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**

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**

19 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**

The project has successfully completed the trial stage 1 and is currently evaluating the performance of the methods. The evaluation of the methods utilised in trial stage 1 is expected to conclude to the satisfaction of the project objectives. The evaluation of trial stage 1 will be concluded shortly and result in a gate review meeting with internal stakeholders, where the performance of the innovative cable overlay methods as opposed to the traditional overlay methods will be reviewed. The following constitutes the project progress to date:
• A 'Horizon Scanning' exercise has been completed. The exercise demonstrated that the cable overlay topic is being looked at by a few different suppliers and that the TRL of available solutions varies significantly per supplier.

• Commercial terms and conditions have been agreed with the identified cable overlay suppliers (JSM Construction Ltd., Rook Services Ltd.) and project suppliers that undertake project specific tasks (i.e. evaluation work such as CBA, Quantity Surveying work, etc.).

• The requirements of internal SSEPD stakeholders have been gathered, analysed and documented. The requirements document informed the site selection process, the testing schedule and is being used as a guideline for internal reviews.

• The site selection of trial stage 1 is completed and the selected sites satisfied the requirements of internal stakeholders. Considering the lessons learnt from trial stage 1, a review of the selected sites of trial stage 2 is underway and will conclude to a final selection.

• 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 govern the project communications with project stakeholders and the data related items.

• Quantity surveying activities have been undertaken and baselined for the sites participating in trial stage 1 and for a percentage of sites selected for trial stage 2. The surveys will be delivered on time and inform the method evaluation in order to draw conclusions.

• The trial stage 1 is completed with 4 field trials having been delivered. Currently, the project team is evaluating the performance of the innovative methods and will conclude in a gate review meeting by appropriate internal stakeholders in due course.

• 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 which was laid on grass land in Southampton. The total length of the target circuit was approximately 94m.

• Trial T1.2 undertaken between 14/03/2016 and 25/03/2016. The cable to be overlaid was a redundant 11kV cable which was laid on unmade land near a pig farm in Salisbury. The total length of the target circuit was approximately 85m.

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 by JSM. As JSM offers two candidate methods for cable overlay, a decision was made to trial both of them – the more established method to target a section of

75m, while the method with lower development work to target a section of 25m. It was proven that further development work was required for the method that aimed to overlay 25m and as a result JSM overlaid both 75m and 25m of the redundant cable with the more developed method.

• Trial T1.4 was undertaken between 03/05/2016 and 27/05/2016. The cable to be overlaid was a redundant 33kV cable in carriageway in Weymouth. The total length of the circuit to be overlaid was roughly 72m.

• Two focus groups have been undertaken with local residents that were affected by the field trials (Trial T1.1 and Trial T1.4). The focus groups were facilitated by the project supplier Social Market Research and the outcomes are currently being analysed in order to draw conclusions.

• Further to the above, the project has already hosted two knowledge and dissemination events with participants from other DNOs and the National Grid. Each event was related to one of the two methods that the project is investigating (Trial T1.2 and Trial T1.4). The feedback from the stakeholders was very positive and generated valuable lessons.

The current stage of evaluation reviews all parameters and characteristics of the delivery in order to derive firm conclusions against the project objectives.

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

As described earlier, the project has completed trial stage 1 which included 4 field trials and quantity surveys in order to baseline the cost of the traditional open cut methods. The lessons learnt from the trial stage 1 have been gathered and are currently analysed in order to identify financial, technical, customer and environmental benefits. As part of the analyses and evaluation, the cost of the cable overlay methods will be compared with the cost of traditional open-cut methods and conclusions provided. The project is performing to the required standard and there is high confidence that the project objective in reference will be met successfully.

Objective2: 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 trial stage 1 which included 4 field trials, as per agreed scope, is completed. Two of these trials were undertaken in residential areas and the works have affected nearby residents (Trial T1.1 and Trial T1.4) through noise, visual intrusion, etc. To date, two focus groups have been undertaken with local residents impacted by the innovative overlay works and their feedback on the disturbance caused in comparison to traditional methods was obtained. The preliminary feedback is that the disturbance will be reduced, but the outcomes of the focus group are currently being analysed in order to provide a conclusive outcome. The project is performing to the required standard and there is high confidence that the project objective in reference will be met successfully.

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)

The trial stage 1 which included 4 field trials, as per agreed scope, is completed. In all of the field trials, the suppliers have provided information on certain aspects of the operation related to the environmental impact of the cable overlay. The results are currently being analysed in order to produce conclusive outcomes. The project is performing to the required standard and there is high confidence that the project objective in reference will be met successfully.

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).
As explained earlier, the outcomes and lessons learnt from trial stage 1 are currently being analysed and evaluated in order to produce conclusive outcomes that will inform the trial stage 2. The project is performing to expectation and there is high confidence that the success criteria will be 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 are required.

As a further opportunity for trial stage 2, the project currently investigates whether the redundant 33kV cables could be overlaid with a power duct (that will include the electrical cables) along with a fibre optic duct (which will be adjacent to the main power duct). Under BAU practice next to all 33kV circuits a fibre optic cable is installed in order to support the communications and protection of the circuit. The project considers whether the tested cable overlay methods could address the fibre optic duct installation as well and provide a complete solution of installation required for 33kV cables. The cost of the fibre optic duct as well the extra labor cost that will be incurred by the contractors, in case that the investigation concludes to being successful, will be met by the current project budget and these will not impact the timescale. The project considers the installation of the fibre optic duct as an opportunity with the potential to generate additional learning without impacting the cost or time.

**Lessons Learnt for Future Projects**

The project has completed the trial stage 1 and the performance of the trialed method is currently being analysed and evaluated. Although the project has not been completed yet and no response to achieved TRL level can be provided, lessons learnt from trial stage 1 and project design are provided below.

Further to the technical delivery, the current stage of evaluation reviews all parameters and characteristics of the delivery in order to derive firm conclusions against the project objectives. Further to the evaluation of trial stage 1 and internal gate review, the trial stage 2 will be considered for commencement. The trial stage 2 will aim to address certain items that were identified in trial stage 1 and also challenge the innovative cable overlay methods in an environment that assembles closer to an operational situation (i.e. greater number of nearby services – crossings, reduced space requirements, etc.). It is believed that post the completion of the trial stage 1 evaluation and post the completion of trial stage 2, SEPD will be able to provide a view on the achieved TRL.

Lesson Learnt 1: Feasibility Study
The trialed cable overlay methods have reduced visibility of ground conditions and obstacles in the ground in comparison to the traditional open cut method. The success of the trialed overlay methods depend on knowledge of cable joints, ground conditions, cable diameter, cable route profile, proximity to nearby services, among other items ahead of the commencement of the works.

The lesson learnt is that a feasibility study (including intrusive and non-intrusive surveys) ahead of the commencement of the works is required. The feasibility assessment would consist of ground surveys (i.e. CAT & Genny) for identification of nearby services, as well as the undertaking of trial holes. The trial holes would investigate the ground conditions, depth of the cable, proximity to nearby services and cable diameter, as well as other site-specific parameters. This lesson learnt is applied in the project in preparation of the trial stage 2.

Lesson Learnt 2: Cable Joints
Commonly the cable joints are of higher diameter in comparison to the cable diameter. As a result, cable joints will present an obstacle to the propagation of the drill head. Knowing the exact location of the cable joints before commencing the works would allow for accurate and improved planning of the works. For example, the presence of a joint (where the drilling could not progress) would mark a suitable position for the launching or receiving pit of the cable overlay method and would allow the progress of the work. However it became apparent that not all records of joints are always available in the central register and that presents an obstacle to the implementation of the method. As a control measure against unknown location of cable joints, the contractor need to monitor the pressure of the drill head as it propagates through the ground. In case the pressure increases significantly the operation needs to be halted and investigation of the potential obstruction to take place.

Lesson Learnt 3: Depth of the cable
Knowing the depth of the cable before the commencement of the work would support the success of the operation. The depth of the cable could be retrieved from historical records and in the absence of such records, from site surveys. Ground penetration radar surveys could provide an indication of the cable depth. However, the depth should be validated via trial holes in order to have a more comprehensive view of it. If the cable depth is not known and cannot be monitored in conjunction with the depth of the drill head, the project runs the risk of the rig head cutting through the cable and continuing its propagation in a different route in comparison to that of the cable. The lesson learnt is that the drill activity needs to be monitored closely in order to ensure an effective operation.

Lesson Learnt 4: Concrete Warning Tiles
It is a common practice to install concrete warning tiles above 33kV cables. The concrete tiles are likely to present an obstacle to the progress of the overlay method. In case the drill head hits a tile it is likely not to be able to progress. The resolution is to excavate at the point of the obstruction and aim to resolve it.