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

Oct 2019

Project Reference Number

NIA_WPD_045

Project Registration

Project Title

Virtual Monitoring Data (VM-Data)

Project Reference Number

NIA_WPD_045

Project Licensee(s)

National Grid Electricity Distribution

Project Start

October 2019

Project Duration

1 year and 1 month

Nominated Project Contact(s)

Ricky Duke

Project Budget

£2,748,755.00

Summary

The VM Data project will deliver a VM capability across our Low Voltage network. This will reduce need for physical monitoring and improve our knowledge of asset loading against time, thus avoiding the costs associated with physical monitoring and demonstrating RIIO-ED2 cost savings and transition to Distribution System Operator.

Current lack of access to half-hourly data about household power flows on our network inhibits the understanding of LV network load flows, and of where electric vehicles and low carbon technologies are connected at LV level. With the acceleration of LCT take up, this could result in clustering on the network which then creates a need to install physical monitoring at substations to monitor the loading of the network. The VM Data project will investigate the feasibility of creating half-hourly load profiles for WPD's customers, including those with EV / LCT that can be fed into a Virtual Monitoring tool for the LV networks.

Third Party Collaborators

ElectraLink

IBM

Problem Being Solved

The operation of the electricity distribution network is complex and evolving – particularly with growing smart technologies and embedded, renewable generation. The increasing number of 'invisible' changes (Electric Vehicles, Embedded Generation, Smart Home, Storage) challenges existing network practices to the extent that the status quo is no longer possible. At present, technology change is outpacing changes in modelling and forecasting of consumer uptake of 'smart', Distributed Energy Resources (DER) or Electric Vehicle (EV) technology; therefore, it is difficult to monitor or understand the change in requirements on the LV network, under existing arrangements, without monitoring EV and DER impacts directly at source (or substation level).

Method(s)

The overall project method is to use IBM's cutting-edge Artificial Intelligence (AI) and cognitive analytics capability to further develop a model developed in the previous "LCT Detection" NIA project, which analyses changes in consumption patterns linked to EV/DER proliferation or other factors. The model will use MPAN-level consumption data from the Energy Market Data Hub (EMDH) plus

detailed consumption data (half-hourly intervals or less). The detailed consumption data will also be used to create and refine a set of half hourly customer profiles, which will be used to extrapolate EMDH consumption data into virtual daily consumption profiles, which will be aggregated to achieve virtual feeder and transformer half hourly loading profiles.

Scope

The project will establish a data platform and carry out an analytics programme based on data provided by us and ElectraLink. The project will be carried out in three phases:
Discovery: A business analysis phase incorporating design thinking activities and setting out the work plan for subsequent phases.
Execution: Five one month long “sprints” of data analytics activity covering two workstreams – Advanced LCT Detection and Profile Modelling.
Consolidation: Bringing the two workstreams together to produce a final report and model which will enable us to predict load patterns on the LV network.

Objective(s)

The project will fulfil two key objectives:
Validation and enhancement of the model developed in last year’s LCT Detection NIA project; and
Development of a set of domestic half hourly consumption profiles which can be aggregated and used for virtual network monitoring at feeder level, as well as enabling enhanced network planning and demand prediction.

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

n/a

Success Criteria

The success of the VM-DATA project is predicated on the following:

1. An improved version of the LCT Detection model that identifies Low Carbon Technology (LCT) on the LV network.
2. Validation results showing, with a high level of confidence, the level of accuracy of the improved LCT Detection model. This will include validation against half-hourly feeder-level readings from our existing LV substation monitoring.
3. A set of customer profiles, which will enable the extrapolation of ElectraLink’s monthly consumption data to be extrapolated to half hour load profiles on each LV feeder.
4. Validation results showing, with a high level of confidence, the level of accuracy of the half-hourly feeder loads predicted by the VM data model.
5. Delivery of an LCT detection and Virtual Monitoring approach that can be transferred into the business as a BAU approach.
6. Incorporation of the Virtual Monitoring data outputs into one of our tools or network management systems. The project will provide load data at feeder level, with improved accuracy, in a format that is compatible with our systems. The data can be integrated into our existing capabilities/applications which are currently being used by planners/control engineers.

Project Partners and External Funding

ElectraLink – Project Lead, data, data governance and dissemination activity. IBM – Supplier of Data Analytics and AI.

Potential for New Learning

The potential for new learning is significant. The VM Data project will develop an enhanced analytics capability; a new operational practice that is directly related to the operation of the electricity system; it will have the capability to support existing and developing industry processes, including dynamic network control, network asset management and DNO installation support for smart installations, thus delivering value for money for customers, and accelerating the development of the low carbon energy sector. The project will disseminate its findings across the GB energy networks sector and beyond. Once proven through the VM Data project, the data analytics and virtual monitoring capabilities will be replicable across all GB DNOs.

Scale of Project

The project will overlay and analyse data on a number of representative network topologies across our Electricity Service Areas (ESAs). It is likely that all the ESAs will be required in order to ensure a sufficient number of known locations to help train and validate the model. The number of customers assessed for consumption profiling will reflect the volumes required to generate a sufficiently large candidate set to validate the model and to identify regional differences in model effectiveness. Many of the project costs are not scale dependent.

Technology Readiness at Start

TRL4 Bench Scale Research

Technology Readiness at End

TRL8 Active Commissioning

Geographical Area

This project covers all of our four license areas, South West, South Wales, West Midlands and East Midlands.

Revenue Allowed for the RIIO Settlement

N/A

Indicative Total NIA Project Expenditure

£2,473,879.00

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 estimated cost benefit of virtual monitoring is £52M in total for our licence areas. This is based on: 1) 76,114k LV ground mounted substations across our network, with very few having physical real-time monitoring, of which 52,566 are forecast to be loaded upwards of 90% of their total capacity by 2030 (taken from the network assessment tool). 2) An average £2k install cost per monitor. If physical monitoring requirements of this group are reduced by 50% as detailed in the learning objectives, through virtual monitoring, this could potentially defer £52m of monitoring spend.

Please provide a calculation of the expected benefits the Solution

According to the Network Assessment Tool, which was developed as a part of Electric Nation, 26,681 of our distribution substations are forecast to be loaded over 90% of their capacity within 2020. This will require them to be monitored so to avoid fuse operations and appropriate deferral/re-enforcement actions taken. The total cost of monitoring these sites with physical monitors would cost 53 Million, and given an assumed accuracy of 50% of the virtual monitoring tool, we would save approximately 26.5 Million in the trial phase for 2.8 million expenditure.

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

Given the wholesale coverage of the ElectraLink data set across all GB DNO license areas, the Method could be replicable across the entire Network Licensees' system.

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

The Cost of rolling this out across the whole of GB would equate to £1,005,128. This would include the costs of MPAN and feeder mapping and set-up of systems.

There would also be on-going costs of circa £850,000 per year, which would cover cloud infrastructure storage and data science services. This equates to 3p per customer, per year.

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)

Our 2019 Innovation Strategy highlights “Customer Focus” as a top priority for innovation, noting the enablement of Low Carbon Technologies deployment, such as EVs and solar photovoltaic panels. Another key focus is the DSO Transition plan, which will ensure that we future energy demands of all of our customers. The VM Data project will support both the 2019 objectives by enabling us to manage and enable LCT connections more effectively. LV network visibility and accurate data for LCT installations will support the development of dynamic control systems at LV, and are a requirement to support normal planning activities and long-term forecasting.

☑ 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.

There is no current NIA or NIC project that addresses the same challenge, nor one that delivers the same outcomes. ElectraLink’s EMDH dataset lies at the heart of the VM Data project; this data set has not been used for any similar activity, thereby giving confidence that this project is not duplicating other activity. The project will present at our Balancing Act event; along with associated PR and marketing activities, the project will raise awareness of its activities to ensure no duplication occurs post project approval.

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

VM Data will build upon the LCT Detection through validation and additional AI and cognitive analytics capability to extract key

information from the EMDH dataset plus our existing datasets relating to LCTs. Aggregation of MPAN-level virtual daily demand profiles at LV network level will allow us to model and understand power flows at critical network points and drive decisions that affect reinforcement investment or deferral.

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 project will prove or disprove the general hypothesis that LCT detection and virtual monitoring are possible through the analysis of existing available consumption data. Once proven through the VM Data project, the data analytics capability will be replicable across all GB DNOs.

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

As noted in the NIA guidance, certain projects are speculative in nature and yield uncertain commercial returns. This is the case with this project, as a previously untested and novel application of technology; any Licensee would carry the commercial risk of not securing a return on the resource expenditure, making this project untenable without NIA support.

This project has been approved by a senior member of staff

☑ Yes