WESTERN POWER DISTRIBUTION
Serving the Midlands, South West and Wales

Date of Submission

Dec 2019

NIA Project Registration and PEA Document

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.

Project Registration

Project Title

LTE| Connecting Futures

Project Reference

NIA_WPD_050

Project Licensee(s)

Western Power Distribution

Project Start Date

January 2020

Project Duration

1 year and 0 months

Nominated Project Contact(s)

Faithful Chanda

Project Budget

£1,035,615.00

Nominated Contact Email Address(es)

wpdinnovation@westernpower.co.uk

Problem(s)

Although the precise nature of the energy distribution networks of the future is still emerging, it has become clear that WPD's plans for the roll-out of Active Management functionality will require much greater levels of enhanced and near real-time monitoring and control throughout the network. This will require a much more sophisticated and resilient telecommunications network than has been required in the past. The telecommunications network will need to be connected to a much greater number of points and be designed to carry greater volumes of data traffic. The recent Network Innovation Allowance (NIA) funded 'Next Generation Wireless Telecoms' analysis concluded that a Long Term Evolution (LTE) network would deliver the connectivity required to support this Smart Grid network up to 2030 and beyond. No energy utility or sector service provider has carried out a multi-site, multi-vendor LTE trial with adjacent Evolved Node Bs ('eNodeB' - equipment for one base station) in a 'real' energy environment. The planned network would mimic on a small scale the type of network which would be deployed as part of the roll-out of Active Management functionality and a migration to a Smart Grid network including the deployment of this radio technology across multiple DNO licence areas.

Method(s)

A full scale LTE network consists of many, many base stations and a number of Evolved Packet Cores (EPC's). A base station consists of a number of sector antennas which cumulatively contributes to a 360 degree service area surrounding the site, typically between three and six sectors per base station. Each sector represents a cell attached to the base station and Customer Premises Equipment (CPE's) will connect to a particular cell on a particular base station, depending on radio characteristics.

The trial will consist of the minimum number of three base stations and sectors (cells) needed to fulfil a basic LTE network which will allow for an evaluation of the system characteristics. Therefore it is intended to install a three sector (cell) base station at Taunton and two single sector (cell) base stations at Elworthy Burrows and Bowdens Hill. The single sector (cell) base stations will face towards the Taunton base station to represent a typical LTE configuration. All three base stations will be connected back to the EPC which will be installed in Taunton.

Scope

This project will be the UK's first multi-site, multi-vendor LTE trial designed to mimic on a small scale, and develop proposals for, the roll-out of a telecommunications network to support Active Management functionality. This is an important follow up to the a single vendor; single base station LTE evaluation trial at Portishead which provided data on the fundamental design and capabilities of LTE and illustrated how such a communications network might be integrated into WPD infrastructure. This showed that an LTE network is better equipped than a traditional narrow-band Supervisory Control and Data Acquisition (SCADA) network in the harsh environment [e.g. electrically noisy sites, RF interference, multipath etc.] to be found in the context of an energy network and that the likely data throughput would be as predicted.

The recent NIA funded 'Next Generation Wireless Telecoms' analysis was carried out jointly with JRC and established a provisional model of the radio network planning methodology and technical infrastructure for an LTE radio network deployment across single or multiple DNO area(s). This project is important as a traditional narrow-band SCADA system will not be able to support the number of connections and services required in future. It is therefore essential to plan to deploy a more advanced technology and this project is an important step in reducing the risks associated with achieving the predicted coverage and throughput in any subsequent full-scale rollout with the required availability and resilience. The project runs for 12 months and has been broken down into 4 Phases which are defined according to various stages of the project.

Objectives(s)

The objective of the project is to develop learning on:

- Confirmation that LTE is a suitable solution for providing communications for the energy industry
- Confirmation regarding using an Frequency Division Duplex (FDD) or Time Division Duplex (TDD) system
- Confirmation on bandwidth requirements
- Confirmation on types of data that can be passed over an LTE system
- Confirmation on antenna solutions for different situations
- Confirmation on training requirements and test equipment for staff

Success Criteria

- Confirmed propagation predictions and performance in a multi-site environment;
- Confirmed seamless interoperability of multi-vendor CPE and EPC equipment;
- Security & authentication successfully tested on LTE ecosystem;
- Testing of mobile and handheld device connectivity including Wi-Fi;
- Confirmation that LTE will support low-latency applications such as tele-protection;
- Document(s) outlining installation practises, test regimes and training requirements for LTE.

Technology Readiness Level at Start

TRL 5

Technology Readiness Level at Completion

TRL 7

Project Partners and External Funding

Joint Radio Company (JRC) will monitor and report on the progress of the project and provide technical support. JRC offers spectrum management and wireless network design support to its members and administers and co-ordinates the UK radio spectrum utilised to operate the existing DNO monitoring and control networks.

Nokia will provide equipment and installation specification for the construction of a test lab that will act as an enabler to progress with field trials later in the project. Nokia offers a complete private LTE wireless broadband and Internet Protocol/Multi-Protocol Label Switching (IP/MPLS) solution for power utilities built on 3rd Generation Partnership Project (3GPP) standard-based solutions.

There will be no funding from any of the partners.

Potential for New Learning

The project expects to develop learning on the following topics:

- The operability of and adaptability of LTE
- The value of increased information on how different topographies can accommodate LTE
- Market investment decisions
- Confirm whether LTE is a suitable solution for providing communications for the energy industry, through either a FDD or TDD system.

Scale of Project

A full scale LTE network consists of many, many base stations and a number of EPC's. A base station consists of a number of sector antennas which cumulatively contributes to a 360 degree service area surrounding the site, typically between three and six sectors per base station. Each sector represents a cell attached to the base station and CPE's will connect to a particular cell on a particular base station, depending on radio characteristics.

The trial will consist of the minimum number of three base stations and sectors (cells) needed to fulfil a basic LTE network which will allow for an evaluation of the system characteristics. Therefore it is intended to install a three sector (cell) base station at Taunton and two single sector (cell) base stations at Elworthy Burrows and Bowdens Hill. The single sector (cell) base stations will face towards the Taunton base station to represent a typical LTE configuration. All three base stations will be connected back to the EPC which will be installed in Taunton.

Geographical Area

It is proposed to develop the field and lab networks centred on WPD's Taunton Depot and two adjacent 'one-cell' base stations at our existing Elworthy Burrows and Bowdens Hill radio sites. The field test will be within a 25km radius of our Taunton location.

Revenue Allowed for in the RIIO Settlement

0

Indicative Total NIA Project Expenditure

£932,053

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 the GB the Network Licensee must justify repeating it as part of a Project) equipment (including control and communications systems and software)	X
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 Licensee's System	X
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 explain how the learning that will be generated could be used by relevant Network Licenses.

The results and conclusions provided by the joint WPD/JRC team will allow WPD Management and Operations, supported by JRC, to assist (e.g. via ENA Strategic Telecommunications Group (STG)] work to identify spectrum and plan regional and national networks to support Active Network Management functionality and other initiatives as well as supporting existing SCADA data collection functionality. The desktop model and outline technical solution developed jointly by WPD and JRC is designed to be readily adaptable to other DNO areas and flexible enough to accommodate topographies from dense urban to remote and challenging geographic locations, alternative communications technologies, a range of physical parameters for both radio base stations and the terminal equipment to be installed and even alternative Ultra High Frequency (UHF) spectrum if the preferred 400MHz bands was not available.

2b. Is the default IPR position being applied?

Yes	X

2c. Has the Potential to Deliver Net Financial Benefits to Customers?

Yes	X

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

Assuming 10 minutes of interruption, for say, 9000 customers in each of our four licence areas, the Customer Minutes Lost (CMLs) cost would be £116,054.88 based on the WPD CML calculator 2019/2020. The LTE solution will ensure that there is greater awareness of the behaviour of the network resulting in the reduction of the number of CML since any disturbance and any unusual activity or abnormalities on the network will be monitored. Investigation time and hence restoration of supplies after an incident will be accelerated. Therefore, by ensuring that more visibility is made possible, the LTE solution could ensure that £116,054.88 of lost revenue through the CMLs can be avoided.

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 hardware of a scanning base station and LTE base station will cost the same, £6k. However the number of devices a scanning base station could communicate with would be limited to 30 devices, whereas an LTE base station could communicate with 1,000 devices. The cost to monitor 30,000 devices via scanning would be £6million. The cost to monitor 30,000 devices via LTE would be £180k.

Using scanning telemetry, to monitor 30,000 devices the cost would be £6million whereas to do this by LTE would be £180k.

The total estimated financial benefits would then be: £6,000,000 - £180,000 = £5,820,000.

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.

By better understanding the latest developments in LTE applications and the supporting communications systems required, informed decisions can be made regarding how these will interact with, or replace, legacy communications systems within the UK's power distribution networks. Greater awareness of the characteristics of network flows and more active management as well as interconnectivity is set to become a much bigger issue as the network facilitates the connection of flexibility services by more dynamically adding and removing power or time shifting energy demand customers.

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

The costs of roll out across the UK would simply require each DNO to do an individual assessment of their licence areas. It is almost certain that the technology will be widely deployed around the UK and as such will attract multi-vendor support and large volume cost reduction.

2d. Does not Lead to Unnecessary Duplication

Yes	X

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

This project will be the UK's first multi-site, multi-vendor LTE trial designed to mimic on a small scale, and develop proposals for, the roll-out of a telecommunications network to support Active Management functionality. We are unaware of any other such projects.

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 (ie not business as usual) and has an unproven business case where the risk warrants a limited Research and Development or Demonstration Project to demonstrate its effectiveness	X

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

No energy utility or sector service provider has carried out a multi-site, multi-vendor LTE trial with adjacent Evolved Node Bs ('eNodeB'-equipment for one base station) in a 'real' energy environment. The planned network would mimic on a small scale the type of network which would be deployed as part of the roll-out of Active Management functionality and a migration to a Smart Grid network including the deployment of this radio technology across multiple DNO licence areas. The 'LTE Innovation' project will confirm the deployment of higher bandwidth networks whenever required, whilst in parallel support the co-ordination and deployment of similar operational communications networks by other DNOs. Building primarily on the design capability developed jointly with Joint Radio Company (JRC) and the technology supply and support capabilities of Nokia, this project will place us at the forefront of this development

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

The delivery of this project will help to identify the risks and quantify the benefits which will inform future stages including costs, installation, commissioning, testing, and documentation and training requirements. This LTE innovation trial will aid with the process of establishing BaU for future data telecommunications data networks once a rigorous and thorough understanding of the risks is ascertained.

iii) Please identify why the Project can only be undertaken with the support of the NIA, including reference to the specific risks (eg commercial, technical, operational or regulatory) associated with the Project

The Network Innovation Allowance (NIA) provides WPD with the mechanism to demonstrate the benefits of LTE Analysis in a low risk way. If demonstrated and proven, the solution will provide a proactive way to monitor the network, understand in real time the power flows and system needs and helping WPD to manage network reinforcement / asset replacement in a more strategic way. The project will provide a better understanding of any risks associated with the deployment of such a technology in a way that the impact on the day to day operations of WPD is minimized. It is therefore understood that the NIA is the best route to support the project.

This project has been approved by a senior member of staff