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

Jun 2022

Project Reference Number

NIA_WPD_070

Project Registration

Project Title

Running Cool

Project Reference Number

NIA_WPD_070

Project Licensee(s)

National Grid Electricity Distribution

Project Start

June 2022

Project Duration

1 year and 10 months

Nominated Project Contact(s)

Liza Troshka

Project Budget

£361,892.00

Summary

Running Cool seeks to challenge current Active Network Management (ANM) curtailment arrangements by creating a new post fault capability for overhead lines and a new ANM architecture which will help to avoid curtailment. An improved system of short term dynamic OHL ratings (informed by real-time conductor temperatures) and a new corresponding ANM control system architecture will be the key outputs of this work.

Problem Being Solved

Full Active Network Management (ANM) systems are being implemented in areas where multiple complex constraints are affecting a number of customers over a long time period. A significant number of WPD ANM systems will curtail customers on a pre-cautionary basis under intact network conditions in anticipation of the next worst circuit fault to keep assets within defined ratings. This is partly because our overhead line (OHL) ratings are defined either as pre-fault or post-fault which do not permit an ANM system to wait for an event to happen and instruct generators to curtail. This ultimately means that curtailment is enacted even if an event doesn't occur.

Pre-event curtailment strategies significantly increase the level of curtailment imposed on generation customers which can make a business case for some generation developers unviable. Under current regulatory arrangements we are not required to reinforce when an ANM area is being categorised as "full". However, from 2023 it is expected that generators will not be required to directly cover the cost of deep reinforcement and this cost will be borne by WPD and, consequently, our customers. It will be our responsibility as a Distribution Network Operator (DNO) to ensure that there is sufficient generation capacity for all generation connection applications.

Method(s)

This project seeks to challenge current curtailment arrangements by creating a new post fault capability for overhead lines and a new ANM architecture which will help to avoid curtailment. An improved system of short term dynamic OHL ratings (informed by real-time conductor temperatures) and a new corresponding ANM control system architecture will be the key outputs of this work. This project will be delivered in five concurrently run stages as shown below:

Work Package One: Consideration of changes required to the ANM Control System Architecture

WP1 will review existing ANM scheme arrangements and will establish whether there are any planned upgrades to ANM systems and their timeframes. Once this step is successfully completed, WP1 will identify gaps in the existing ANM system arrangements and will map out changes required for ANM to support a new short-term post-fault ratings to supplement existing seasonal static ratings. Consideration will be given to failover arrangements of the ANM system if conductor temperature monitoring information becomes unavailable, for example, gracefully reverting to seasonal static post-fault ratings.

The output of WP1: will include a technical document outlining the functional changes required to the existing ANM system architecture.

Work Package Two: Short-term post-fault ratings and risk assessment.

WP2 will build on the high-level technical implementation of a short-term post-fault rating delivered under OHL Power Pointer project. This approach will deliver a set of requirements (in a technical specification) for a short-term post-fault rating suitable for use in a live operational environment.

The output of WP2: will be an updated specification for the derivation of a short-term post-fault OHL rating. A risk assessment document specifying the risks of the application of short-term post-fault ratings and available risk mitigation measures which could be adopted.

Work Package Three: Development of Network Use Case and Power System Studies.

WP3 will define representative network use cases comprising areas of the network. Network use cases will consider different conductor characteristics, mixed composition circuits (including underground and overhead cable sections), availability of the conductor temperature monitoring system, etc.

Power system studies utilising the network use cases will be undertaken to quantify the maximum capacity that can be released (in MWh) if the ratings derived from historic data[1] are applied. It is proposed to carry out power systems studies to quantify the energy lost (MWh) due to full pre-event curtailment for the base case (current ANM scheme) by modelling the general profile of connected generation and checking the power flow constraints on circuit within the study area of the network. Where static seasonal ratings for conductors have been considered in the base case, these shall be substituted for short-term post-fault ratings captured under the OHL Power Pointer project for the method case, and the studies will be repeated.

The output of WP3 will be a technical report with a detailed description of network use cases and quantified benefits (in MWh) that can be realised by the application of short-term post-fault ratings within each of the use network cases.

Work Package Four: Finalised control system architecture and devices' specification documents.

The key focus of WP4 will be on the finalisation of the proposed ANM control system which will support the application of real-time short-term post-fault OHL ratings. As part of WP4, interfaces between various control platforms will be established and user requirements defined.

Consideration will be given to retrofit requirements for the conductor temperature monitoring equipment, which will be suitable for installation on 33kV, 66kV and 132kV OHL distribution network. The specification will list a set of minimum technical requirements, suitable for tendering on the open market (i.e. vendor agnostic).

The output of WP4: will include a specification document for the ANM system (including proposed ANM control system architecture) and a specification for the retrofit conductor temperature monitoring equipment for OHL systems.

Work Package Five: Cost-benefits analysis and policy amendments

WP5 will aim to evaluate what impact an increase in post-fault capacity may have on the design life of OHL conductors, by exploring the high-level methodology for the existing 'expected' life span of OHL conductors, and determining any shortened life span should be expected due to elevated post-fault capacity.

The reliability of conductor temperature monitoring devices and network security options (if/when monitoring devices become faulty) will be evaluated with a failover arrangements within ANM considered shall conductor monitoring information become unavailable.

Relevant policies will be reviewed with recommendations for amendments drafted.

The outputs of WP5: will include a finalised cost-benefit analysis of the proposed solution, drafted policies with clear recommendations for amendments, a slide deck and other supporting presentation material to ensure effective project dissemination. Through voluntary contribution to the project Nortech (a project partner) will run at least four session with relevant WPD teams to demonstrate capability delivered as part of this project and potential benefits.

Scope

This project seeks to challenge current curtailment arrangements by creating a new post fault capability for OHLs and a new ANM architecture which will help to avoid curtailment. An improved system of short term dynamic OHL ratings (informed by real-time conductor temperatures) and a new corresponding ANM control system architecture will be the key outputs of this work. By improving the overall capacity of the distribution network WPD can look to accommodate more clean embedded generation connections, which would lead to a reduction in the overall carbon intensity of energy delivered to customers and thereby help to deliver and achieve 'decarbonisation and Net Zero' – a priority area in WPD Innovation Strategy.

Objective(s)

This project will aim to integrate a short-term post-fault rating (derived from real-time conductor temperature measurements) into ANM systems in order to create a new post fault capability for OHLs. The key objectives of the projects are:

- To demonstrate what benefits can be realised by the application of OHL short-term post-fault ratings in ANM.
- To develop all required documentation to ensure safe integration of new capability into ANM.

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

N/A

Success Criteria

- The benefits that can be realised by the application of OHL short-term post-fault ratings in ANM are quantified and documented.
- A specification document for the ANM system incorporating new functionality.
- Specification documents for relevant monitoring devices is finalised and fit for purpose.
- Relevant policies reviewed and recommendations for amendments are documented and approved.

Project Partners and External Funding

Nortech Management Limited will be a project partner for this project.

Nortech's role will be:

- Improving OHL short-term post-fault ratings;
- Developing an ANM architecture integrating a capability of post-fault short-term ratings;
- Developing specification documents for ANM system and conductor-temperature monitoring devices;
- Undertaking CBA of a new proposed solution;
- Review relevant policies and provide recommendations for amendments as per the findings of the project.

Nortech's contribution to the project is £20,000.

Potential for New Learning

Learning will be generated from this project through work packages reports and documents that will be produced throughout the lifecycle of the project. These reports will include a new ANM system architecture and devices' specification documents that will take account of real-time short-term OHL rating into its decision making.

Learning will be disseminated through WPD's established channels.

Scale of Project

This will primarily be a desk-top study partially utilising monitoring data gathered during OHL Power Pointer Project.

Technology Readiness at Start

Technology Readiness at End

TRL6 Large Scale	TRL8 Active Commissioning

Geographical Area

The project will take place in WPD's South West licence area as this is where the EHV network is most thermally constrained. Network use cases in WPD's other licence area(s) could be considered for validation purposes if the data from the South West network is not sufficient.

Revenue Allowed for the RIIO Settlement

N/A

Indicative Total NIA Project Expenditure

Project budget = £361,891.20

WPD DNO Contribution = £36,189.12

Funding from NIA = £325,702.08

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)

Under current charging arrangements and ANM requirements if new post fault capability is to be adapted the cost incurred by generation customers will include £3,000 per 10km of overhead circuit (a set of three devices providing temperature monitoring of all three phase conductors at intervals of approximately 10km along a circuit) and £32,000 for suitable communication infrastructure. To compare it with the reinforcement cost of, for example, 175mm2 Lynx ACSR to 300mm2 Upas AAAC, would cost in the region of £6-8m / 10km. This estimate can increase to approximately £20m / 10km if the existing infrastructure does not support reconducting. Therefore, in the worst case reinforcement scenario, the alternative short-term post-fault rating solution can save up to £20m / 10km.

The general body DUoS customers will benefit from a proposed short-term post-fault rating solution when it can also be shown that it helps defer reinforcement. A simplified sensitivity study demonstrated that up to £14.2m (132kV) and £5.62m (33kV) across all related reinforcement schemes could potentially be saved over the course of ED2 if post-fault OHL short-term ratings are successfully integrated into ANM and able to provide a capacity uplift of 30%.

Please provide a calculation of the expected benefits the Solution

N/A

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

It is anticipated that the outputs of this work will be applicable across all DNOs.

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

If the outputs of the project are successfully trialled and approved by the business they can be directly embedded within business as usual processes. Staff training will be required to ensure understanding of the approach and functionality.

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

Integration of a short-term post-fault rating (derived from real-time conductor temperature measurements) into ANM systems will be performed with capacity release benefits quantified. These benefits are expected to be directly transferable to other DNOs.

Or, please describe what specific challenge identified in the Network Licensee's innovation strategy that is being addressed by the project (RIIO-1 only)

By improving the overall capacity of the distribution network WPD can look to accommodate more clean embedded generation connections, which would lead to a reduction in the overall carbon intensity of energy delivered to customers and thereby help to deliver and achieve ‘decarbonisation and Net Zero’ – a priority area in our Innovation Strategy.

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.

The methodology for Running Cool has been reviewed against other projects registered on the Smarter Networks Portal to ensure no unnecessary duplications will occur.

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

This project will build on the findings from WPD OHL Power Pointer project with no duplication.

Additional Governance And Document Upload

Please identify why the project is innovative and has not been tried before

WPD will be the first company to integrate a short term post fault rating (derived from real-time conductor temperature measurements) into ANM systems.

Relevant Foreground IPR

Background IPR (WPD):

- IPR generated through other innovation projects (such as OHL Power Pointer, FALCON, SoLa BRISTOL, FlexDGrid, ECHO etc.).
- Trademarks, copyright and industrial processes relating to the ownership and operation of distribution network assets.
- Policies for the installation and location of equipment (Smart Navigators 2.0).

Background IPR (Nortech):

- Trademarks, copyright, industrial design and production rights relating to the Smart Navigator 2.0 overhead line sensor.
- Trademarks, copyright, industrial design and production rights relating to the iHostTM software platform.
- iHost software: Real-time post-fault rating module.

The following IPR is expected to be generated during delivery of this project:

- Functional specification for the ANM system architecture incorporating short term rating and real-time conductor temperature.
- Technical specification for the derivation of a short-term post-fault OHL rating.
- Risk assessment for the adoption of a short-term post-fault rating.
- iHost software: New software features and enhancements to existing software modules.

Data Access Details

Anonymised data will be available to share in accordance with WPD's data sharing policy www.westernpower.co.uk/Innovation/Contact-us-and-more/Project-Data.aspx

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

Developing a methodology for short-term post-fault calculations and integrating it into ANM systems requires specialists' knowledge and is currently outside of WPD remit.

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

This project is looking to improve and integrate short-term post-fault rating into ANM systems which (at the time of writing this document) has not been performed before. ANM functionality is currently outsourced by WPD and therefore any manipulation with it requires specialist knowledge, and an innovation study with key specialist skills is the most sensible approach.

This project has been approved by a senior member of staff

☑ Yes