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NIA Project Registration and PEA Document

Date of Submission

Sep 2018

Project Reference Number

NIA_WPD_034

Project Registration

Project Title

Next Generation Wireless Telecoms Analysis

Project Reference Number

NIA_WPD_034

Project Licensee(s)

National Grid Electricity Distribution

Project Start

September 2018

Project Duration

1 year and 2 months

Nominated Project Contact(s)

Faithful Chanda

Project Budget

£259,901.00

Summary

Electricity distribution networks face unprecedented challenges. More and more distributed generation is embedded in their networks, much of it intermittent and at the edges of the networks, with significant increases in loading, driven by electrification of transport and heat as the UK seeks to reduce greenhouse gas emissions.

Re-enforcement of the networks has traditionally been the response but at significant cost and disruption. Alternatively, making the networks more intelligent and responsive can often delay or even avoid such investments, minimising the cost and disruption to customers.

The key to the intelligent energy network of the future is enhanced visibility of the network assets in real time, allied to secure and fast switching to ensure a rapid response to changes in the energy supply dynamic. This will

Problem Being Solved

Electricity distribution networks face unprecedented challenges. More and more distributed generation is embedded in their networks, much of it intermittent and at the edges of the networks, with significant increases in loading, driven by electrification of transport and heat as the UK seeks to reduce greenhouse gas emissions.

Re-enforcement of the networks has traditionally been the response but at significant cost and disruption. Alternatively, making the networks more intelligent and responsive can often delay or even avoid such investments, minimising the cost and disruption to customers.

The key to the intelligent energy network of the future is enhanced visibility of the network assets in real time, allied to secure and fast switching to ensure a rapid response to changes in the energy supply dynamic. This will enable supply and demand to be balanced on a minute by minute basis at the Distribution Network Operator (DNO) level and will be a key component of the transition of the Distribution Network Operator (DNO) to becoming a Distribution System Operator (DSO).

Utilities already have extensive and varied radio networks connecting thousands of monitoring and control points. However, these systems need to be expanded and enhanced to manage the increasingly diverse and dynamic electricity networks they control with the anticipated replacement of legacy systems in the process. More intelligent networks will be able to prevent some outages; but when they do happen, advanced telecommunications help restore supplies more quickly. Applying more intelligence into the networks will also avoid or delay more costly re-enforcement investments.

Method(s)

Project will be delivered over a 12 -13 month's period in 4 overlapping phases below:

- Project initiation and mobilisation;
- Refine designs and services;
- Optimisation
- Analysis and Close Down (Analyse results, evaluate Next Generation Wireless Telecoms solution)

The project will be delivered by JRC with support of the WPD Project Manager working in collaboration with personnel from Surf Telecom. A detailed scope shall be established contractually between the two parties at the Project Plan agreement phase (Milestone 1). The Project Manager shall ensure that all deliverables are met within the timeframe.

Scope

The project will build on an existing WPD telecommunications trial by expanding from a single site trial into a full network design. This will require:

- Estimating what are the key parameters and the resolution of their values to calculate the data volume from each point to be monitored; and
- The total number of points on the network requiring communications and their geographic disposition.
- RF Coverage design based upon existing WPD sites employing eLTE technology (TDD / FDD). Establishing Power Density at sub stations and distribution poles for data communications and taking into account electrical systems operational requirements.

These data flows will be turned into a geographic data traffic profile in order to establish radio network capacity. This will allow radio channel bandwidth options to be derived to support asset visibility and control on a location by location basis.

Having determined an idealised network model, sophisticated radio planning tools (referencing International technology standards), terrain height databases and clutter data will be utilised to envision the underlying radio network capable of delivering this service. The radio traffic requirements will be overlaid on a database of existing WPD radio base stations to create a practical implementation of the radio network required to deliver the desired capacity and coverage.

In order to undertake this modelling, the initial assumption will be to use eLTE technology currently being trialed by WPD.

Objective(s)

The Project will be centred on the WPD license areas in order to establish the traffic characteristics and operational communication needs of both planned and anticipated 'Smart Grid' deployments. Once the traffic profile and area of service have been established the network modelling will produce a Radio Network Design that will;

- Define the scale of equipment and infrastructure deployment necessary;
- Determine the performance characteristics that can be sustained in a robust and resilient manner;
- Characterise the functionality available to enable 'Smart Grid' operations;
- Identify the amount and characteristics of radio spectrum needed;
- Network Design Learning can be leveraged across other use cases and DNO areas;

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

n/a

Success Criteria

The project will document the outputs of the radio network design, the system interfaces and will also provide insight on the existing communications infrastructure that will enable us to continue to the next steps towards a commercial solution. The success will be based on:

- Ability to define the scale of equipment and infrastructure deployment necessary;
- Understanding of the performance characteristics that can be sustained in a robust and resilient manner;
- Ability to characterise the functionality available to enable 'Smart Grid' operations;
- Understanding of the amount and characteristics of radio spectrum needed;
- A tool-kit for radio network design and deployment that can be leveraged across other use cases and DNO areas;
- Define the investment requirements for future communications capability;
- Case for spectrum access established to facilitate negotiating with Government & Ofcom; and
- The development of the planning rules for operational telecommunications network design to facilitate Smart Grid functionality.

Project Partners and External Funding

JRC (Joint Radio company)

Potential for New Learning

The establishment of an optimised radio network design to support the enhanced data traffic needs of future active networks serving the whole of the WPD region will allow a detailed understanding of how the radio network can be optimised to support the traffic needs of a diverse range of topographies, communities, energy network configurations and demand profiles. This diversity of use cases across the WPD footprint allows the project to develop the tool-kit of design solutions and network performance characteristics to represent 'use-cases' across the GB network footprint and ultimately establish a methodology for optimised radio network design for all DNO's. Moreover, the establishment of an optimised solution based on eLTE will offer the potential for enhanced functionality within the operational communications capability of the DNOs, to support enhanced voice, teleprotection, etc. which would further enhance the benefits of scale economies from the design learning that could be leveraged by the GB DNOs.

Scale of Project

The project seeks to establish a radio network design for the WPD license areas of West Midlands and South West aligned to the existing infrastructure, both active and passive and in so doing minimise the likely investment. This design will provide for an enhanced operational communications capability to serve future initiatives such as Active Network Management whilst also enabling the anticipated increase in embedded generation on the network. The licensed areas of West Midlands and South West have been selected to allow the project to maximise the knowledge gain as it will allow the project to establish the design and functionality of the network across a diverse set of topographies, communities, energy network environments and demand needs and in so doing encompass the broad range of use cases present across both the WPD and broader GB footprint. Moreover, LTE Networks are designed to be scalable from a single base station (as is currently being trialled by WPD at Portishead) up to national networks (as used by the mobile operators) and as such there is no reason why an eLTE network could not be built to serve the whole of the WPD area and the rest of the UK.

Technology Readiness at Start

TRL2 Invention and Research

Technology Readiness at End

TRL4 Bench Scale Research

Geographical Area

The analysis will establish a radio network design for the WPD's West Midlands and South West license areas.

Revenue Allowed for the RIIO Settlement

Nil

Indicative Total NIA Project Expenditure

£233,911

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)

The development of this technology will be standardised and the required reinforcement will be minimised by understanding the full impacts on the electrical network.

Please provide a calculation of the expected benefits the Solution

Not applicable – Analysis/Research project

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

This analysis/research is relevant to all DNOs

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

This analysis/research is relevant to all DNOs

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

n/a

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

In line with WPD's Innovation Strategy 2018, Section 5.3.1, Telecommunications Infrastructure such as 5G, will play a pivotal role in enabling Distribution Network Operators transition to a smarter electricity network and ultimately a UK-wide low carbon economy. The deployment of Next Generation Wireless Telecoms, 5G, will allow greater visibility, control and protection of network assets with enhanced centralised control functions as well as autonomous de-centralised functions. Active and pro-active network management will be essential to optimise the installed assets, whilst meeting the challenges associated with more distributed generation and storage as well as dealing with consumers changing energy demands. This project will conduct a number of studies and experiments relating to communications technologies to understand the technical and infrastructure requirements to facilitate this mass increase in real-time data collection from the network.

- 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.

Research has shown that no electricity licensees have identified any projects which may cause duplications. The outputs of this project will be disseminated to all UK DNOs.

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

Based on a detailed understanding of WPD's plans for the roll-out of Active Management functionality and the underlying need for enhanced real time monitoring and control JRC will develop a radio network coverage plan based on eLTE performance characteristics, in so doing establishing a practical capability to underpin the design and deployment of this new radio technology. Such capability will in due course cost effectively facilitate the deployment of higher bandwidth networks for WPD whilst in parallel support the co-ordination and deployment of similar operational communications networks by other DNOs. In addition, it will provide a practical insight into the radio spectrum needs of UK Energy Utilities to support the digitalisation of their core energy networks and represents the first network design of the operational telecommunications component of critical national infrastructure utilising eLTE technology, a precursor to 5G, which will provide key insight into future strategic planning of energy network design.

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

The NIA needs to establish the validation of the technology and to demonstrate the technology in a working environment. The project 'Next Generation Wireless Telecoms Analysis', provides another 'building block' and a pathway to the next stage in the evolution of future communications, by analysing the RF requirements and criteria needed to facilitate this future.

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

There a number of inherent technology risks that will require understanding such as radio spectrum. There also concerns that this technology may not be widely supported by the vendor community. There is also a likelihood that the UK Government may release the spectrum via auction and this would mean that WPD is unable to acquire the spectrum on acceptable terms and conditions.

This project has been approved by a senior member of staff

Yes