NIA Project Registration and PEA Document

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.

Project Registration

Project Title		Project Reference
Distribution Asset Thermal Modelling		NIA_ENWL002

Project Licensee(s)	Project Start Date	Project Duration
Electricity North West Limited	Jul 2015	18 Months

Nominated Project Contact(s)		Project Budget
Geraldine Bryson (geraldine.bryson@enwl.co.uk)		£260,000

Problem(s)

One of the key challenges facing DNOs today is a significant change in loading on LV networks from increased penetrations of Low Carbon Technologies (LCTs). The DECC projections for Electric Vehicle and Heat Pump uptake will lead to a marked increase in the daily peak demand placed on LV networks and combined with the observed increase in generation from domestic PV result in the potential for a significant change in the manner LV networks are utilised. These changes have the potential to significantly alter the existing power flows, which is expected to increase instances of distribution asset thermal overload risking premature ageing induced by higher operating temperatures and potential asset failures particularly for transformers where resultant hotspots lead to a loss of insulation oil. The forecasted changes in the utilisation of distribution assets is contrasted with the limited understanding of the behaviour and performance and their potential to accept increased loadings whilst still achieving the expected economic lifetime.

A greater understanding of the thermal behavior exhibited by distribution assets could be used by DNOs to maximise their lifetime by applying new understanding to network design, maintenance and asset management procedures.

This project is being raised to complete work on two projects raised under IFI funding; "Distribution Transformer Real Time Thermal Ratings" and "Dynamic Thermal Analysis of Low Voltage Underground Cables."

Method(s)

The project will be split in to two distinct methods:

1.   Building upon work already completed within the IFI project, a thermal failure model for distribution transformers will be developed taking into account load profiles, transformer manufacturers, designs and ageing conditions. This model can then be used to categorise the DNOs distribution transformer population and identify those types which have an increased probability of failure associated with future loadings scenarios.

2.   A prototype network design tool for LV cables using high fidelity Finite Element Analysis (FEA) models will be developed. This tool will assist in establishing how LV cables behave thermally over time when either balanced or unbalanced currents are applied and will provide DNOs with access to a catalogue of simplified thermal models that reflect typical installation scenarios. These models can be used by DNOs to help support network investment planning activities.

Scope

The project will cover all common types of distribution (11kV or 6.6kV to 415V) transformers and low voltage (415V) cables installed

by Electricity North West.

Objective(s)

1. To develop a Thermal Failure Model for distribution transformers.

2. To develop an LV cable network design tool based on thermal models of typical installation scenarios

Success Criteria

1. A database which describes a distribution transformer's thermal performance and probability of failure under different loading scenarios which can be used to project future investment plans.

2. An Excel based network design tool for LV cables which will use predefined inputs and FEA models to produce a maximum and minimum operating temperature envelope which can be used to demonstrate whether the cable can accept new LCTs.

Technology Readiness Level at Start	**Technology Readiness Level at Completion**
2	4

Project Partners and External Funding

The University of Manchester

Potential for New Learning

The project will deliver two "tools" which can be used by all DNOs to assess the thermal performance of distribution assets against future load projections. This assessment can be used to inform future network investment plans.

Learning from this Project will be shared with the network operator community through tried and tested dissemination methods. Key to this will be learning materials and availability of Project personnel at the LCNI conferences in each delivery year and the annual and closedown reports. We will also be available for one to one discussions with interested DNOs

Scale of Project

The project will produce tools and methodologies which can be applied to 90% of distribution transformers and low voltage cables.

Geographical Area

The project will use data from the Electricity North West distribution network.

Revenue Allowed for in the RIIO Settlement

None

Indicative Total NIA Project Expenditure

£260000

Project Eligibility Assessment

Specific Requirements 1

1a. A 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 systems and 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	☐

Specific Requirements 2

2a. Has the Potential to Develop Learning That Can be Applied by all Relevant Network Licensees ☒

Please answer one of the following:

i) Please explain how the learning that will be generated could be used by relevant Network Licenses.

The tools, models and methodologies produced by the University will be made available to all other DNOs to allow them to assess their own asset base and inform future investment plans.

ii) Please describe what specific challenge identified in the Network Licensee's innovation strategy that is being addressed by the Project.

The Electricity North West's innovation strategy for RIIO-ED1 has one theme of affordable reliability. Using the improved thermal assessment methodologies produced by this project will allow Electricity North West to target their investment in the right areas. This will lead to a more efficient response to the increase of Low Carbon Technologies and ageing assets.

2b. Is the default IPR position being applied?

Yes	☒
No	☐

If no, please answer i, ii, iii before continuing:

i) Demonstrate how the learning from the Project can be successfully disseminated to Network Licensees and other interested parties

ii) Describe any potential constraints or costs caused or resulting from, the imposed IPR arrangements

iii) Justify why the proposed IPR arrangements provide value for money for customers

2c. Has the Potential to Deliver Net Financial Benefits to Customers ☒

i) Please provide an estimate of the saving if the Problem is solved.

It is not possible to estimate a financial saving at this point. This project will improve understanding of risks associated with the adoption of LCT and deliver improved methodologies to assess our assets for an increasing demand. These improved methodologies will lead to more efficient future business plans.

ii) Please provide a calculation of the expected financial benefits of a Development or Demonstration Project (not required for Research Projects). (Base Cost – Method Cost, Against Agreed Baseline).

Not Required as this is a Research project.

iii) Please provide an estimate of how replicable the Method is across GB in terms of the number of sites, the sort of site the Method could be applied to, or the percentage of the Network Licensees system where it could be rolled-out.

The tools and methodologies produced by this project could be applied to 90% of all DNO distribution transformers and Low Voltage cables.

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

There is no rollout cost. The methodologies will be made available to all DNOs.

2d. Does Not Lead to Unnecessary Duplication ⊠

i) Please demonstrate below that no unnecessary duplication will occur as a result of the Project.

There have been a number of projects looking at thermal ratings of assets but these are primarily at higher voltages or have been focused on real time thermal ratings. The intention of this project is to produce improved methods for assessing when an asset needs to be replaced or upgraded which will produce more efficient business plans.

ii) If applicable, justify why you are undertaking a Project similar to those being carried out by any other Network Licensees.