

NIA Project Registration and PEA Document

Date of Submission

Dec 2013

Project Reference Number

NIA_NGET0015

Project Registration

Project Title

Dinorwig Thermal Cycling and Cable Rating

Project Reference Number

NIA_NGET0015

Project Licensee(s)

National Grid Electricity Transmission

Project Start

February 2013

Project Duration

4 years and 2 months

Nominated Project Contact(s)

David Scott

Project Budget

£370,000.00

Summary

The project aims to undertake a detailed study on the thermal cycling effects subjected on the Dinorwig cable circuits with particular emphasis on the stop joints. The live data captured on site will enable us to model the stop joint using Finite Element Analysis. The results of this analysis should yield better understanding on the expected performance of these stop joints under differing load patterns as well as shed light on any relevant amendments regarding assumptions made in the current cable ratings model.

Nominated Contact Email Address(es)

box.NG.ETInnovation@nationalgrid.com

Problem Being Solved

The 400kV electricity connection for Dinorwig Power Station over recent years has suffered from poor reliability problems associated with abnormally high Dissolved Gas levels in the cable fluid. These levels have forced NGET to switch out the Dinorwig-Pentir 1 circuit in 2012 resulting in a circuit outage to replace the 'gassing' stop joint accruing BSIS costs of circa £150k per day.

An identical issue occurred in 2011 on the Dinorwig-Pentir 2 circuit with identification of another 'gassing' stop joint.

These incidents have prompted an action to probe further into the likely root cause as well as further studies to understand the resultant effects (pertaining to stop joints) from an aspect of thermal cycling.

Method(s)

National Grid will install condition monitoring on existing stop joints on the Dinorwig Cable Circuit. This data will be observed and monitored, and then the temperature data will be coupled with system records of circuit load. This merged data will then be used to validate updated Finite Element Analysis models of joint bays and compared to existing methods. This difference (if any) will be then identified and analysed.

Scope

The project aims to undertake a detailed study on the thermal cycling effects subjected on the Dinorwig cable circuits with particular emphasis on the stop joints. The live data captured on site will enable us to model the stop joint using Finite Element Analysis. The results of this analysis should yield better understanding on the expected performance of these stop joints under differing load patterns as well as shed light on any relevant amendments regarding assumptions made in the current cable ratings model.

Objective(s)

The desired results for this project are to improve the accuracy and understand the effects of thermal cycling on stop joints.

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

n/a

Success Criteria

This project will be successful if we increase the knowledge and understanding around the thermal cycling effects on stop joints.

Project Partners and External Funding

n/a

Potential for New Learning

n/a

Scale of Project

The project is focussed on a laboratory scale, with data being obtained from a cable circuit.

Technology Readiness at Start

TRL4 Bench Scale Research

Technology Readiness at End

TRL6 Large Scale

Geographical Area

The work is being completed in Southampton, with data being collected from Dinorwig.

Revenue Allowed for the RIIO Settlement

Zero

Indicative Total NIA Project Expenditure

IFI - £35,000

NIA - £335,000

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)

Gassing stop joints on this circuit have cost National Grid in the region of £500k a day in constraint costs. Minimum outage times for these costs are in the region of 6 weeks (usually longer), so total cost is £21m. If improved modeling contributes a 1% improvement to this cost, the total would be £210k.

Please provide a calculation of the expected benefits the Solution

Base = £210k Method = £110k

B-M= £100k

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

This should be applicable to all Network Licensees' sites where there are stop joints on Oil Filled cable circuits (with potential for minor modifications).

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

Modeling can be updated within this project, so the impacts will be felt across the whole system within this project.

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

RIO-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 (RIO-1 only)

This project addresses reliability with focus on optimizing asset management of older cable circuits.

- ☒ 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