the innovative and traditional methods has been projected for schemes of greater length. For the traditional methods cost, this was based on utilizing of existing framework agreements of SSEN and guidance from quantity surveyors. For the cost of the innovative methods, this has been based on refined unit rates provided by the participating suppliers and experience gained through the project. The costs included in the analysis include costs from the pre-construction phase (i.e. archaeological surveys) and construction phase (i.e. actual delivery of the overlay work).

The project learning demonstrates that the innovative technologies will not reduce the current cost of cable overlay, at their current technology readiness level and at the environments over which they were tested. The project experience led to the refinement of the initial unit rates, identification of additional costs that were not known in the beginning of the project and thus the project concluded to a well informed business analysis that drives the previous outcome.

Objective 2: The project will determine if the identified innovative cable overlay methods can reduce the disturbance to stakeholders through qualitative information collected from focus groups.

As described previously, the project has undertaken two focus groups with residents living local to the areas where Trial T1.1 (Southampton) and Trial T1.4 (Weymouth) were undertaken. SSEN supplier had been tasked with the organisation, facilitation and results/ outcome presentation. The main outcome of the focus group is presented below:

Participants in the groups had a high level of exposure to the site works.
• All focus group participants lived within a mile of the site works, with 23% living on the street / road affected
• 78% said they had driven past the site works, with 65% having walked past the site works;
• 86% were aware of the works in their area prior to being contacted to take part in the focus groups

The group of people who participated in the focus group was aware and impacted by the works completed and therefore could offer valuable insight in the reference question.

The previous outcome demonstrates that the majority of the focus group participants (77%) believe that the innovative methods would reduce disruption in comparison to the traditional cable laying methods. It is concluded that the objective 2 of the project was fully met.

Objective 3: The project will determine if the identified innovative cable overlay methods can reduce the environmental impact of the cable overlay process (qualitative and/ or quantitative).
In principle, the innovative cable overlay methods have the potential to reduce the environmental impact of the cable overlay activity through the reduction of the amount of excavation, backfill and reinstatement required in order to complete the work. However, it is SSEN's conclusion that further development in the technology and its application is required in order to achieve a technical feasible operation which will allow the environmental benefits to be realized.

Performance against the success criteria (100% Satisfied):
Success Criterion: The project will be considered a success if it can determine the effectiveness (positive or negative) of the innovative cable overlay methods in comparison to the traditional open-cut trench approach. The effectiveness will be measured through variation of the unit cost of cable overlay (quantitative information), variation of the disturbance caused due to the innovative cable overlay method (qualitative information) and variation in the environmental impact of the cable overlay process (qualitative and/ or quantitative information).

As described earlier, It is concluded that at the current readiness level the technologies trialled and their application are not effective and further development is required ahead of being considered for BAU implementation. The success criterion is met.

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 were required. For clarification to the NIA document and as declared in the progress report in July 2016, the redundant underground cables that are targeted by the project were overlaid with a duct that includes the power cables. The diameter of the duct was of greater cross section in comparison to the extracted cable and the use case is satisfied. Cables of various diameters could be installed within the installed power duct.

Lessons Learnt for Future Projects

Recommendations on how the learning from the project could be explored further:
The project made some key conclusions and lesson learnt which are summarised in learning reports which could be asked by the Future Networks team of SSEN only by Network Licensees.

The project had been disseminating the project outcomes and undertaken demonstration events:
• Two knowledge and dissemination events with participants from other DNOs and the National Grid were undertaken. Each event was related to one of the two methods that the project investigated (Trial T1.2 and Trial T1.4). The feedback from the stakeholders was very positive and generated valuable lessons learnt.
• Presentation of the project outcomes from the trial stage 1 in the LCNI conference of 2016.
The target technology readiness level at the beginning of the project was 6. It was concluded the trialed technologies require further development in order to reach TRL 6 and currently residing at TRL 4.

The Network Licensee should also state if the Project discovered significant problems with the trialled Methods.
As discussed earlier, the environment within which the innovative cable overlay methods operate is non ideal. As a result numerous challenges were identified, with a greater number experienced in trials T1.1 and T1.4. The encountered challenges and the way that the technology deal with them, allowed SSEN to conclude the further development work is required on the technology and its application and thus decided to halt the project.

The Network Licensee should comment on the likelihood that the Method will be deployed on a large scale in future.
At the current readiness level, the technology would not be deployed on SSEN's network.

The Network Licensee should discuss the effectiveness of any Research, Development or Demonstration undertaken.
SSEN believes that the undertaken project resulted in a conclusive outcome. Considering that the work undertaken produced conclusive outcomes, the NIA project added value to the network operators and demonstrated effective use of customers' funds.

Note: The following sections are only required for those projects which have been completed since 1st April 2013, or since the previous Project Progress information was reported.

The Outcomes of the Project

Key Results and Outcomes:

The learning from field trial stage 1 demonstrated that the technology and its application require further development in order to allow the network operators and the customers to realise benefits from its adoption. As a result it has been decided not to proceed to the next stage of field trials and instead focus the innovation efforts to other technologies with higher potential to deliver benefits to the network operators and the customers.

Technology Readiness Levels
The target technology readiness level of the project was 6. It was concluded the trialed technologies require further development in order to reach TRL 6 and currently residing at TRL 4.

Planned Implementation

With the current readiness level of the technology, no implementation in BAU is considered by SSEN.

Other Comments

In the case Network Licensees are interested in further information and lessons learnt, they can email fnp.pmo@sse.com and ask for a copy of the project's learning report (including description of the trials and exhaustive list of lessons learnt) and the report from the focus groups undertaken (including the local residents perspective). The report will be circulated only to Network Licensees only.