SIF Project Registration

Date of Submission

Mar 2022

Project Reference Number

SIF_WWU_2_01

Project Registration

Project Title

HyPark

Project Reference Number

SIF_WWU_2_01

Project Licensee(s)

Wales & West Utilities

Project Start

March 2022

Project Duration

2 Months

Nominated Project Contact(s)

Darren Cushen (darren.cushen@wwutilities.co.uk)

Project Budget

£150,000.00

Project Summary

HyPark aims to support the roll out of electric vehicles, using smart technology to identify the best way to charge the vehicle, while keeping the impact on the electricity grid to a minimum. The gas grid connection means that in the future, the fuel cell will be converted to run on hydrogen, while HyPark will also enable the fuelling of hydrogen vehicles.

Nominated Contact Email Address(es)

innovation@wwutilities.co.uk

Problem Being Solved

Cars, vans and heavy goods vehicles are the most significant sources of greenhouse gas emissions in the transport sector. This project seeks to enable the transition to large-scale net-zero vehicles, using whole-system thinking to optimise both the gas and electricity network infrastructure.

Project Approaches And Desired Outcomes

The Big Idea

Our vision is to develop a truly innovative and investable, multi-vector solution that will drive the uptake of zero-emission transport. HyPark will use advanced machine-learning to evaluate and quantify the trade-offs between network power, storage and on-site generation using gas-grid connected fuel-cells. The use of grid-aware fuel-cell and battery storage modules will not only help to accelerate the deployment of rapid EV charging infrastructure by reducing the need for costly reinforcement but will offer valuable flexibility services that support a smarter, more integrated energy system.

Energy networks are already seeking to address the urgent challenge of rapid EV charging through NIC projects such as DC Share which is investigating the installation of a new DC network as an alternative to traditional AC reinforcement. This traditional reinforcement-based approach is an important counterpoint to the multi-vector HyPark concept. Moreover, since fuel-cells produce DC, HyPark would also actively support the equalisation of any new DC network infrastructure.

The individual technology components required for the HyPark project are available commercially. Although expensive, fuel-cells are already deployed in a range of applications. They can be fuelled by methane, bio-methane, or hydrogen and can be stacked to form expandable generation modules. These modules will reduce the impact on the electricity system whilst actively supporting the decarbonisation of the gas network. The HyPark team has purposefully not selected a fuel-cell manufacturer as we did not want to be limited to a specific type of system at 'Discovery' stage. Co-location of transport infrastructure and a gas-connectivity also offers expansion for hydrogen refuelling.

Easee is a highly innovative provider of EV charging solutions with a rapidly expanding portfolio. Their open software architecture will be particularly important to this project as it is designed to support third-party management and integration without proprietary control platforms. Passiv UK has advanced metering, monitoring and control capabilities using innovative, machine learning control algorithms which will be enhanced to support the Hy_Park asset mix. Passiv already manages multi-vector assets, providing network services and will be central to integrating and optimising the Hy_Park system.

The project partners intend to conform to the default SIF arrangements for IPR. Prior to the Discovery Phase, a declaration of background IP will be made as part of the consortium agreement to clearly define what established IP each partner brings to the project. Hy_Park is currently TRL 7 and plans to progress to TRL 9 during Alpha and Beta stages.

Innovation Justification

Hy_Park will help deliver the UK Government's ambitions for a world-class EV infrastructure. Conventional network reinforcement necessary for high-capacity EV charging hubs are disruptive and already prohibitively expensive, particularly in constrained urban settings where they will be increasingly required.

Our vision is to develop a modular, multi-vector solution for rapid EV charging integrating stationary, gas-grid connected fuel-cells and storage using grid-aware machine-learning. This innovation will offer an investable, "plug-and-play" system for localised generation and capacity needed to enable at-scale zero-emission transport options.

The objective of HyPark is to explore in detail the key themes of net-zero transport to develop a cost-effective solution that will increase the volume of EV's on the road. We will build on the knowledge that has already been developed through previous NIA projects, like Optinet, FREEDOM & MADE to inform the outputs of this discovery phase.

Developing an advanced control system to evaluate an operational strategy that takes into account transport requirements, gas, electricity prices, carbon-intensity, grid-constraint signals in real-time will be central to this project. Passiv will deliver this capability through their energy management platform and know-how, building on unique insights from applying control algorithms to optimise multiple assets across energy vectors gained through previous R&D projects.

Easee is actively commercialising state-of-the-art EV charging systems capable of remote monitoring and active load balancing between groups of charge points and has patented capabilities to enable connection to all types of electric grids, signal systems, earthing and phases. These technologies, and open software architecture, and insight into the international EV sector will be essential to delivering this project.

WWU is leading pathfinder projects using whole system modelling to assess changes in energy flows to support the decarbonisation of the gas grid. Understanding the value streams, sector developments and processes for switching to green-gas and hydrogen will be central to delivering the innovation.

This first-of-its-kind project will explore solutions for EV charging balancing multi-vector energy sources. We want to deeply understand the problem and its feasibility from a technical and economic perspective. This will be a large-scale innovation project that will benefit from the 3 steps of the SIF process. It will also benefit from the collaboration of 4 energy-companies, 2 gas-networks and 2 technology-providers.

The project team has considered BAU private-sector funding, but the concept is still at an early stage requiring research, testing, demonstration, de-risking to prove the technical and commercial viability for investors.

Project Plans And Milestones

Project Plan And Milestones

We will develop a Project Execution Plan to specify core projects aims, success criteria, organisation structure, and governance structure enabling clear decision making, key reporting and control processes. Using this approach will provide transparency, cohesion and collaboration amongst the stakeholders, and avoid duplication.

Work package 1: Project Management / Mobilisation

This WP will use best practices, agile project management techniques, tools and governance processes to get excellent input from all project partners in this expert group. We will ensure that data, analysis, modelling, other outputs are captured, recorded, documented to provide guidance and assistance in the development of the deliverables and reports.

Work package 2: Stakeholder Engagement

The aim of this WP is to create learning opportunities for the Hy_Park concept through key external stakeholders and to get the most out of every engagement opportunity with a wide range of industry partners, particularly the wider GDN, DNO communities, energy suppliers, C&I, social landlords and real estate owners.

Work Package 3: Market Research

In this WP we will apply a range of market-research techniques including desk research, structured stakeholder interviews and engagement to identify suitable technologies for Hy_Park: stationary fuel-cells, flexible storage, charging systems and direct refuelling.

Work Package 4: Feasibility Study

A feasibility study that considers network, economic, technical, legal, and installation deployment considerations. Ascertain investability of deploying the Hy_Park technology at a commercial scale.

Work package 5: Dissemination

The aim of this WP is to enable all project partners to disseminate their outputs and learnings at key stages.

Route To Market

The development of rapid charging hubs in urban areas will be a key enabler for the decarbonisation of transport.

Large scale uptake of EV's is likely to be first seen across commercial fleets and users, such as taxis, car clubs, delivery drivers and other company vehicles. In addition to this, over 40% of the population do not have the off-street parking space needed for home EV charging. These consumers and organisations will need to charge in ways that are at least as convenient as current refuelling and EV charging hubs enabling rapid turnaround will be needed.

The costs associated with installing and enabling rapid EV charging infrastructure will be significant. In most cases, the power demands for rapid charging with multiple connection sites will be greater than 1000 kVA, requiring the installation of secondary transformers and additional HV interconnectors. Conventional AC reinforcement is not necessarily the most cost-effective solution and this offers a key route to market for the HyPark technology.

While the HyPark offers a potentially more cost-effective solution to network reinforcement, on-site generation and storage, this has not been demonstrated in practice and funding is required to prove technical and commercial viability.

We have identified two primary use cases emerging from the challenges of supporting widespread net-zero carbon transport solutions:

1. commercial users, fleets such as taxis and delivery services requiring quick turn around and;
2. private users without slow home charging systems or with vehicles capable of high-speed charging.

A key part of the Discovery phase will be to understand the most appropriate technology configurations that will be deployed within the HyPark module. We will then begin to explore business models arising from these use cases and the market interactions of the HyPark technology, EV users, Hydrogen users, heat offtake, developers, investors and wider energy system.

In addition to the primary use cases, we intend to assess how the commercialisation can be further supported by other applications of the HyPark technology including:

- Benefits of dynamic demand management and flexibility services using on-site generation and storage
- Use of on-site heat produced as a by-product of the fuel-cell could increase the overall efficiency to +90%
- The use of hydrogen - futureproofing against the growth in hydrogen vehicles
- Co-location with mixed-use developments and opportunities for C&I, social landlords and real estate owners;
- Tri-generation configuration of natural gas-supplied fuel cells (i.e. to generate power, heat & hydrogen

Costs

Total Project Costs

150000

SIF Funding

150000

This project has been approved by a senior member of staff

☑ Yes