NIA Project Registration and PEA Document

Date of Submission

Jan 2017

Project Reference Number

NIA_SPEN0016

Project Registration

Project Title

Network Constraint Early Warning Systems (NCEWS)

Project Reference Number

NIA_SPEN0016

Project Licensee(s)

SP Energy Networks Distribution

Project Start

February 2017

Project Duration

2 years and 4 months

Nominated Project Contact(s)

Jim Whyte (Senior Project Engineer)

Project Budget

£352,800.00

Summary

This is phase 1 of a multi-phase investigation requirement into the benefit of SM data in LV network Design and Planning. Full SM coverage is realistically expected to take between 3-5years (2017-20 or beyond if deployment delayed). It has been started by the industry that operational benefit will not be achieved from SM's until 60% penetration. Within the early years of SM Penetration (2017-18) it is hoped to utilise pockets of high level SM penetration to carry out fundamental research and try to derive early benefit from SM data.

The Project will focus on the provision of Data Science research learnings but will require improved Data Analytical capability from our existing LV connectivity understanding,

WP1 – LV Connectivity Improvement

- Fixed timescale SME Consultant support

WP2 – Full Time Data Science KTP Researcher (2 years)

- Voltage Limit Excursion: Data Science research on Minimum Data and SM monitoring points required for LV network Voltage excursion monitoring Systems

- Power Constraint: Use of Power profile Limits and After Diversity Maximum Demand's (ADMD's) for provision of initial 'aggregated' thermal levels intelligence

WP3 – Dissemination

- Dissemination will be mainly achieved through demonstration of web based GIS 'Visualization' systems to key internal Business experts and external industry Stakeholders.

- Final report on the learnings found and documentation of next steps in the use SM Monitoring Data in Planning will be provided.

Third Party Collaborators

Derryherk

Nominated Contact Email Address(es)

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Problem Being Solved

The ability for Smart Meters (SM) to provide cost effective LV network monitoring data has the potential to help solve the problems that will be created from future UK domestic 'Prosumer' Low carbon energy use. Increasing volumes of domestic customer's investment in Low Carbon Technology (LCT) will drive Distribution Network Operators (DNO's) to establish dynamic 'System Operation' LV 'Smart Grid' network management systems rather than higher cost traditional reinforcement. A central pillar of this requirement is detailed visibility and analysis of customer dynamic energy use and the effect this has on overall LV network voltage and thermal constraint. The mandated SM roll-out and access by the DNO to voltage and energy use data is an ideal opportunity to help derive this visibility but will require research to prove its overall value and use.

When working within this potential 'Big Data' flood of information from SM's the problem is to understand what level of monitoring is required when and where. This will be dependent on network construction and topology, individual customer energy use and growing network energy access requirement from increasing penetration of LCT. It is hoped to derive recognition algorithms that can identify constraint or drift towards constraint through analysis of the SM data and improved understanding of background GIS network models.
 To help minimise the overall SM data requirement it will explore generating automatic classification of network constraint levels,

- Low risk of constraint background monitoring – The majority of the network
- Increased risk action trigger requirements – Increasing requirement as LCT penetration increases
- Analysis by exception 'connection' systems – Traditional network extension activity.

Method(s)

To solve the stated problems focus of this Phase 1 SM research project will be on the adaptation of existing customer connectivity systems and analysis of the integration requirements for SM monitoring data,

- Explore the Improvement of existing LV connectivity systems for step change in Data Analytical requirement from application of SM data
- Data Science led research on initial use of Alerts & Measurement Profile 'Limits' to provide **minimum** SM monitoring requirements for sufficient gateway Early Warning Network Constraint Visibility
- Build understanding of the scale of future requirements when utilising the full penetration of Dynamic SM Network profile data within Smart Grid Systems

This project will utilise the Innovate UK Knowledge Transfer Partnership (KTP) programme with Heriot Watt University to jointly fund a Data Science/Data Analytical researcher to carry out the main research requirement. This approach is intended to,

- Minimise costs for this initial investigation
- Maximise the research learnings potential through integration with a research institution
- Transfer new Data Analytical and Data Science knowledge and skills into the business.
- Transfer existing Network Management skills in SMART systems

This Data Science researcher will need proven Data Analytical support to improve the capability of existing LV connectivity systems,

- Provide adaptive Python based algorithms for creation of ordered connectivity LV circuits and breakdown into relevant circuit 'Components' e.g. Changes in Circuit size, Teed circuits etc.
- Detail connectivity relationship between the individual consumer, consumer LCT requirement and Circuit Component sections

Scope

This is phase 1 of a multi-phase investigation requirement into the benefit of SM data in LV network Design and Planning. Full SM coverage is realistically expected to take between 3-5years (2017-20 or beyond if deployment delayed). It has been started by the industry that operational benefit will not be achieved from SM's until 60% penetration. Within the early years of SM Penetration (2017-18) it is hoped to utilise pockets of high level SM penetration to carry out fundamental research and try to derive early benefit from SM

data.

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Objective(s)

There are a number of objectives within this project,

WP1

- Improve Data Analytical preparedness of current LV connectivity models which are embedded with GIS linear Asset Management systems for future high levels of SM data penetration
- Increase visibility and understanding of Customer and LCT relationship to 'aggregated' LV circuit Component level using SM data and other related customer connectivity intelligence

WP2

- Integrate initial volumes of SM 'Profile Limit' data to research minimising Network Monitoring requirement to provide early and ongoing warning of Network Constraint
- Provide Big Data/Data Science research Knowledge Transfer capability to SPEN
- Transfer expert LV Network Constraint Management into SMART systems utilising Data Analytics and Big Data
- Provide next step requirements for BAU use of Early Network Constraint monitoring systems in the management of increasingly Dynamic Smart Grids: Within full SM and increasing LCT penetration scenarios

WP3

- Proof of Concept (POC) SM Data Visualisation systems to demonstrate Business value from Constraint early warning systems in Network Planning Management (Connections and Reinforcement Management)

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

n/a

Success Criteria

Within the identified risks from the lack of the ability to control the Supplier led penetration of Smart Meters and consumer lead penetration of LCT technologies the Success of this project will be measured from,

WP1

- Improvement in Data Analytical translation of Key LV Network Topologies,
  ◦ Successful breakdown of LV circuits into network components
  ◦ Understanding of Customer and LCT device connectivity to LV network components:
- Greatest chance of success as it is independent of identified risks and working with a well-established LV connectivity model in SPEN

WP2

- Data Science research clarification of minimum SM Network Monitoring points required to give Network Constraint Early Warning systems: Success may be limited to key network topologies and LCT penetration scenarios.
- Knowledge transfer of Big Data/Data Science expertise into SPEN and expert network management expertise into SMART systems
- Next steps understanding of the Potential and Scale of Data Analytical requirements from full SM penetration

WP3

- Delivery to internal expert business users a POC GIS Visualisation system for access to SM business intelligence on Network Constraint understanding

Project Partners and External Funding

n/a

Potential for New Learning

n/a

Scale of Project

This is a low cost research project which is seen as an key enabler for delivering the RIIO Planning Business Benefit from SM monitoring data once the penetration of SM's reach a suitable scale. It is intended to maintain an highly agile project approach that will need to react to,

- Availability of high Penetration levels of Smart Meter's
- Available interaction between LCT penetration and Supplier led SM penetration

Practical judgments will be required to continually assess Scope to maximize research benefit.

Technology Readiness at Start

TRL3 Proof of Concept

Technology Readiness at End

TRL6 Large Scale

Geographical Area

Geographical area will also depend on the agile approach taken within the project. The advantage of Data Analytical system is they they can be scaled up quickly once the base data analytical complexity is understood. Limits to that will come from different network topologies, LCT penetration scenarios and overall data quality improvement requirements.

Revenue Allowed for the RIIO Settlement

None

Indicative Total NIA Project Expenditure

£279.5k

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)

This project is a key enabler in generating the stated Planning benefit from SM in the RIIO timescale.

Please provide a calculation of the expected benefits the Solution

N/A in research level project

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

The Data Analytical techniques derived in this research can be applicable within **all** DNO LV network topologies. Use of this research will help the UK wide commitment to integrate SM data within LV connectivity systems to derive Business Benefit in Smart Grid Planning Systems.

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

N/A in research level project, indicative costs to be calculated as part of this project

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

All UK DNOs have access to the same SM monitoring data through the Smart Energy GB SM infrastructure. They also have also stated similar benefits (along with the ENA and BEIS) in the Planning environment in RIIO business plans and will need to implement systems that can utilise this data within their own LV connectivity systems. The Data Science learning established within this project will only be maximised within LV connectivity systems that are tailored for the integration of the SM Network Monitoring data. This research will demonstrate the benefit of increasing Data Analytical requirement and Data Science expertise and show how it can be integrated within LV connectivity understanding to maximise the benefit of SM network monitoring.

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.

n/a

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