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_NGET0123

Project Registration

Project Title

EPRI Research Collaboration on Substations

Project Reference Number

NIA_NGET0123

Project Licensee(s)

National Grid Electricity Transmission

Project Start

April 2013

Project Duration

2 years and 4 months

Nominated Project Contact(s)

Glyn Kirkland

Project Budget

£1,148,620.00

Summary

Protection and Control Maintenance Approaches EPRI Project 37.103: The purpose of this project is to address utility challenges in protection and control.

Multi-year research will address three themes:

- Enabling technologies and engineering for non-intrusive maintenance;
- Development of an industry-wide relay performance repository; and
- Development of configuration management process and tools.

Nominated Contact Email Address(es)

box.NG.ETInnovation@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 substations which address key aspects of National Grid's Innovation Strategy.

The EPRI substations program helps substation owners enhance safety, reliability, equipment life, and performance, as well as prioritize their asset investments and allocations of limited resources. It offers a portfolio of tools and technologies such as risk-based asset and fleet management decision support analytics and transformer monitoring.

Method(s)

EPRI is a non-profit organization which facilitates a variety of research projects relating to substations 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 10 Substation put forward by EPRI members for the 2013/14 programme, National Grid has identified 2 of particular value to the GB Transmission system.

EPRI Project 37.103 - Protection and Control

EPRI Project 37.108 - SF6 Management

The research applies EPRI-created knowledge of the fundamental aging and degradation process of materials, components and systems to define inspection and monitoring approaches, maintenance activities, and mitigation options. Research results will be transferred to members in reports, reference guides, easy-to-use operational and procedural guidelines, and workshops.

- Equipment aging assessment tools—failure modes, degradation mechanisms and diagnostics
- Risk-based fleet management—decision support analytics and methodologies
- Diagnostic effectiveness assessment
- Asset management and maintenance best-practices guidelines
- Reference books, guidelines, videos, field guides, and technology transfer workshops
- Industry-wide equipment performance databases
- Collaborative environments for sharing lessons learned and best practices

Scope

Protection and Control Maintenance Approaches EPRI Project 37.103: The purpose of this project is to address utility challenges in protection and control. Multi-year research will address three themes:

- enabling technologies and engineering for non-intrusive maintenance;
- development of an industry-wide relay performance repository; and
- development of configuration management process and tools.

For full details of the scope of project 37.103 following this link.

http://portfolio.epri.com/ProgramTab.aspx?sId=pdu&rId=263&pId=7736&pjId=7739

SF6 Management EPRI Project 37.108: The following tasks are being conducted under this project:

- Information gathering through laboratory experiments including testing on live-filling strategies;
- Evaluation of available and emerging SF6 leak detection technologies.
- Laboratory testing in the EPRI Charlotte Lab.
- Full-scale laboratory testing.
- State-of-the-science understanding through studies and surveys.
- Engagement in industry, academic, and regulatory groups to understand the issues.
- Knowledge transfer through computer-based training and task forces.

For full details of the scope of project 37.108 following this link

http://portfolio.epri.com/ProgramTab.aspx?sld=pdu&rld=263&pld=7736&pjld=7742

Objective(s)

Protection and Control Maintenance Approaches EPRI Project 37.103:

- To improve electricity transmission network reliability and security by reducing the changes of relay mis-operation.

SF6 Management EPRI Project 37.108:

- Reduce SF6 emissions from the electricity transmission network.

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

n/a

Success Criteria

Protection and Control Maintenance Approaches EPRI Project 37.103:

In 2014, proposed research tasks will evaluate configuration management processes, tools and develop applicable templates to assist utilities in the implementation of configuration and setting management. Future year tasks will collect use cases from utilities to generate recommended practices as well as identify the potential gaps for improvement. The ultimate outcome from the configuration management research will help utilities move towards standardized design, and automate processes such as protection setting verification.

SF6 Management EPRI Project 37.108:

Under this project, the following tasks will be conducted in 2014 to support the research:

- Information gathering through laboratory experiments including testing on live-filling strategies
- Evaluation of available and emerging SF6 leak detection technologies
- State-of-the-science understanding through studies and surveys
- Engagement in industry, academic, and regulatory groups to understand the issues
- Knowledge transfer through computer-based training and task forces

Future year tasks will collect use cases from utilities to generate recommended practices as well as identify the potential gaps for improvement.

The outcomes from both projects are shared during the annual EPRI Dissemination Event and by National Grid through the ENA website.

Project Partners and External Funding

Each project facilitated by EPRI is funded through collaborators, including National Grid, that contribute to the development of the project portfolio and then express specific interest in being involved in a project once the portfolio is decided. Total external funding to the value of £0.96 million has been provided by other collaborators involved in the Protection & Control and SF6 Management projects. This is demonstrated in the table below:

Potential for New Learning

EPRI's varied portfolio enables National Grid to select appropriate R & D projects that align to delivering benefits to consumers covering therefore objectives relating to the design, management and operation of substations. Each project provides opportunities for extensive learning and knowledge generation through collaboration which would not be economically feasible if carried out independently.

The EPRI Protection and Control project 37.103 will create new learning opportunities on the maintenance programmes and configuration management processes in assessing the reliability and performance of protection and control systems.

The SF6 Management project 37.108 will develop understanding of reducing SF6 emissions through new technologies, improved SF6 tracking and reporting approaches, training and knowledge transfer and lifecycle management processes.

Scale of Project

Both 37.103 and 37.108 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 Substations programme is predominantly carried out in the UK and the US, although the programme also reviews the latest research from across the world.

Revenue Allowed for the RIIO Settlement

Zero.

Indicative Total NIA Project Expenditure

The total NIA expenditure is £258,000

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)

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.

The Protection and Control project will generate key learning which can improve and maintain the reliability of the system. The SF6 Management for Substations project will deliver environmental benefits for through reduced greenhouse gas emissions.

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

Protection and Control is presents at all substations throughout the transmission and distribution networks.

SF6 Management is relevant to any sites that have gas insulated equipment. Approximately 90% of National Grid's substations have SF6 containing components.

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 GB electricity licensees own and manage substations and an increasing number deploy equipment containing SF6. The learning from EPRI's substation programme number 37 will be relevant to all GB electricity Network Licensees.

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.

By participating in collaborative projects through EPRI National Grid can ensure that unnecessary duplication with other projects under NIA is avoided.

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