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

Apr 2018

Project Reference Number

NIA_UKPN0034

Project Registration

Project Title

Smart Charging Architecture Roadmap

Project Reference Number

NIA_UKPN0034

Project Licensee(s)

UK Power Networks

Project Start

April 2018

Project Duration

0 years and 11 months

Nominated Project Contact(s)

Thanos Zarogiannis

Project Budget

£428,413.00

Summary

The project is focussed on understanding the systems architecture (such as technology, assets, information flows, standards, business functions and commercial arrangements) which is required to facilitate smart EV charging for residential customers in urban, suburban and rural areas. The project will identify a range of potential models for smart EV charging, in order to understand the architecture requirements needed to support each of those models. The project will develop architecture representations specific to each option, including detail at the point of customer connection or interaction with charging infrastructure, and outline the requirements between the substation and the internal systems and processes that a DNO may need.

By determining an architecture that details the full smart charging landscape, this project can build upon the findings of existing projects that have focussed on specific parts of smart charging solutions, such as the link between charging points and substations. This architecture can then be assessed on its ability to support the various smart charging business models that the project identifies.

Nominated Contact Email Address(es)

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Problem Being Solved

The UK Government's decarbonisation plan includes the electrification of transport. It has recently announced a plan to ban all sales of new petrol and diesel vehicles by 2040. This policy intends to drive a rapid uptake in the number of electric vehicles (EVs) over the coming years. UK Power Networks' (UKPN's) Low Carbon London project demonstrated that unmanaged EV charging aligns with the peak domestic demand and that the majority of charging activity is at home. SSEN's My Electric Avenue[1] (MEA) project has shown that approximately 30% of low voltage networks could need upgrading by 2050 when 40-70% of customers have an EV. Consequently, there is a case for managing EV charging.

At present, there is little understanding and interaction between DNOs and EV stakeholders on the systems architecture that is needed to support mass management of EV charging (smart EV charging), and DNOs do not fully understand the capabilities they need to establish. If DNOs are not able to plan the asset and technology investments that enable smart EV charging, this could lead to customers having to wait to connect EV charging points until reinforcement is undertaken, frustrating policy objectives.
In order for DNOs to be able to continue delivering great customer service and providing quick charge point connections, then they must understand how best to plan for and deliver a combination of smart EV charging and flexible connection propositions. In parallel

unmonitored and unmanaged charging may also negatively impact the reliability of the distribution network and create further challenges in forecasting and delivering load related expenditure. Therefore, the DNO solutions that support smart EV charging must increase visibility of charging profiles and network locations to support the management of system security.

[1] http://myelectricavenue.info/sites/default/files/documents/Summary%20report.pdf

Method(s)

At a high level, the steps required to answer the project questions are as follows:

· Identify the credible range of smart EV charging models that could be deployed in the UK;

· Describe the architectures required to accommodate each of these models, and how this would apply to a DNO/DSO;

· Determine common and additional architecture elements across the models;

· Estimate the cost of delivering the common architecture elements (i.e. the no regrets investment);

· Undertake a CBA of the non-common elements; and

· Make recommendations on the core architecture, the CBA framework, and the development of a future roadmap
The proposed project would have three phases structured around three work streams – Stakeholder Engagement, Architecture, and Business Impacts and Benefits.

Scope

The project is focussed on understanding the systems architecture (such as technology, assets, information flows, standards, business functions and commercial arrangements) which is required to facilitate smart EV charging for residential customers in urban, suburban and rural areas. The project will identify a range of potential models for smart EV charging, in order to understand the architecture requirements needed to support each of those models. The project will develop architecture representations specific to each option, including detail at the point of customer connection or interaction with charging infrastructure, and outline the requirements between the substation and the internal systems and processes that a DNO may need.

By determining an architecture that details the full smart charging landscape, this project can build upon the findings of existing projects that have focussed on specific parts of smart charging solutions, such as the link between charging points and substations. This architecture can then be assessed on its ability to support the various smart charging business models that the project identifies.

The geographical focus will be on GB, but the project will draw on international experiences of smart charging where appropriate. The study will consider the possibility that there are differences in smart charging models and the architectural requirements between urban, suburban and rural areas.

Objective(s)

The objectives of the project are to:

1. Identify the principles for smart EV charging and the range of models which could be used;

2. Establish and work with a Stakeholder Group to identify relevant EV charging models for GB;

3. Define the core systems architecture DNOs will require to support the range of most relevant EV charging models for GB i.e. no regrets investment which can support a range of models;

4. Identify the costs and benefits associated with the additional investments (above the core systems architecture identified) to support each of the relevant smart EV charging options;

5. Develop a roadmap that describes how to deliver the core architecture needed, and evaluate incremental investments required to support specific smart EV charging models; and

6. Define the high-level methodology and use cases of integrating the smart EV charging solution with the business applications such as the ANM, NMS (PowerOn), RTUs etc.

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

n/a

Success Criteria

The success of the project will be determined by the completion and approval of a series of key deliverables:

1. Case studies of smart charging: Report detailing the different models for smart EV charging models that are deployed or being trialled in geographies relevant for comparison with the UK.

2. Establish an EV stakeholder group based on the roles identified through the case studies.

3. EV Stakeholder group findings: Summary of findings from EV Stakeholder Group engagement detailing current and future models and architecture details for the interaction with DNOs.

4. Quantification of unmanaged charging: Analysis of the costs and wider impacts of allowing unmanaged charging on the network to provide a baseline for the benefits of smart EV charging.

5. Smart charging architecture models: Architecture models for each of the models that have been shortlisted (based on criteria decided by internal and external stakeholders), including assets, information flows, standards and commercial arrangements.

6. Cost of change for each model: Assessment of a cost of change for each architecture model.

7. Smart EV charging roadmap: Time-based view of what capabilities need to be developed by the DNO and what developments are expected or known within the market place over the ED1 and early ED2 period, to provide a time base for the implementation of changes for smart EV charging.

8. Smart EV charging impacts for DNOs: A report for the wider DNO audience detailing the impacts over time of accommodating smart EV charging and recommendations on the architecture components that should be aligned across DNO businesses to best enable smart charging in the UK.

Project Partners and External Funding

The project will be carried out with support from Baringa Partners. No external funding.

Potential for New Learning

Through completion of this project the following learnings are expected:

· Leverage previous LCNF/NIC/NIA projects that have examined specific aspects of smart EV charging (e.g. substation to charging point communication), to produce a view and recommendation on how to realise all architecture components of smart EV charging;

· Ensure that DNOs have a robust understanding of the architectural impacts of smart charging and they are they are ready to respond to an increase in EVs and use the knowledge gained from the project to ensure efficient load related expenditure is proposed in the ED2 business plans; and
Understand the costs and benefits of supporting different smart charging models and technical architectures. This will provide a basis for engagement and shared development with vendors and service providers, as well as better informing DNOs investment plans.

Scale of Project

The project will look at smart charging operating models that can be applicable across all our three networks in order to cover EV charging patterns representative of urban, semi-urban and rural environments. By covering this scope we can ensure that the learning generated from the project can be easily used by other network operators.

Technology Readiness at Start

TRL2 Invention and Research

Technology Readiness at End

TRL4 Bench Scale Research

Geographical Area

The project will be carried out across all three of UK Power Networks licence areas; Eastern Power Networks, South Eastern Power Networks and London Power Networks.

Revenue Allowed for the RIIO Settlement

None

Indicative Total NIA Project Expenditure

The total Allowable NIA Expenditure reclaimed for this project will be £385,572.

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)

SSEN's project "My Electric Avenue" has demonstrated that through solutions that allow the DNO to influence EV charging, GB DNOs could save £2.2billion by 2050 by avoiding network reinforcement. The project is looking at different smart charging operating models to produce recommendations for GB DNOs on an economically, socially and technically preferred option. Part of the project will look at developing cost-benefit analysis models to inform no-regrets investments for DNOs for implementing smart charging smart solutions as part of their flexibility portfolio. This will help DNOs manage the uptake of EVs at the lowest possible cost. We expect that the adoption of the smart charging operating model by the GB DNOs could help deliver the £2.2billion savings stated by My Electric Avenue.

Please provide a calculation of the expected benefits the Solution

This is a Research project (starting TRL 2) and as such, it is difficult to provide an estimation of the expected financial benefits. The output of this will include recommendations on the preferred smart charging model (method) including an estimation of associated costs for the implementation of it (method cost).

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

We expect that the Method will be applicable to all GB DNO license areas.

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

Currently we do not have an estimation for the Method costs as it is a research project. This will be an output of the project and we plan to advise on costs for rolling out the Method across GB as part of the NIA Close Down report.

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

This project will propose a smart charging operating model that will help all DNOs facilitate the Government's plans for the electrification of transport across all network types.

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.

A number of GB projects have been carried out or are underway examining aspects of smart EV charging. Each of these projects have focussed on aspects of smart charging solutions, such as the link between charging points and substations, or on investigating consumer behaviour in relation to smart charging, and are progressing solutions in the context of a DNO-led intervention to protect local LV networks at risk of overload (a specific use-case is an "interim" solution to manage EV uptake in the short-term). This project will instead investigate the broader range of industry-wide model options for smart charging, encompassing a wider and more general set of use cases. By determining an architecture that details the full smart charging landscape, this project can build upon the findings of existing projects, helping to position them on a longer-term and more complete picture of industry evolution. This work may therefore also help to constrain work looking into options that are less likely to be of use in the longer-term.

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

Smart charging trials to date in the UK have been focussed on an interim solution of a DNO-led intervention to protect LV networks at risk of overload due to increasing EV connections. These projects have not investigated a longer-term solution due to the pressing need for progress on the interim solution, and also due to the fact that various critical wider industry questions were still unanswered. This project is proposed in the context of progress into (a) the interim solution, (b) the ENA's Open Networks project into the evolving

DSO landscape, and (c) Ofgem's Smart Systems & Flexibility plan and Network Access & Charging review. Given these conditions it is now more possible to move forward with the longer-term smart charging model.

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

There is currently no consensus regarding the evolution of the smart charging landscape, and there will be significant work and engagement required to move things forward. Advancement of this thinking will be of benefit for all parties in the industry, and can be of no benefit to any single party without the collaboration of the industry as a whole. As such, there is no business case for a single party to progress this work in isolation. We therefore believe that it is appropriate to use NIA funding to advance the solution at this stage.

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 noted above, and so 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