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

Nov 2013

Project Reference Number

NIA_NGET0036

Project Registration

Project Title

ThermoMechanical Forces in XLPE Cable

Project Reference Number

NIA_NGET0036

Project Licensee(s)

National Grid Electricity Transmission

Project Start

July 2012

Project Duration

3 years and 7 months

Nominated Project Contact(s)

David Moorhouse

Project Budget

£280,000.00

Summary

This project is addressing an unknown entity in the Thermomechanical forces in XPLE cables. The scope of the project is to test different temperature conditions (that are indicative of that experienced during load variations) by heating the cable and observing the results.

Nominated Contact Email Address(es)

box.NG.ETInnovation@nationalgrid.com

Problem Being Solved

National Grid has a problem understanding the magnitude of thermo-mechanical effects of large cross-section cross linked polyethylene (XLPE) cables. This problem leads to particular difficulties in designing the steel support work where cables meet gas insulated substation (GIS) and air insulated substation (AIS) terminations. It is currently suspected that they are over engineered.

Method(s)

Through testing of cable samples in differing conditions, we will be able to create a model that allows us to have an increased understanding of the Thermomechanical forces in XLPE cable systems.

We will be researching methods of calculating / measuring the thermo-mechanical forces imposed when a cable is in servoce, and possible methods of eliminating them. This will be achieved by physical testing and the use of Finite Element Analysis.

Scope

This project is addressing an unknown entity in the Thermomechanical forces in XPLE cables. The scope of the project is to test

different temperature conditions (that are indicative of that experienced during load variations) by heating the cable and observing the results.

Objective(s)

Research

The objective of this project is to be able to provide assurance to National Grid, that cables that experience a higher loading, and therefore run hotter (up to 105 degrees) due to increased loading will not experience any unknown or unexpected mechanical effects and therefore will not have shortened life expectancy or unexpected failures.

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

n/a

Success Criteria

This project will be successful if the cables are modelled successfully at operating temperatures agreed with the suppliers. A further success would be if National Grid could implement an increased ratings recommendation based upon this work (this would need to be complemented by other work).

This project will therefore be successful if we increase our level of knowledge on the behavioural aspects of heated cables.

Project Partners and External Funding

n/a

Potential for New Learning

n/a

Scale of Project

This project is being completed on a laboratory scale, at the Tony Davies High Voltage Lab at the University of Southampton. We do not feel that we can reduce the scale any more and still provide the same level of knowledge around this issue, and therefore the same amount of value to customers. Conversely, we do not need to have a bigger project to demonstrate increased value to the customer.

Technology Readiness at Start

TRL3 Proof of Concept

Technology Readiness at End

TRL4 Bench Scale Research

Geographical Area

This project will directly affect the sections of the network where XLPE cable systems are installed. Areas where cables are installed typically include urbanised areas (London, Birmingham, Sheffield etc) and also areas of outstanding natural beauty or other sites of special desigation. A map of the Electricity Transmission system can be found on our corporate webiste - www.nationalgrid.com

Revenue Allowed for the RIIO Settlement

Zero

Indicative Total NIA Project Expenditure

280,000

Project Eligibility Assessment Part 1

There are slightly differing requirements for RIIO-1 and RIIO-2 NIA projects. This is noted in each case, with the requirement numbers listed for both where they differ (shown as RIIO-2 / RIIO-1).

Requirement 1

Facilitate the energy system transition and/or benefit consumers in vulnerable situations (Please complete sections 3.1.1 and 3.1.2 for RIIO-2 projects only)

Please answer **at least one** of the following:

How the Project has the potential to facilitate the energy system transition:

n/a

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

n/a

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 (RIIO-1 projects only)

National Grid have a large amount of XLPE cable installed in high risk areas, as is true with most cable systems. In order to continue to provide a high security of supply, we need to understand all of the issues that we may experience on our network. This TM Forces issue is one that could be prevalent in these high risk areas - including the London Power Tunnels currenlty being installed.

Please provide a calculation of the expected benefits the Solution

Not Required - Research Project

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

This can be applied to all systems where XLPE cable is installed. It will also be used on new installations of XLPE cable. Typically these are in Cities and Areas of Outstanding Natural Beauty.

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

This is a model, so the project should deliver an indication as to what the thermo-mechanical forces are in all XLPE systems. As such, this means that the learning will be bought back into National Grid and a policy update will be written.

Requirement 3 / 1

Involve Research, Development or Demonstration

A RIIO-1 NIA Project 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

☐ 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

n/a

Or, please describe what specific challenge identified in the Network Licensee's innovation strategy that is being addressed by the project (RIIO-1 only)

This project addresses – Affordability, Future Networks, Smarter System Management, Working the System harder, and an indirect impact on Visual amenity.

☑ Has the Potential to Develop Learning That Can be Applied by all Relevant Network Licensees

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.

Please demonstrate below that no unnecessary duplication will occur as a result of the Project.

n/a

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

n/a

Additional Governance And Document Upload

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

n/a

Relevant Foreground IPR

n/a

Data Access Details

n/a

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

n/a

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

n/a

This project has been approved by a senior member of staff

☑ Yes