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

Feb 2014

Project Reference Number

NIA_NGET0088

Project Registration

Project Title

Transformer Research Consortium

Project Reference Number

NIA_NGET0088

Project Licensee(s)

National Grid Electricity Transmission

Project Start

April 2013

Project Duration

4 years and 7 months

Nominated Project Contact(s)

Paul Jarman

Project Budget

£1,050,000.00

Summary

This proposal for funding a research consortium at the University of Manchester follows two phases of a very successful collaborative research programmes at Manchester with most of the same partners into the properties of natural and synthetic esters and their suitability for use in transformers. The knowledge gained has proved to be world class and these oils are now being used in auxiliary and earthing transformers to successfully reduce fire protection costs. There is a significant possibility of using alternative fluids in a city centre project to reduce fire risks. This project continues that collaboration into an expanded range of transformer issues agreed by the partners to be of critical interest to the industry. The costs are split equally and this represents particularly good value. The project helps to retain transformer knowledge and expertise at Manchester.

Nominated Contact Email Address(es)

box.NG.ETInnovation@nationalgrid.com

Problem Being Solved

National Grid have an ageing fleet of Power Transformers on the Electricity Transmission system. In order to provide a transmission system that is fit-for-purpose and provides a secure supply at a low cost, it is critical that National Grid replaces these transformers at the correct time. There are a large number of variables that can cause a power transformer to fail - Ageing, Partial Discharge, Abnormal Magnetic fluctuations and Hot Spots to name a few. National Grid needs to better understand the problems faced by day-to-day operation of the transformers in order to inform the asset management business, and ensure the most value is provided for consumers.

Method(s)

Research

The University of Manchester are going to undertake research on behalf of the consortium in the following areas:

- Interpretation of ageing markers in transformers and new ageing indicators. This will be based on lab work and data gathered from

transformer scrappings.

- Types of partial discharge, intensity rate of damage and electrical and chemical indications, based on lab work of various oil types.
- Dissolved Gas Analysis (DGA) interpretation based on practical work on how faults produce gas, different types of oils and operational data.
- Transformer Thermal Design aspects, hotspot temperature measurement and thermal limits, based on CFD studies and practical work on lab scale models.

Scope

This proposal for funding a research consortium at the University of Manchester follows two phases of a very successful collaborative research programmes at Manchester with most of the same partners into the properties of natural and synthetic esters and their suitability for use in transformers. The knowledge gained has proved to be world class and these oils are now being used in auxiliary and earthing transformers to successfully reduce fire protection costs. There is a significant possibility of using alternative fluids in a city centre project to reduce fire risks. This project continues that collaboration into an expanded range of transformer issues agreed by the partners to be of critical interest to the industry. The costs are split equally and this represents particularly good value. The project helps to retain transformer knowledge and expertise at Manchester.

Objective(s)

The research objectives are on the following topics:

- Ageing assessment (methods and experience)
- Partial discharge diagnostics (laboratory studies of discharge, detection and effects)
- Dissolved gas analysis, practical work on DGA understanding
- Thermal analysis, providing practical tools for assessing thermal capability and design of transformers

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

n/a

Success Criteria

This project will be successful if we gain a greater understanding of the research areas, and are able to use that knowledge to influence the management of transformers on the UK system.

Project Partners and External Funding

n/a

Potential for New Learning

n/a

Scale of Project

This project is focussed on a laboratory scale, but will take into account system issues. As a result, we cannot reduce the scale of the work and provide the benfits to consumers that are required.

Technology Readiness at Start

TRL3 Proof of Concept

Technology Readiness at End

TRL5 Pilot Scale

Geographical Area

The project will deliver in Manchester.

Revenue Allowed for the RIIO Settlement

Zero

Indicative Total NIA Project Expenditure

Indicative NGET NIA contribution £275,000
Indicative SPEN NIA contribution £250,000
Indicative UKPN NIA contribution £250,000

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)

Transformers are a critical part of the electricity network. This work will provide new information on the effective day-to-day management of the transformer fleet, for all network licensees to utilise in the efficient operation of the system.

Please provide a calculation of the expected benefits the Solution

Research project - not required.

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

This work will be applicable to 100% of GB Transmission system sites.

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

This knowledge will be rolled out via the technical experts in the day-to-day operations of the system, and will be shared through industry conference, best practice fora and the annual NIA/NIC conference.

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

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 the theme of reliability improvements with specific focus on optimising asset management for the transformer population.

☑ 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