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

Jul 2025

Project Reference Number

NIA_ENWL034

Project Registration

Project Title

Cool Runnings

Project Reference Number

NIA_ENWL034

Project Licensee(s)

Electricity North West

Project Start

August 2025

Project Duration

0 years and 7 months

Nominated Project Contact(s)

Delroy Ainsworth

Project Budget

£154,205.00

Summary

Cool Runnings will explore the technical and practical implementation of the Smart Heat Variable Transformer Rating method. The Smart Heat NIA project investigated different approaches to manage the impact of network overloads due to the increase in network demand caused by the uptake of heat pumps (HP). Cool Runnings will investigate the extent to which capacity released by applying variable ratings in distribution transformers, can support the additional load from HP uptake for various network designs (building type; transformer size, age, design) and ambient conditions. This phase of the project will develop an initial variable rating algorithm and define the laboratory testing required to prove it which will be conducted in future phases.

Third Party Collaborators

Ricardo

Nominated Contact Email Address(es)

innovation@enwl.co.uk

Problem Being Solved

The UK government has targeted an increase of 600 000 HP installations per year by 2028, according to its Ten Point Plan. Whilst there is still uncertainty around the size and profiles of the demand that will result from the large-scale uptake of HPs, the increased demand is expected to create a significant challenge for distributed network operators (DNOs).

Even with the current range of innovative methods used by DNOs, the network will not be able to support the UK government's plan for the electrification of heat without intervention. To avoid the requirement for extensive network reinforcement works upfront, further innovation is required to meet the challenge of a rapid acceleration in HP installations.

Method(s)

Variable rating is a new tool being developed in Cool Runnings to provide near real-time ratings for distribution transformers that vary with ambient temperature and substation environment. As the variable rating will be higher in cooler ambient conditions, additional capacity can be released in winter when it is anticipated that heating load will be at its peak. Therefore, this tool is specifically suited to managing the increased demand associated with HPs.

This project will focus on developing the methodology (including specialist temperature measurement techniques) and designing the test schedules to enable physical transformer testing in the next stage of the project.

Scope

This project will:

· Prove the technical capability of distribution transformers to support loading up to a calculated variable rating.

· Update and validate the Smart Heat Variable Rating approaches using experimental data and an understanding of the likely BAU implementation.

· Understand the work, tools, processes, and changes in thinking needed in ENWL and the other GB DNOs for BAU implementation, and the fit of this method alongside emerging new technologies and approaches.

· Scope and specify the required next steps, including the detailed scope for a Phase 2 project.

As a part of the Smart Heat NIA Final Project Report, a Cost Benefit Analysis (CBA) was conducted for the Smart Heat solutions which indicated that the Smart Heat Variable Rating solution has significant financial and carbon benefits over alternatives, including traditional reinforcement and alternative smart solutions.

The CBA (2022 figures) indicates that implementing the Variable Rating solution alone would provide an estimated financial benefit of £127.4m, as well as 30ktCO2e in carbon benefit above the traditional base case (current BAU), that is up to 2050 over the Electricity North West network region.

Objective(s)

The objective of this project is to scope out testing of distribution transformers, which will include definition of the test requirements and a detailed test plan.

· Scoping of Testing: develop written requirements, scope and deliverables for Distribution Transformer testing. This will include an exploration of transformer monitoring options, which builds on ENWL's initial investigations (from previous innovation projects), definition of test requirements and definition of detailed test plan. This will include a review of previous data to understand the baselining needed in order to develop variable rating equations.

· Develop Initial Variable Rating Method: Investigation into Variable Rating algorithm in advance of trial testing. Areas to understand is the quantity of data needed during initial testing to characterise the transformer into the algorithm. Another point to consider is the type of load profiles to apply during initial testing to acquire enough data to understand the relationships between hotspot and surface temperature

· Develop initial template for Variable Rating Tool: Develop an initial template of what the Tool will look like.

· Initial Scoping of Tools and Process Changes: Initial view into how this process would integrate into BAU solution architecture.

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

An assessment of distributional impacts (technical, financial and wellbeing related) for this project has been carried out using a bespoke assessment tool, which assesses the project as having a positive, negative or neutral effect on consumers in vulnerable situations. To help inform the assessment, this tool considers the categories of consumers identified in the Priority Services Register.

This project has been assessed as having an overall positive impact on consumers in vulnerable situations. The assessment has identified that overall this project will look to reduce the costs for households and reduce the amount of disruptions to them in the home. Other considerations including the projects impact on supply, immediate health and safety in the home have been made in carrying out this assessment.

Success Criteria

· Detailed transformer testing plan

- Temperature measurement process established
- Initial Variable rating methodology established

Project Partners and External Funding

ENWL will work alongside the following project partners to achieve the project objectives:

- Ricardo Energy

Potential for New Learning

The implementation of this project will provide opportunities for learnings for ENWL and other GB DNOs with respect to the following:

- Technical capability of Distribution transformers to deploy real-time Variable Rating methods
- Requirements (tools, process, procurement, technology, procedures, etc.) to implement Variable Rating methods into BAU

Project dissemination will take place in the form stakeholder engagements, workshops and training interventions, and potentially presentation at seminars and conferences to share project learnings with a broader stakeholder base.

Scale of Project

The project will scope out the testing requirements and design for testing approximately 9 distribution transformers in a future phase of the project. This is to cover a representative diversity of transformers found on the ENWL network. That is the minimum number assumed to be required to cater for variances in network topology and design.

Technology Readiness at Start

TRL3 Proof of Concept

Technology Readiness at End

TRL4 Bench Scale Research

Geographical Area

North West of England

Revenue Allowed for the RIIO Settlement

£0

Indicative Total NIA Project Expenditure

£154205

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:

The Variable Transformer Ratings method could address the problem of insufficient capacity on the distribution network to accommodate a large and sustained rise in the uptake of low carbon heat by domestic customers.

The successful roll out of this final solution could enable increased uptake of HPs while ensuring minimal disruption to existing networks, and could bring significant cost reductions and carbon benefits over both traditional infrastructure reinforcement methods, and other smart solutions.

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

As a part of the Smart Heat NIA final project report, a CBA was conducted for the Smart Heat solutions which indicated that the Smart Heat Variable Rating solution has significant financial and carbon benefits over alternatives, including traditional reinforcement and alternative smart solutions.

The CBA was performed for several scenarios to see the benefits each solution can bring individually, over the 'Traditional Case' that only assumes traditional reinforcement of distribution transformers as well as the 'Smart Base Case' which includes both traditional methods (network reinforcement) and any innovative emerging solutions that are expected to become BAU over the modelling period (Celsius Rating, Voltage Optimisation and Active Cooling).

The CBA (2022 figures) indicates that implementing the Variable Rating solution alone would provide an estimated financial benefit of £127.4m, as well as 30ktCO2e in carbon benefit above the traditional base case (current BAU), that is up to 2050 over the Electricity North West network region.

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

This must be 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.

If proved successful, the Variable Ratings algorithm could be applied to all distribution transformers across GB.

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

The cost of rolling out the method is expected to be minimal as we will use existing LV load monitoring equipment and retrofittable

temperature sensors to collect the data.

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

The implementation of the Variable Rating method can assist licensees with maximising capacity of the existing asset base, and thus support the integration of low carbon heating (HPs) across GB, particularly in the short-medium term (i.e. without the need for extensive network reinforcement works)

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.

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.

A review of the Smarter Networks portal has not revealed any other projects in this area. This project builds on the learning obtained from the Celsius NIC project.

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

The methodology for calculating variable ratings is based largely on the methodologies and equations developed in the Celsius project. Variable rating is distinct from Celsius rating in that it is based on operational and real time methods which will be operationally critical.

The aim of the first phase in this project is to undertake the vital research required to bridge the research gaps from Celsius to enable greater confidence in Variable Rating methods, including gathering and analyzing data at higher loading levels (up to calculated variable ratings), and from direct transformer hotspot monitoring (of which there was only limited availability in Celsius). This will be based on testing of monitored transformers under test loading conditions, including up to 150% of the nameplate rating, to develop evidence and experience of various transformers' performance at high loading under different ambient conditions. This will be used to build on the initial model developed in the Celsius project to produce methodologies suitable for the Variable Rating tool.

Relevant Foreground IPR

The Variable Rating algorithm is the IPR for this project. The Variable Rating solution is based on an underlying model of transformer thermal behaviour which predicts the loading when the transformer will reach its maximum operating temperature, considering numerous factors such as ambient conditions as well as the transformer size, age and design. This solution builds on the learning of the Celsius project to develop a method to produce ratings for distribution transformers that vary with the ambient temperature, and to some extent loading conditions.

Data Access Details

Data will be made available as per our "innovation data sharing policy" on the ENWL website: Our data sharing policy (enwl.co.uk)

Please identify why the Network Licensees will not fund the project as apart of it's business and usual activities

Additional work is required to build confidence in the variable rating methods, including testing transformers at very high loading (up to the calculated variable rating) and measuring transformer hotspot temperature, before implementation at a BAU level. Trials will also provide learnings with respect to safety, for both personnel and equipment, prior to BAU implementation.

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

There is no guarantee that the proposed solution is viable. The extent to which transformers can be loaded and the subsequent effect on their asset life is unknown. Therefore, it is necessary to assess this under NIA conditions.

This project has been approved by a senior member of staff

☑ Yes