WESTERN POWER DISTRIBUTION
Serving the Midlands, South West and Wales

Date of Submission

NIA Project Registration and PEA Document

Notes on Completion: Please refer to the **NIA Governance Document** to assist in the completion of this form. Please use the default font (Calibri font size 10) in your submission. Please ensure all content is contained within the boundaries of the text areas. The full-completed submission should not exceed 7 pages in total.

Project Registration

Project Title

Network Event and Alarm Transparency (NEAT)

Project Reference

Funding Licensee(s)

Western Power Distribution

Project Start Date

28/10/2020

Project Duration

Years	Months
2	0

Nominated Project Contact(s)

Jenny Woodruff

Project Budget

£500,729

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Lead Sector

Electricity Distribution	☒	**Gas Transmission**	☐
Electricity Transmission	☐	**Gas Distribution**	☐

Other Sectors

Electricity Distribution	☐	**Gas Transmission**	☐
Electricity Transmission	☐	**Gas Distribution**	☐

Research Area

Network improvements and system operability	☒
Transition to low carbon future	☐
New technologies and commercial evolution	☐
Customer and stakeholder focus	☐
Safety, health and environment	☐

Problem(s)

New DSO related control systems, such as Active Network Management (ANM) and System Voltage Optimisation (SVO), are increasing the number of alarms and events that need to be managed in the control room. This is expected to increase further as new systems are developed to support new DSO functions. Therefore we expect both the types of events and number of events to increase as systems make greater use of new data in-feeds as well as existing SCADA inputs. The underlying cause of events is sometimes difficult to ascertain and where systems interact with each other, understanding the relationships between their events and alarms will reduce the time spent supporting new DSO related systems and ensure that they can operate optimally.

Method(s)

The project will develop a tool to analyse the relationship between alarms and events within and across the control room system and those for ANM and SVO. This will be sufficiently generic that future systems can be included and analysed in the same way. It will have functions to highlight relationships helping identify common causes that can then be used to put remedial actions in place, which will include automatic grouping of alarms to simplify their management.

Scope

The investigation will consider how the alarms in the new ANM and SVO systems relate to the alarms within PowerOn or to each other. However, the approach taken and prototypes developed will be generalised as far as possible so that it could be applied to future systems yet to be developed, or systems in use by other DNOs.

The analysis will result in rules or information that can be used to understand root causes for alarms and events allowing the system support staff to take steps to reduce their frequency.

For the avoidance of doubt, the existing alarm and event management facilities within PowerOn already provide a number of features to simplify and prioritise the information provided to the control engineers and the project does not intend to duplicate these.

The project approach will contain six distinct work packages:

WP1. Specification – Gather detailed business domain knowledge to ensure a solid understanding of the WPD network region, business processes and availability of data.

WP2. Design – This work package will look into the design of the NEAT platform through a data quality assessment, data analysis and identification of advanced analytical techniques. This will cover checking the

data is complete and whole, identification of outliers or other logical inconsistencies and ensuring that the joining of datasets does not lose information or incur further data issues. An initial phase of data analysis will be used to derive preliminary insights and observations. This may involve the use of statistical models but primarily aims to identify characteristics of the data set and inform the formal modelling task.

WP3. Build – During the build phase the advanced analytical techniques and dashboard development will be completed. Depending on the insights identified during the initial data analysis during the design phase these may include; clustering analysis, network association analysis, spatial analysis where geographical information is present, time series analysis, and predictive forecasts. The analytical techniques will be integrated into the NEAT dashboard and will also include the development of stage that load data from the databases into the analytic tool to be formalised and available to run on a regular basis.

WP4. Deploy and Test –Selection and integration of the project into the NEAT dashboard. This stage also requires the scripts that load data from the databases into the analytic tool to be formalised and available to run on a regular basis as well as user acceptance testing.

WP5. System Trial & Analysis The prototype dashboard will undergo further development during a live system trial to extract insights from the alarm and event analysis. This will include reviewing trends during the trial period to look for results improvement and learnings.

WP6. Dissemination and Closedown Report – This will cover the findings in terms of alarm relationships as well as trends from the ANM and SVO alarm systems. This will highlight the benefits and improvements possible through better understanding of the interactions between different events and improving the analysis from control room operators.

Objective(s)

The objective of the project are to;

- understand the data that can be used to provide context for the alarm and event analysis
- assess the quality of this data and where possible correct quality issues
- derive preliminary insights from the data to inform the selection of models
- carry out advanced analytics to understand the relationships between alarms and events in different systems and the external datasets
- create a prototype dashboard to allow the analysis to be run regularly and present the user with results
- trial the use of the dashboard using real data over a period of time
- consolidate and share the learning from the project

Success Criteria

The success of the project would be indicated by the following outcomes.

- The project has gained an understanding of the new types of alarms and events associated with new systems supporting DSO functions, how these differ from “traditional” control system alarms and how the needs for their management differ to traditional alarms and events.
- The data sources that are available to contextualise these alarms have been explored and relationships between data items and the alarms and events have been found.
- The learning gained from analysing relationships between alarms and events and the contextualising data has been incorporated into a dashboard which is suitably generic in design to facilitate future systems to support DSO functions that are not yet known.
- A dashboard to assist with the management of these alarms and events has been developed and tested. Learning from the trial has been used to recommend changes to datasets, processes, systems etc. to reduce alarms and events in the future and/or the way in which alarms and events are managed has been improved to reduce the time spent on their management.

Technology Readiness Level at Start **Technology Readiness Level at Completion**

6	8

Project Partners and External Funding

Project partners are PSC and Harmonic. There are no external sources of funding.

Potential for New Learning

This project has potential for new learning as the processes to correlate alarms and events with new systems to support DSO functions have not previously been developed. The systems that are raising these alarms are new and resulting in more complex and unfamiliar alarms for the control engineers. They are also not trivial, as an in-depth investigation of the system is required to identify the events that led to alarms before they can be resolved.

The solution proposed as part of this project will aid the processing of these alarms in two innovative areas:

- Use of analytical modelling methods, such as Bayesian Analysis, Machine Learning and other statistical techniques to develop clustering, predictive and inferential models. These methods will seek to describe the correlations and causation between events, data inputs, and resulting alarms, so they can be understood and resolved.
- State of the art dashboarding visualisation for the analysis, processing, and presentation of alarms to the control engineers and more detailed investigation teams.

Scale of Project

This project will develop a prototype tool and test it using datasets extracted from relevant systems. It does not involve trialling on the distribution network.

Geographical Area

The project data will all relate to WPD's South West region due to the location of the SVO and the Cornwall ANM systems. The events analysed are expected to include the Bowhays Cross BSP and Tiverton Moorhayes Primary.

Revenue Allowed for in the RIIO Settlement

Not applicable

Indicative Total NIA Project Expenditure

Total project costs are budget as £500,729 with a DNO contribution of £50,073 leaving £450,656 funded via NIA.

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 learning generated is expected to be applicable to other systems implemented by other DNOs including those which may not yet have been implemented. The process and prototype tools could be applied where there are similar datasets to allow the alarms and events to be correlated.

This increase in control room alarm numbers has already been seen in DNOs in the Australia / NZ as additional systems for Active Network Management or System Voltage Optimisation are introduced. This challenge is expected to be common amongst DNOs around the world for the same reasons. Therefore, we believe other UK-based Network Licensees will be interested in reducing alarm volumes and therefore, interested in NEAT.

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

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 how 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

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

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

£70k per annum saving in annual costs, with initial development costs in the region of £100k and system configuration costs in the region of £200k

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).

The Base Cost is made up of the cost to the DNO of managing alarms without an additional system. This is expected to be in the region of £100k per annum to cover salary and associated costs for full time control systems support engineer.

The Method ongoing cost of managing alarms and events with the assistance of the software is expected significant less with a reduction of support staff time estimated at 80% therefore reducing that cost element to £20k per annum. There would be expected support costs for the dashboard system of circa £10k per annum resulting in ongoing annual costs of £30k per annum. This is a saving of £70k per annum is expected

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 method could be applied across all Network Licensees systems.

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

Replication costs are relatively high as while the tool is developed to be generic, for each new installation there would need to be a process of identifying datasets, assessing data quality, determining the most effective relationships etc. Subsequent installations would benefit from not requiring to spend the £100k development costs for the re-usable software. Assuming a cost of £200k configuration cost per installation this would range from between £1m and £2.2m depending on whether it was installed per DNO license area or shared installations within common ownership groups which have common datasets.

2c. Does Not Lead to Unnecessary Duplication ☒

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

No other projects are known to have addressed this particular problem. This is a relatively new problem that has become apparent since the implementation of ANM and SVO.

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

Additional Governance Requirements

Please identify that the project is innovative (i.e. not business as usual) and has an unproven business case where the risk warrants a limited Research, Development or Demonstration Project to demonstrate its effectiveness ☒

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

The systems generating the additional alarms are relatively new and therefore the potential increase in volume and types of alarm were not previously known.

ii) Please identify why the Network Licensee will not fund such a Project as part of its business as usual activities

This is an area of work which could not have been included in the ED1 business plan as the requirement for this have only recently become apparent. The project will develop a software tool using complex analytics to generate a dashboard which could be applied to future systems that are yet to be developed. Thus the work required is very far from BAU processes and the skillsets and requires a very different approach.

iii) 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

The project is dealing in advanced analytics with new datasets that have not yet been fully explored. There is a technical risk that the analytics will not be able to provide the required outputs.

Additional Registration Questions

These are required for summary section of registration; some areas can be copied from sections above.

Technologies (select all that apply)

☒ Active Network Management	☐ Environmental	☐ Network Monitoring
☐ Asset Management	☐ Fault Current	☐ Overhead Lines
☐ Carbon emission Reduction Technologies	☐ Fault Level	☐ Photovoltaics
☐ Commercial	☐ Fault Management	☐ Protection
☐ Condition Monitoring	☐ Harmonics	☐ Resilience
☐ Community Schemes	☐ Health & Safety	☐ Stakeholder Engagement
☐ Comms & IT	☐ Heat Pumps	☐ Substation Monitoring
☐ Conductors	☐ High Voltage Technology	☐ Substations
☒ Control Systems	☐ HVDC	☐ System security
☐ Cyber Security	☐ Low Carbon Generation	☐ Transformers
☐ Demand Response	☐ LV & 11Kv Networks	☒ Voltage Control
☐ Demand Side Management	☐ Maintenance & Inspection	☐ Gas Distribution
☐ Distributed Generation	☐ Measurement	☐ Gas Transmission
☐ Electric Vehicles	☐ Meshed Networks	☐ Electricity Distribution
☐ Energy Storage	☐ Networks Automation	☐ Electricity Transmission

Project Short Name

NEAT

Project Introduction

DNOs across the world are experiencing increasing numbers of alarms in their control rooms as additional systems for Active Network Management or System Voltage Optimisation are introduced.
There is a risk that the number of alarms becomes a distraction and that control engineers find it increasingly difficult to assess the network and prioritise their actions appropriately. This would in turn lead to a higher risk of error, reduced effectiveness and lower morale.

The project goal is to improve transparency of alarms and events so that by understanding the root causes, the number of alarms can be reduced.

Project Benefits

1. Simplify the process of relating alarms and events to underlying causes, reducing the time spent by control engineers and/or DSO system support staff managing these alarms, and
2. Ensuing optimal operation of ANM and SVO schemes, reducing the degree to which connected generation is constrained and the subsequent impact on balancing costs.

PEA Version	**1**		
	Name and Title	**Signature**	**Date**
Prepared by	Jenny Woodruff Innovation and Low Carbon Engineer		29/09/2020
Approved by	Yiango Mavrocostanti Innovation Team Manager		