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

Aug 2021

Project Reference Number

NIA_SPEN_0060

Project Registration

Project Title

ADAPT-DC

Project Reference Number

NIA_SPEN_0060

Project Licensee(s)

SP Energy Networks Distribution

Project Start

September 2021

Project Duration

2 years and 1 month

Nominated Project Contact(s)

Jack Haynes, Michael Eves

Project Budget

£241,250.00

Summary

ADAPD-DC will convert areas of the LV AC network into LV DC in order to facilitate an increase in capacity.

Third Party Collaborators

Derryherk

Nominated Contact Email Address(es)

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Problem Being Solved

The decarbonisation of transport and heat, whilst a hugely important step towards reducing the effects of climate change, will put a huge strain on the electricity network. Particularly for Low Voltage networks where without intervention, circuits will become heavily overloaded with the expected EV uptake in the coming years.
Coupled with, many Low Carbon Technologies such as EV chargers have a DC output meaning they are incurring an AC to DC loss as result of the local network. ADAPT-DC seeks to address both of these issues by converting areas of the Low Voltage Alternating Current (LVAC) network to Low Voltage Direct Current (LVDC) allowing for huge increase in power transfer capacity in the existing cable infrastructure to facilitate more efficient and effective LVDC Rapid Electric Vehicle (EV) Charging Hubs.

Method(s)

Package 1: Rectifier Procurement & Trial Site Selection(3 months)

- With the novel nature of this installation SPEN must first find the most competitive market solution to the LVAC to LVDC network rectification problem. A high level RFI has already been completed with some “off the shelf” ready solutions available from power network equipment manufactures. The first 3 months of the project will be spent procuring the substation rectifier via SPENs robust tender exercises.

- In tandem with the procurement exercise the final trial site for the project will be selected. Engagement with land owners at a high level has already taken place with support received.

Package 2: Trial Site Design & Build (6 months)

- Having procured the site and equipment required for the solution, the following 6 months will be spent designing and building the DC Rapid Charging hub at the preferred trial site.

- This will involve the completion of any construction required at the substation and at the site for the landing of the DC Rapid Charging Hub itself.

Package 3: Operation, Monitoring, Maintenance and Dissemination of Trial Site Findings (12 months)

- Having constructed the trial site the following 12 months will be spent operating it to measure its effectiveness compared to the standard traditional LVAC means.

- Monitoring of the site will involve measuring security of supply, any voltage fluctuations, utilisation of charging infrastructure and power transfer, amongst others

- Any faults or maintenance issues will be addressed in this time and noted in the final report.

- Dissemination activities following sufficient operation time will also take place in this period. Including workshops/ seminars and demonstrations.

Scope

Following on from the learning garnered from SPEN’s NIA project “A Transition to LVDC Networks – Phase 2” SPEN are looking to investigate and demonstrate a viable alternative to traditional LVAC EV connections. At present the best means of facilitating Rapid EV Hubs (500kW+) is to provide a connection to the existing mains (where there is sufficient capacity) or to build a purpose-built secondary substation and connect the EV charging hub to the network via a dedicated LV Mains feed. This can be costly and in particular very disruptive to the local environment as substantial roadworks/ digging is required to facilitate this. Coupled with this is the requirement for an AC to DC conversion either within the charger of on the EV itself, this is costly and a complexity that can be removed with an LVDC solution.

ADAPT-DC approaches this problem differently by switching the network from LVAC to LVDC unlocking much greater power transfer capability meaning the Rapid EV Charging hub of 500kW+ can be met with the infrastructure that is already in the ground. In many examples the cost of the two solutions is comparable however with APADT-DC the requirement for digging (and as such disruption to the local area) is all but removed. ADAPT-DC will be an important piece of the puzzle in reaching Net-Zero and a great addition to the suite of options available to network designers. Thus the scope of the project is to demonstrate this in practice.

Objective(s)

· Build, operate and demonstrate a viable commercial alternative to traditional LVAC EV connections

· Implement safe working practises for LVDC Networks

Expand the capability of our existing assets particularly the LV Mains cable infrastructure as well as secondary substations

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

N/A

Success Criteria

· Full ADAPT_DC trial site build

· Operation and monitoring yielding high level of security of supply

· Utilisation of charging infrastructure by customers

Market ready alternative developed through demonstration

Project Partners and External Funding

Partners are to be confirmed during the project.

Potential for New Learning

Capability of LVDC networks to provide alternative solution to traditional LVAC EV connections. Being an important piece of the puzzle in reaching Net-Zero and a great addition to the suite of options available to network designers.

Scale of Project

Local to specific Trial Site

Technology Readiness at Start

TRL5 Pilot Scale

Technology Readiness at End

TRL8 Active Commissioning

Geographical Area

Greater Glasgow and Clyde area

Revenue Allowed for the RIIO Settlement

N/A

Indicative Total NIA Project Expenditure

£241,250

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)

Up to £20,000 per site dependent on length of specific cable assets required to facilitate Rapid EV Charging Hub

Please provide a calculation of the expected benefits the Solution

£1000-£20,000 per site utilised in this way. With an estimated 600 Rapid EV charging sites required in the SPEN region by 2050 the savings would be between £0.6m - £12m. The social return on investment is not quantified here, as mentioned above removal of the need for digging/ roadworks cannot be quantified directly as a £ figure but is of great advantage to the customer.

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

The solution if successfully demonstrated and replicated could potentially be utilised for any large dedicated EV connection across the UK. Assuming similar levels of sites are required in other DNOs region as are in SPENs then approx. 8400 sites could take advantage of the ADAPT-DC solution. This would incur savings of between £8.38m - £167m.

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

The costs for rolling out the method across GB would be site specific however savings are demonstrated in the section above.

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

- ☐ 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

The network alternative solution ADAPT-DC hopes to demonstrate and develop is applicable to all UK DNOs. The solution it will provide could be used in all areas of the UK network as the solution can be utilized by the assets other DNOs use. The asset base used by DNOs in this area (LV mains/ Substations) is largely consistent allowing this project to be helpful to all other Network Licenses.

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

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.

Checks on ENA Smarter Networks Portal revealed no other projects for this specific problem provide a similar solution.

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

The method of converting LVAC to LVDC to free capacity has not been trialled in this way in the UK previously.

Relevant Foreground IPR

N/A

Data Access Details

https://www.spenergynetworks.co.uk/pages/data_sharing_policy.aspx

Please identify why the Network Licensees will not fund the project as apart of it's business and usual activities

The risks in this project on the conversion justify the usage of innovation funding to trial this.

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 are some technical risks present in this project, with the conversion from AC to DC and connection of LCTs to this system.

This project has been approved by a senior member of staff

☑ Yes