

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

Feb 2016

### Project Reference Number

NIA\_ENWL015

## Project Registration

### Project Title

Tap Changer Monitoring

### Project Reference Number

NIA\_ENWL015

### Project Licensee(s)

Electricity North West

### Project Start

February 2016

### Project Duration

6 years and 4 months

### Nominated Project Contact(s)

Electricity North West Innovation Team

### Project Budget

£2,000,000.00

## Summary

Previous research carried out under an IFI project into Tap Changer monitoring determines that monitoring is required. The technique used had limitations therefore there is a need to develop a more robust technique/system.

We will work closely with Camlin power to develop and productionise a retrofitable tap changer monitoring system to accurately monitor the tap changer performance. In turn determining the intervention/triggers points.

For this project it is proposed to install this system on 10 x 132kV Tap changers and 30 x 33kV Tap Changers and understand the tap changer performance over a 24 month period to allow seasonal changes to be taken into account.

The project will allow Electricity North West to develop its understanding of the effects of tap changer failure modes and maintenance requirements and to identify the optimum window for monitoring in the life cycle of tap changers.

### Nominated Contact Email Address(es)

innovation@enwl.co.uk

## Problem Being Solved

As part of operating an efficient network Distribution Network Operators need to maximise the use of existing assets. This forms a key part of Electricity North West's Innovation strategy for RIIO ED1.

The industry has identified that there is a lack of any accurate online monitoring of tap changer condition to identify when intervention is required for repair, maintenance or replacement.

The development of a leading indicator of asset condition aims to minimise the number of tap changer failures that the industry has seen over recent years by identifying early warning indicators allowing proactive intervention.

## Method(s)

The project will develop, bring to pre-production, and ultimately trial, a tap changer condition monitoring system. Other Tap changer monitoring techniques will also be explored.

The project will carry out field trials to identify the optimum point at which Tap changer monitoring is required in the life cycle of a transformer. To ensure a representative sample of the transformer population is analysed, a varying number of tap changer types with different manufacturing periods, designs and operating environments will be selected. Tap changers of the same type/model will have monitoring installed at varying ages of their lifecycle to allow comparison.

There is a need to identify and develop intervention and investigation trigger points through data visualisation which will feed into the future asset management strategies.

## Scope

Previous research carried out under an IFI project into Tap Changer monitoring determines that monitoring is required. The technique used had limitations therefore there is a need to develop a more robust technique/system.

We will work closely with Camlin power to develop and productionise a retrofitable tap changer monitoring system to accurately monitor the tap changer performance. In turn determining the intervention/triggers points.

For this project it is proposed to install this system on 10 x 132kV Tap changers and 30 x 33kV Tap Changers and understand the tap changer performance over a 24 month period to allow seasonal changes to be taken into account.

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## Objective(s)

This project is split into four distinct phases:

**Phase 1** is to develop a retrofitable tap changer monitoring system

This phase to be completed by December 2016

**Phase 2** is the onsite installation of 40 monitoring systems

This phase to be completed by August 2017

**Phase 3** is the continuous data analysis and visualisation of the tap changer condition

This phase to be completed by August 2019.

**Phase 4** is the implementation of identified trigger points into company policy and procedures.

This phase to be completed by January 2020

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

n/a

## Success Criteria

Production and trial of a condition monitor for Tap Changers

## Project Partners and External Funding

Camlin Power.

## Potential for New Learning

Improved knowledge of the tap changer operation to identify when and what intervention is required

Contribute towards the RIIO ED-2 Tap changer Management strategy

More accurate and up to date Probabilities of Failure of the assets

## Scale of Project

The project has been designed to allow a robust statistical sample of tap changer sites – any reduction in the sample size would

provide too little data for accurate comparison and would be open to a individual set of results having a major impact on the overall outcome.

Running the project over a 4 year period will allow seasonal changes to be taken into account and to show a deviation in tap changer operation over a number of years.

### **Technology Readiness at Start**

TRL2 Invention and Research

### **Technology Readiness at End**

TRL8 Active Commissioning

### **Geographical Area**

Electricity North West licence area

### **Revenue Allowed for the RIIO Settlement**

Zero

### **Indicative Total NIA Project Expenditure**

£1,500,000

## 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)

It is estimated that the saving would be £2 million a year by not replacing assets and improved operator safety.

#### Please provide a calculation of the expected benefits the Solution

The savings have been estimated based early tap changer interventions for 871 active tap changers which have the potential to cause a disruptive failure requiring the entire transformer system to be replaced. The savings also reflects the revised inspection and maintenance activities based on tap changer condition, rather than number of operations it has experienced or a predetermined time interval.

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

The optimum tap changer intervention strategy will differ dependent upon the tap changer type and its operating conditions. This approach will aim to identify early signs of deterioration or fault development for ENWs fleet of 871 active tap changers of which there are 46 different types. As all DNO have a similar age and type profile to ENW therefore it is assumed that this could be rolled out to all network licensees.

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

The cost of rolling this approach out across GB would be the cost of purchase and installation, development/adaption/interfaces of communication and data visualising on all the Licensees tap changers. Therefore it is estimated at £3 million per Licensee and £42 million across GB.

### 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 trialed 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 project will produce all Policies and Procedures relating to the installation and operation of the condition monitoring equipment which will be made available to all DNOs. In addition we will also provide the necessary information to allow DNOs to conduct their own analysis of the data and decide when intervention needs to occur.

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

Maximizing the use of existing assets and optimizing the tap changer intervention window

- 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.

Electricity North West has previously carried out research in IFI which demonstrated that monitoring is required as no other real time tap changer monitoring is being trialled. Therefore we are not duplicating any existing research in this field.

### 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

n/a

### 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**

n/a

**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**

n/a

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

Yes