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

Mar 2013

Project Reference Number

Project Registration

Project Title

Exported Potentials and Profiles Around Earth Electrodes and Opposite-Side Injection for Large-Area Earthing Systems

Project Reference Number

Project Licensee(s)

National Grid Electricity Transmission

Project Start

January 2011

Project Duration

4 years and 3 months

Nominated Project Contact(s)

National Grid TO Innovation Team

Project Budget

£201,000.00

Summary

The project proposal is divided into five areas of investigation:

- Prediction of ground surface exported potentials and potential fall-off in the vicinity of earth electrodes. Previous work has demonstrated that exported potentials can be measured fairly accurately using the developed techniques. It is proposed that these tests are carried out at Dinorwig and at Llanrumney test sites

- Investigation into scalability of low-current injection testing. Previous tests have shown that there is a current dependence of the measured earth impedance in the range 10mA to 5A. In this project, it is proposed to explore and understand these changes over a wider range of current magnitudes including the high current impulse test

- Investigation of non-linear effects of earth impedance at low-current magnitude and associated polarisation. These laboratory-based investigations will be focussed on clarifying the observed dependence of earth impedance on current magnitude. In particular, it will explore the physical phenomena involved with this behaviour, e.g. i) polarising effects at the electrode-soil interface and the soil-soil particle interface and ii) other non-linear effects including thermal dependence

- Investigation into frequency effects of earth impedance. An investigation into the frequency effects in earthing system measurements will be undertaken in the laboratory and in the field, to explore further the variability seen from the previous tests and allow a better understanding of the trends

- Modelling of earth electrodes accounting for non-linear effects. Comparison of the test results, obtained from the practical tests described in the points above, with computer simulations of the electrodes (CDEGS and physical modelling, finite element and boundary element) will allow a better model and equivalent circuits of earth electrodes to be developed accounting for the nonlinear effects.

Nominated Contact Email Address(es)

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Problem Being Solved

Method(s)

Scope

Objective(s)

To determine the safety voltages, the extent of hot-zones and exported potentials accurately is crucial in terms of earthing systems design. This will allow developing efficient and reliable mitigation measures.

In addition, current testing methods/instruments operate in the range of 10mA to 5A. Hence, the scalability of the measurement (to high fault current) is yet to be established. Non-linear effects were seen as a function of frequency and current for low magnitudes. Such phenomena will be investigated and the issue of scalability of test results will be addressed. This forms a significant part of this project.

Furthermore, the credibility and accuracy of predictions using simulation software packages has yet to be fully verified experimentally, and this project willaddress these challenges.

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

n/a

Success Criteria

n/a

Project Partners and External Funding

n/a

Potential for New Learning

n/a

Scale of Project

n/a

Geographical Area

Revenue Allowed for the RIIO Settlement

Indicative Total NIA Project Expenditure

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)

n/a

Please provide a calculation of the expected benefits the Solution

n/a

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

n/a

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

n/a

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)

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

Please demonstrate how the learning from the project can be successfully disseminated to Network Licensees and other interested parties.

Please describe how many potential constraints or costs caused, or resulting from the imposed IPR arrangements.<

Please justify why the proposed IPR arrangements provide value for money for customers.

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