SIF Discovery Round 2 Project Registration

Date of Submission

May 2023

Project Reference Number

10061568

Project Registration

Project Title

Lightspeed

Project Reference Number

10061568

Project Licensee(s)

UK Power Networks

Project Start

Apr 2023

Project Duration

3 Months

Nominated Project Contact(s)

innovation@ukpowernetworks.co.uk

Project Budget

£170,290.00

Funding Mechanism

SIF Discovery - Round 2

SIF Funding

£140,552.00

Strategy Theme

Net zero and the energy system transition

Challenge Area

Accelerating decarbonisation of major energy demands.

Lead Sector

Electricity Distribution

Other Related Sectors

Funding Licensees

SPEN - SP Distribution Plc

Lead Funding Licensee

UKPN - South Eastern Power Networks Plc

Collaborating Networks

SP Energy Networks Distribution

Technology Areas

Demand Response, Distributed Generation, Electric Vehicles

Equality, Diversity And InclusionSurvey

Yes

Project Summary

The project will meet challenge 4: enabling cost-effective integration of a transport decarbonisation solution aligned to net zero timescales. It will develop a solution that will accelerate deployment of public charging infrastructure, facilitating widespread adoption of EVs. The solution meets requirement 1: effectively facilitate, manage, and integrate multiple demands and demand-side solutions. It will develop a charger for wide deployment with minimal network disruption to facilitate EV demand. It will have DER, smart charging and V2G capabilities, which can be used to provide flexibility services.

The energy network innovation comes from the deployment of a DC converter at the point of connection, allowing higher-speed charging with minimal network reinforcement. This converter, with smart charging and V2G capabilities, also has a communication module. This allows for innovation in dynamic power and energy management systems, LV flexibility services, adaptive planning, and near-real-time data access.

The experience and capability of project partners:

- UK Power Networks: as the largest DNO in the UK serving 8.4m customers, we have deep expertise in developing innovative and smart solutions to facilitate charging infrastructure and the uptake of EVs and flexibility services. There are 20,000 public chargers in our licence areas, the most of any DNO.
- Otaski Energy Solutions: a smart infrastructure and AI-based energy management company that innovates to create circular economies for smart infrastructure. They have developed the first of its kind smart lamppost, the INtuitIV Digital Lamppost (IDL). This project will advance IDLs by developing bi-directional MIMO DC-DC converter hardware that drives a multifunctional system.
- Brighton and Hove City Council: they serve nearly 300,000 residents on the south coast. They have already rolled out around 200 lamppost chargers in the city, with plans to install a further 400 in the next few years.
- SP Energy Networks: SPEN's experience in offering EV chargepoints will contribute to test the scalability of the solution developed by another DNO.

The potential users of the innovation are owners of lampposts, principally local authorities and car park operators, as well as chargepoint operators. The end users are customers, who will use the public charging provided. The project addresses local authorities' needs by developing a simple, easy to implement and low-cost solution to public charging, with the potential for a revenue stream from their assets. It meets customers' needs by providing fast public charging in convenient on street locations, with the potential for added value from smart charging and V2G services.

Project Description

Problem:

We need to rapidly accelerate the deployment of public charging infrastructure to meet customer demand and government targets over the next decade, especially for the almost 40% of UK households that do not have off-street parking. Deployment of on-street charging can be constrained or delayed due to the need for network upgrades and local planning rules preventing large scale installation of charging infrastructure. Public charging also needs to be affordable, and customers need to be able to access the same flexibility services (such as smart charging and V2G) as those who charge off-street.

Proposed solution:

The aim of this project is to design and prototype a bi-directional multifunctional DC/ DC converter system that can be used to create a lamppost-based electric vehicle (EV) charger with V2G capabilities. By using energy balancing and distributed energy resources (DER) at the local level (batteries and solar PV), the solution seeks to support smart lighting and multiple levels of smart charging (7-22 kW) in a system designed for lower power demand (3-5 kW). It can also provide an additional source of energy flexibility (through bidirectional management of the rate of EV battery charging and discharge and the DER) and reduce EV charging costs by enabling variable customer pricing structures.

The system has two use cases:

1. in new developments, with a converter at a single point of connection to the network and a DC line network between new lampposts; and
2. a smaller, modular converter for retrofitting existing lampposts.

The innovation:

Lamppost EV chargers already exist. However, these solutions typically provide AC charging at 3-5 kW, which hinders their utilisation, and therefore business case. The DC/DC convertor and introduction of underground battery storage, which facilitates higher powered charging with minimal network costs, is a new technical innovation in on-street charging. The V2G capabilities of the charger is also innovative in an on-street context.

Benefits:

The solution would enable rapid rollout of public charging infrastructure to support consumers without access to private charging, without the need for significant infrastructure upgrades or changes to existing lampposts in the second use case. By supporting smart charging and V2G, the solution can provide an additional source of flexibility to the network, while also providing value to customers. This will be of commercial benefit to chargepoint operators, and we anticipate it will come at a lower cost than the current V2G chargepoint solutions on the market.

Third Party Collaborators

Brighton & Hove Council

Otaski Energy Solutions

SP Manweb

EV Dot Energy Ltd

Nominated Contact Email Address(es)

innovation@ukpowernetworks.co.uk

Project Description And Benefits

Applicants Location (not scored)

UK Power Networks (03870728): Newington House, 237 Southwark Bridge Road, London, SE1 6NP

Brighton & Hove City Council: Town Hall, Norton Rd, Hove BN3 3BQ

Otaski Energy Solutions Limited (11070502): Proto Abbott's Hill, Baltic Business Quarter, Gateshead, Tyne And Wear, United Kingdom, NE8 3DF

Scottish Power Energy Networks Holdings Ltd (SC389555): 320 St. Vincent Street, Glasgow, Scotland, G2 5AD

Project Short Description (not scored)

To help with the rapid increase in the UK's public EV charging infrastructure that is required to meet expected consumer demand, especially for the 40% of customers without a driveway, this solution aims to develop a bidirectional lamppost-based EV charging solution that would support both smart charging and V2G capabilities, while providing faster EV charging at 7 -- 22 kW, without requiring major network upgrades.

Video description

https://www.youtube.com/watch?v=6aUlqATm_uE&list=PLrMOhOrmeR6ldr-EVoT8ABGhTCxgyBKqs&index=47

Innovation justification

Problem:

Around 40% of UK households do not have off-street parking and will rely upon public charging infrastructure to meet their charging needs. To support this, the UK government has predicted that 300,000 public chargepoints need to be installed by 2030. Significant network upgrades, reinforcement and streetworks would be required if this target was met purely by conventional EV chargepoints. A lack of smart charging or V2G at public chargepoints also makes things more costly for customers.

Innovation:

Our solution has two main application approaches: (i) in new developments, with a convertor at a single point of connection to the network and a DC line network between new lampposts; and (ii) a smaller, modular converter for retrofitting existing lampposts.

In both cases, the solution can integrate DER to allow smart, fast charging at 7-22kW with minimal distribution network upgrades. It creates a control management system that integrates customers' needs, the grid's available capacity and DER to dynamically alter charging capacity and provide flexibility to the networks. The data generated from charging events can be shared to support forecasting and planning. With embedded and decentralised storage and the bidirectional converter, the system offers V2G capabilities.

Knowledge gap:

NIA project Charge Collective found that deployment of on-street charging can be expensive and time consuming, and the business model challenging. It also found that customers are willing to do smart charging on-street if the technology is reliable. This project plans to fill the missing gaps from these findings: how can public chargepoint deployment be sped up and more investable, and smart charging made feasible for on-street charging?

Economic and sustainability value:

The appropriate counterfactual is the current on-street charging market. This is either slow lamppost charging, or faster bollard charging with higher network costs. Economic value will be delivered by developing the solution of new DC-line infrastructure that can be rolled out at the installation stage from a single point of connection, minimising costs normally associated with higher powered charging capabilities. If the solution can accelerate the roll-out of public charging, and therefore EVs, this will lead to lower emissions from transport and improved air quality.

This project cannot be funded elsewhere or by BAU as the technology being proposed here is very much at its nascent state. SIF is a clear mechanism that enables us to conduct the research and feasibility assessment required.

Benefits Part 1

Environmental - carbon reduction – indirect CO2 savings per annum against a business-as-usual counterfactual
Financial - cost savings per annum on energy bills for consumers
Financial - future reductions in the cost of operating the network
New to market – products, processes, and services

Benefits Part 2

Financial - future reductions in the cost of operating the network

1. For new developments, we will track the reduction in costs through the network costs for facilitating public chargepoints in locations where the solution is implemented and would expect to achieve a 20-30% reduction in these compared to the business-as-usual counterfactual, but this will be quantified through the development of the solution.
2. For smart charging benefits, UK Power Networks estimates benefits of over £400m from deferred reinforcement costs facilitated by flexibility services in ED2, and this solution could help to realise a small portion of these benefits.
3. The feasibility of smart charging and V2G charging needs to be assessed at Discovery Phase before quantification of this benefit.

Financial - cost savings per annum on energy bills for consumers

Revenues - improved access to revenues for users of network services

Current estimates are £412 of savings per year from smart charging for those who do so off-street. Customers can also earn revenue from smart charging, as seen from ESO's CrowdFlex trial These savings and revenues will be assessed by comparing the cost of similar charging sessions over a year without smart charging.

Environmental - carbon reduction -- indirect CO2 savings per annum against a business-as-usual counterfactual

The reduction in carbon and improvement in air quality from increased EV uptake can be quantified as a monetary benefit using Green Book values and an assumed uptake rate for the new chargers.

New to market -- products, processes, and services

The proposed solution would deliver two new market products. Firstly, a new type of lamppost that would support DC/DC bidirectional EV charging when implemented as part of a new development, and secondly the mechanism to convert existing lampposts to support bidirectional EV charging. Both would also be a new source of energy flexibility.

As part of the Discovery Phase, we will assess the overall benefits of the project through a cost-benefit analysis, looking at the increased cost of the lamppost versus the overall benefits.

Project Plans And Milestones

Project Plan and Milestones

WP1: Stakeholder Engagement (UK Power Networks)

The aim of this work package is to engage with a wide range of stakeholders (including DNOs, local authorities, chargepoint operators, developers) to understand their current pain points and challenges, and workshop how the current proposed design could be adapted to fully meet their needs and requirements. This would be prioritised for Use Case 1 (new development) but will also consider Use Case 2 (retrofitting existing lampposts).

Deliverables: Stakeholder engagement plan, stakeholder insights report (including user stories), assessment of scalability of solution, business model canvas report.

Cost: £25,435.

WP2: User Stories & Functional requirements (UK Power Networks)

The aim of this work package is to define the key functional requirements that the proposed solution should deliver to meet the needs of the different stakeholders and user groups, as identified in WP1. This will include an assessment of regulations and standards that will need to be met by the technical design. These will be prioritised against the key use cases and the different delivery phases.

Deliverables: Functional requirements report, regulatory and standards assessment

Cost: £16,417.

WP3: Technical specifications (OtaskiES)

This work package aims to define all the technical requirements associated with the proposed solution. This includes hardware solution design and technical requirements for the software solution (non-functional, cyber security)

Deliverables: technical specifications for hardware for use cases 1 and 2, non-functional and technical requirements for software solution design

Cost: £96,300.

WP4: Project management (UK Power Networks)

This work package contains all the project management activities that needs to be completed to enable successful delivery of the project.

Deliverables: project plan, risk register, Discovery Phase completion report

Cost: £2,400.

The main risks associated with the project we have identified are:

- Technical: challenges and blocks during the design process hindering prototype development
- Project management and lack of engagement: meeting short timelines of Discovery Phase

The project will adopt a standard risk management strategy in line with programme and project delivery standards. This will be based upon the Risk Register produced as part of this submission, and more detail on these risks and their mitigations can be found there.

Regulatory Barriers (not scored)

We have not identified any existing regulatory barriers with regards to this project, and no additional policy considerations that would block a route to market for this solution. This is because the proposed solution development path falls in-line with existing regulatory purview for lamppost and street furniture deployment and operations. Our project also complies with existing standards as it relates to electricity network deployment and operations and local authority standards/expectations. These include:

- Interfaces; EV Charger-EV, EV Charger-coupler device, EV-grid, EV-back-office, EV-HMI, charging device, communication,

sensors, Telco radio, storage and other third-party assets, OCPP

- DC charging and communication for the interfaces
- Power and voltage rating
- Battery specifications and charging requirements
- Power and energy control functional specification
- Communication, control, and safety interfacing
- Operator interface (for the whole system)
- Corrosion and earthing/insulation monitoring and other safety aspects
- Non-functional specifications

The solution has a very low physical footprint which will aid in alignment with existing rules for street furniture. We will also look to ensure compliance with BSI PAS 1899, for accessible public charging.

For longer term implementation, policy considerations on the widespread adoption of V2G technology will need to be considered. An assessment of this and other regulations and policies, including V2G standard ISO 15118, is included in WP2.

The project would use successful demonstration of the solution to influence future policy and regulations on the adoption and implementation of V2G standards and technology.

No derogation or exemption from regulatory requirements will be required for future phases.

Commercials

Route To Market

The route to market for this project is to develop a viable and innovative charging product available for purchase. In the Alpha and Beta Phases, we will include local authorities and chargepoint operators as partners to provide further insights and guidance towards product commercialisation and real-world application. We also explore whether it can be modularised for different scenarios, various pricing models and international customers.

The project will determine and demonstrate the feasibility of changing how new lampposts are installed and how existing lampposts can be retrofitted to enable them to support DC bidirectional EV charging. The solution will demonstrate one way of tackling slow on-street charging, other organisations are looking at the same problem with different solutions. This project does not undermine competition of other solutions in development.

OtaskiES will be responsible for the implementation of the innovation. They are experienced in development and build of data-driven smart energy infrastructure and AI-energy management software solutions for city-scale/smart city applications.

The customers for this solution can be divided into the following segments:

- Local authorities and companies who own streetlights: They will be the primary purchasers for the hardware to enable either new lampposts or retrofitted lampposts to support EV charging.
- Chargepoint operators and energy aggregators: They will own and manage the EV chargepoint, enabling consumers to leverage bidirectional charging and the asset to support flexibility.
- DSO/DNOs: These assets will provide another source of energy flexibility to the network. We also need to be aware of new technologies and how they behave on our network for operational reasons, and adjust our policies, standards, and processes accordingly.
- EV drivers: These consumers will be the ultimate user and another beneficiary of the charging infrastructure.

The customer value proposition is to reduce the cost of operating EV charging and provide network flexibility services through smart charging and V2G services. It is also to reduce cost and time to install EV chargepoints on-street, minimising network costs and maximising and accelerating rollout of public chargers.

The anticipation is to successfully reach Beta Phase through the SIF, enabling full demonstration of the value of the proposed solution. If successful, funding for adoption will likely be between local authorities and chargepoint operators and aggregators who will develop and operate the chargers and the flexibility services. The structure of the SIF stages allows partners to be brought in at key stages, as the need for them is identified.

Intellectual property rights (not scored)

Our strategy for IPR is based around industry best practice with several levels of security offered by contractual agreements, encrypted code, and other rights.

Any IP created by OtaskiES can be licensed for use by third parties by contractual agreement in line with the IPR agreements set out in the SIF Governance.

The background IP brought to the project includes a patent by OtaskiES for the smart lamppost AI control (GB 201907454 D0 - Artificial intelligence/business intelligence (ai/bi) backed streetlight dimming solutions). The consortium partners have agreed that any necessary rights to background IP will be granted free of charge during the project under strict non-disclosure, but any future exploitation beyond the project will be done so in line with the SIF Governance.

The IPR arising from this project (foreground) will be owned by OtaskiES. The project will lead to a novel technology with a clear commercial potential in a variety of markets. All IP generated from the project will either be individual or joint IP, which will belong to individual partners or be jointly owned by partners. The key innovations will include:

a) Bi-directional MIMO DC-DC converter (hardware), which will be trademarked and patented by OtaskiES; and

b) Novel software for controlling the converter, which will be copyrighted by OtaskiES and encrypted to prevent reverse engineering. This IP can be licensed out by partners for generic or public use.

Foreground IPR developed in the trial in commercial products will not be relevant foreground IPR, but must be made available to purchase, including to other network licensees. Any relevant foreground IPR created during the project must be able to be licensed for free by other DNOs.

Costs and value for money

The total project cost is: £170,290.

- UK Power Networks: £58,250 (34%)
- OtaskiES: £108,300 (64%)
- Scottish Power Energy Networks: £2,140 (1%)
- Brighton and Hove Council: £1,600 (1%)

After the in-kind and compulsory contributions from partners we are left with the following SIF funding per partner:

- UK Power Networks: £44,250 (31%)
- OtaskiES: £108,300 (69%)
- Scottish Power Energy Networks: £1 (0%)
- Brighton and Hove Council: £1 (0%)

The following contributions will be provided by the project partners. This exceeds the 10% compulsory contribution providing further value for money:

- UK Power Networks: £14,000
- OtaskiES: £12,000
- Scottish Power Energy Networks: £2,139
- Brighton and Hove City Council: £1,599

This project will provide for money to consumers and the industry by:

- Using learning from other innovation projects (e.g. Charge Collective, Shift, Powerloop) to facilitate the development of both the stakeholder engagement plan and the different customer journeys and use cases;
- Using the existing lamppost charging solution developed by OtaskiES as the basis for the further development to create the bidirectional lamppost EV charging solution, removing the repeated R&D cost that would be required if multiple parties were to develop this product separately;
- Assessing how new technologies behave on our network and adjusting our policies, standards and processes accordingly; and
- Ensuring the deliverables have a clear purpose and can support the development of an Alpha and Beta Phase proposals.

UK Power Networks will subcontract stakeholder engagement through a formal RFP process, to ensure the best value outcome is delivered.

Document Upload

Documents Uploaded Where Applicable

Yes

Documents:

SIF Discovery Round 2 Project Registration 2023-05-30 10_28

SIF Round 2 Discovery - Lightspeed End of Phase (for upload).pdf

SIF Round 2 Discovery - Lightspeed Show and Tell (for upload).pdf

This project has been approved by a senior member of staff

☑ Yes