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

Jan 2014

Project Reference Number

NIA_NGET0126

Project Registration

Project Title

EPRI Research Collaboration on Overhead Circuits.

Project Reference Number

NIA_NGET0126

Project Licensee(s)

National Energy System Operator

Project Start

April 2013

Project Duration

1 year and 10 months

Nominated Project Contact(s)

Glyn Kirkland

Project Budget

£5,646,100.00

Summary

The Worldwide electricity industry recognises that there are parallel challenges within the field of electricity transmission which are more economically investigated and addressed through collaborative learning and knowledge generation among key industry stakeholders. The Electric Power Research Institution (EPRI), with its wide international membership, takes a key role in determining and delivering the most impactful R&D projects. This portfolio of work is focused on Overhead and Underground Circuits (OUC) which address key aspects of National Grid's Innovation Strategy.

Transmission companies face issues such as improving safety and reliability, as well as reducing operations and maintenance (O&M) costs. They are also seeking ways to increase transmission capacity without making large capital investments. Reducing capital expenditures for new and refurbished equipment is another priority.

This EPRI research program is designed to address the research needs of transmission asset owners and operators. The program includes projects focused on specific components (e.g., insulators, compression connectors, conductors, composite poles, and crossarms) as well as projects focused on issues (e.g., lightning and grounding, live working, transmission capacity, and methods to assess the condition of overhead lines).

Nominated Contact Email Address(es)

box.so.innovation@nationalgrid.com

Problem Being Solved

The Worldwide electricity industry recognises that there are parallel challenges within the field of electricity transmission which are more economically investigated and addressed through collaborative learning and knowledge generation among key industry stakeholders. The Electric Power Research Institution (EPRI), with its wide international membership, takes a key role in determining and delivering the most impactful R&D projects. This portfolio of work is focused on Overhead and Underground Circuits (OUC) which address key aspects of National Grid's Innovation Strategy.

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Method(s)

Research

EPRI is a non-profit organization which facilitates a variety of research projects relating to OUC within the electricity industry. These collaborative projects bring together scientists, engineers and academic experts in the industry to help assess recognised challenges within the field. EPRI's approach in managing collaborative projects is beneficial to provide National Grid with valuable information, learning and knowledge which would be more expensive to formulate on an individual basis.

On an annual basis we work with EPRI to select a portfolio of projects which is made available to all collaborators; this annual portfolio review includes an overview of the project's research value, the approach and alignment of objectives with the needs of and priorities for the GB Electricity Transmission Network. Each project that is chosen for National Grid to join is reviewed and agreed through our governance processes with authority for sanctioning innovation projects within the Company.

Of the 15 projects under EPRIs Overhead Transmission programme (Programme 35), National Grid has identifed 7 that are aligned with our existing research strategy and priorities.

- Conductor, Shield Wire and Hardware Corrosion Management (EPRI Project 35.002)
- Compression Connector Management (EPRI Project 35.004)
- Lightning Performance and Grounding of Transmission Lines (EPRI Project 35.006)
- Live Working: Research, Techniques and Procedures (EPRI Project 35.010)
- Polymer and Composite Overhead Line Components (EPRI Project 35.011)
- Porcelain/Glass Insulator Integrity Assessment (EPRI Project 35.012), and
- Performance and Maintenance of High-Temperature Conductors (EPRI Project 35.015)

Scope

The scope for the seven projects under the prorgamme has an extensive range, further details for each of these projects can be found at the following link:-

http://portfolio.epri.com/ProgramTab.aspx?sId=PDU&rId=263&pId=7705&pjId=7709

Objective(s)

Conductor, Shield Wire and Hardware Corrosion Management

- Develop tools and processes for inspecting and assessing overhead conductors, shield wires and hardware
- Produce management and engineering guides and provide guidance to asset managers.
- Devise guidelines for inspection, selection and application.
- Assess fleet management methodology to perform population assessments of phase conductors and shield wires

Compression Connector Management

- Develop guidelines to assist utilities with the inspection of overhead transmission line compression connectors.
- Undertake tests to determine the performance of HTLS conductors after routine cleaning.
- Evaluate the life expectancy of compression connectors operating at 100°C and below.

- Evaluate compression connectors with known defects.
- Maintain connectors failure/performance data

Lightning Performance and Grounding of Transmission Lines

- Evaluation of techniques to improve the lighting performance of lines to include shielding, grounding, insulation and transmission line surge arresters.
- Establish cost efficiency of different approaches.

Live Working: Research, Techniques and Procedures

- Review live working methodology to include; ropes for live work and energized rescue, live work on HV lines and live work with high-temperature conductors
- Design of structures to facilitate safe, efficient, and economic execution of live work
- Technology transfer through updating the Tan Book, training videos/DVDs, meetings, and webcasts

Polymer and Composite Overhead Transmission Line Components

- Evaluation of a range of composite component concerns.
- Examination of composite components, such as polymer insulators, guy strain insulators, and fiberglass cross arms

Porcelain / Glass Insulator Integrity Assessment

- Develop a guide to identify insulators and design characteristics
- Evaluation of porcelain and glass insulators to provide necessary data to make design and procurement decisions
- improve the Insulator Calculation Engine (ICE) software by adding a library of manufacturer designs
- track in-service insulator failures

Performance and Maintenance of High-Temperature Conductors

- Improve comprehensive guide for the selection and application of various types of high-temperature conductors

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

n/a

Success Criteria

In the period April 13 to December 14, this research program expects to accomplish these objectives:

- Develop tools and mitigation techniques to address sub-grade and conductor corrosion
- Develop guidelines for compression connector management
- Develop inspection and assessment approaches for composite poles and crossarms
- Provide state-of-the-art methods for designing transmission line structures
- Develop live working ropes for new applications
- Evaluate the performance of lightning detection networks
- Update the Lightning and Grounding reference book (the Gray Book)
- Provide composite component accelerated aging results
- Develop software to aid in selection of corona rings for polymer insulators and electric field calculations on ceramic and glass insulators (ICE)
- Develop guidelines for the selection and application of various types of high-temperature low sag conductors

Project Partners and External Funding

n/a

Potential for New Learning

n/a

Scale of Project

All of the selected Overhead Transmission projects are predominantly laboratory or desk based projects and as such there is no scope to reduce the scale of the projects any further.

Technology Readiness at Start

TRL2 Invention and Research

Technology Readiness at End

TRL4 Bench Scale Research

Geographical Area

The research undertaken in the EPRI Overhead Transmission programme is predominantly carried out in the USA with some undertaken in the UK, although the programme also reviews the latest relevant research from across the world.

Revenue Allowed for the RIIO Settlement

None

Indicative Total NIA Project Expenditure

The total expenditure is £655,378

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)

Each project will have different financial savings based on the outcomes and potential benefits gained. Each EPRI programme that National Grid joins has been through two stages of review that consider the potential to deliver financial benefits. In the first instance, within EPRI's governance, the Research Advisory Committee provides guidance on policies and issues that impact the power industry to inform the content of the research programmes. Within National Grid, the Technical Leader for each aspect of the GB Transmission Network undertakes a review of the proposed EPRI programme relevant to their technical expertise and responsibilities and evaluates which provide potential value from a GB perspective as part of an annual review of which programmes to participate in.

Please provide a calculation of the expected benefits the Solution

Not required for a research project.

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

The learning from all the projects National Grid has selected from this prorgamme can be utilised by all Network Licensees systems and can applied to the whole of the GB overhead transmission (and much of the distribution) infrastructure.

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

The direct cost of making a policy or procedure change could range from as little as ten thousand to hundreds of thousands of pounds depending on the complexity of the change implications. The wider cost implications arising from such changes will be dependent on the specific outcomes generated from the project and typically will be subject to further stages of demonstration prior to roll out. Further information regarding roll out costs can be provided prior to demonstration stage.

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

RIIO-2 Projects

☐ 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

All of the Transmission Network Owners and Distribution Owners have a common heritage in terms of the overhead transmission and distribution assets on their network and face similar challenges such as earthing, lightning strikes, corrosion, conductor jointing. The learning from EPRIs Overhead Transmission Programme will be relevant to all owners of such assets.

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

n/a

☑ 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