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## **NIA Project Registration and PEA Document**

### **Date of Submission**

Sep 2020

### **Project Reference Number**

NIA\_WPD\_053

## **Project Registration**

### **Project Title**

Network Event and Alarm Transparency (NEAT)

### **Project Reference Number**

NIA\_WPD\_053

### **Project Licensee(s)**

National Grid Electricity Distribution

### **Project Start**

October 2020

### **Project Duration**

2 years and 8 months

### **Nominated Project Contact(s)**

Jenny Woodruff

### **Project Budget**

£500,729.00

## **Summary**

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.

## **Problem Being Solved**

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.

## Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

n/a

## 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.

## 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.

## Technology Readiness at Start

TRL6 Large Scale

## Technology Readiness at End

TRL8 Active Commissioning

## 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 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 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)

£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 benefits the Solution

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

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.

### 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 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.

#### 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

- 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.

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.

n/a

## **Additional Governance And Document Upload**

### **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.

### **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**

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.

### **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.

### **This project has been approved by a senior member of staff**

Yes