SIF Discovery Round 2 Project Registration

Date of Submission

Oct 2023

Project Reference Number

10059797

Project Registration

Project Title

Shifting Currents

Project Reference Number

10059797

Project Licensee(s)

National Grid Electricity Distribution

Project Start

Apr 2023

Project Duration

3 Months

Nominated Project Contact(s)

Nick Devine

Project Budget

£151,798.00

Funding Mechanism

SIF Discovery - Round 2

SIF Funding

£99,040.00

Strategy Theme

Flexibility and market evolution

Challenge Area

Preparing for a net zero power system

Lead Sector

Electricity Distribution

Other Related Sectors

Funding Licensees

Lead Funding Licensee

NGED - National Grid Electricity Distribution

Collaborating Networks

UK Power Networks

Technology Areas

Demand Response, Low Carbon Generation, Stakeholder Engagement

Equality, Diversity And InclusionSurvey

Yes

Project Summary

This project will meet the challenge of Preparing for a Net Zero Power System, specifically accessing novel grid/system support from the operations of the drinking and wastewater networks of water utilities.

It will build on the pioneering partnership between NGED and South West Water in the FLOWERS NIA project. This feasibility project investigated the potential to adjust the timing and control of water network operations in response to the electricity network. The electricity demand shifted to different times of the day would fulfill several use cases: reducing peak demand in constrained network areas, reducing the carbon intensity of water network demand and reducing need for curtailment of renewable generation.

The aim of the project is to innovate on the interoperability between electricity and water networks to embed whole systems thinking and flexibility in the connections of water network sites to the distribution network. It will design and trial the commercial and technical process required to access operational flexibility in the pumping demand of water networks.

It will demonstrate a unique collaboration between regulated utilities which can double stack benefits for customers served by both electricity and water networks: adding a widely accessible source of flexibility to reduce constraints on existing and potentially constrained networks, while enabling water networks' drive to net zero. This collaboration would be a template for replication countrywide, allowing all UK water and distribution network connected customers to benefit from this area.

NGED will be the lead partner, continuing on in this role as the DNO lead in the initial NIA feasibility study, building on a legacy in the development, trial and rollout of flexibility.

UKPN will be the supporting DNO, with its own track record in flexibility and operating the network with significant crossover with water partners. Smart Grid Consultancy will be the main technical partner, having delivered multiple flexibility innovation projects such as Intraflex.

The water company partners will be Pennon Group (which includes South West Water, Bristol Water and Bournemouth Water), Anglian Water and Severn Trent Water. Each have experience Operating the reservoirs, treatment works, water mains and sewers within the Water Supply and Sewerage Services areas for which they are the licence holders. All are committed to achieving net zero in their operations.

Project Description

The aim of this project is to innovate on the interoperability between electricity and water utilities to embed whole systems thinking and flexibility in the connections of water sites to the distribution network. It will design and trial the commercial and technical process required to access operational flexibility in water networks, which is the potential to adjust the timing and control of operations (primarily pumping) in response to the electricity network. The electricity demand shifted to different times of the day would fulfill several use cases: reducing peak demand in constrained network areas, reducing the carbon intensity of water network demand and reducing need for curtailment of renewable generation.

Unlike electricity demand, where distribution can only take place as electrical energy is consumed, water pumping only needs to take place such that water is available at time of consumption or treatment. This latency between pumping and consumption is the principal opportunity which could be seized through a novel partnership between DNO and water utility, in which the carbon benefits and renewable generation capacity unlocked are provided back to water networks to set against net zero targets.

Two core innovations will be piloted: the technical and operational process for embedding this flexibility, and the commercial agreement which enables it. It will demonstrate a unique collaboration between regulated utilities which can double stack benefits for customers served by both electricity and water networks: adding a widely accessible source of flexibility to reduce constraints on existing and potentially constrained networks, while enabling water networks' drive to net zero.This collaboration would be a template for replication countrywide, allowing all UK water and distribution network connected customers to benefit from this area.

This project builds on a previous NIA project between National Grid Electricity Distribution and South West Water, FLOWERS (Flexible Operation Of Water Networks Enabling Response Services). FLOWERS has identified between 18 and 34 MW of potential flexible demand on SWWs network alone, estimating a potential value of around E5,OOO per hour at the most common current flexibility product rate. With the incentives described above, this value would be a saving when compared with procuring the same amount of flexibility at that rate. Furthermore, aligning pump demand with peak generation has the potential to reduce the cost of increase the capacity for, and penetration of, distributed energy resources.

Preceding Projects

Third Party Collaborators

Smarter Grid Consultancy

South West Water

Anglian Water

Severn Trent Water

Project Description And Benefits

Applicants Location (not scored)

National Grid Electricity Distribution

Avonbank

Feeder Rd

Bristol

BS2 0TB

Project Short Description (not scored)

Shifting Currents will investigate how flexibility can be embedded in the operations Of the drinking and wastewater networks Of water utilities, to deliver whole systems benefits to customers of reduced carbon intensity of water and electricity networks and cost-effective management of electrical capacity.

Video description

Innovation justification

Electrical demand curves from water operations align with distribution networks, with peaks in the morning and evening. Water operations are therefore a proportion of the demand at high congestion periods on distribution networks. Concurrently, water utilities have committed to achieve net zero in their operations. Due to the carbon inherent within the matter processed by water networks, net zero solutions for water utilities must include off set, a proportion of which will be connecting or enabling additional renewable generation.

UK water networks have historically had low participation in DNO flexibility, as the financial benefits from flexibility products do not provide sufficient incentive for them to do so. This project aims to solve this problem by developing a new kind of fflexibility embedded within the timing and control of water network pumping. Unlike electricity demand, where distribution can only take place as electrical energy is consumed, water pumping only needs to take place such that water is available at time of consumption or treatment. This latency between pumping and consumption can potentially be exploited through a novel partnership between DNO and water utility in which the carbon benefits and renewable generation capacity unlocked are provided back to water networks to set against net zero targets.

As such, the project will pilot two core innovations: the technical and operational process for embedding this flexibility, and the commercial agreement which enables it. FLOWERS has produced initial learning on the feasibility of these innovations. However, the assumptions of replicability across the UK need to be tested and there was no real-life demonstration. Doing so carries significant risk due to the technical challenges to be overcome, such as coordinating between up and downstream water sites or accurately forecasting generation intensity and risk of curtailment.

These innovations are significantly different than typical DNO flexibility procurement, and the development of this capability is not within the capacity of these BAU activities.

FLOWERS has identified between 18 and 34 MW of potential flexible demand on SWW's network alone, estimating a potential value of around E5,OOO per hour at the most common current flexibility product rate. With the incentives described above, this value would be a saving when compared with procuring the same amount of flexibility at that rate. Furthermore, aligning pump demand with peak generation has the potential to reduce the cost of increase the capacity for and penetration of distributed energy resources.

Benefits Part 1

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

Benefits Part 2

There are a variety of consumer benefits outlined below.

Flexibility first: Unlocking new flexibility capacity will support networks choosing the most cost-effective option to provide network capacity, which will minimize network costs for all consumers.

Net zero: Electricity network consumers are in nearly every circumstance also water network consumers. This project will alleviate the carbon intensity of the electricity and offset water network emissions, double stacking benefits for consumers.

Whole system: Breaking down the silos between industries through innovative collaboration increases whole system capability, ensuring the infrastructure of the future works harmoniously to deliver for consumers.

Intelligence: The data analysis and forecasting capability that will be developed to enable this type of flexibility will increase capacity to dynamically model the impacts of water networks on electricity networks, and the vice versa.

Environment: Supporting the connection of local generation to water networks will strengthen the resilience of water site electrical plant, reducing the likelihood of incidents.

Metrics: Flexibility capacity unlocked will be measured in the available MW and MWh of water network demand that can be shifted out of peak periods, and the value of this capacity. In the FLOWERS NIA, a methodology was developed for estimating this capacity across South West Water's network, identifying a value of approximately E5,OOO per hour of utilization of this flexibility. This methodology will be applied to the additional partners in this project. These metrics will be validated and tested during the Alpha and Beta phases.

Direct C02 emissions will be measured using tools such as NGED's Carbon Tracer and National Grid ESO's Carbon Intensity API. The carbon intensity of the times the flexed electricity would be consumed with and without the initiatives engaged will be compared, with the C02 saving being the difference between the two. In Discovery/Alpha, this will use the estimation of the flexible capacity compared against historic carbon intensity data. In Beta, this would be the actual demand shifted against contemporaneous carbon intensity data.

Best practice for measuring Indirect C02 emissions is still emergent, and this project will keep abreast of developments in methodologies for calculating the marginal impact of flexibility on the generation mix of the UK grid. An approach using the BEIS levelised cost of energy method will also be considered.

New market creation will be measured by the adoption of the alternative connection approach by DNOs, and the capacity obtained under this scheme.

Project Plans And Milestones

Project Plan and Milestones

Agile approach: An agile approach will be taken to allow the project to adapt to the additional challenges that may be uncovered through engagement with water network partners, changes to technological and operations requirements and other uncertainties.

WPI. Use case definition (23% expenditure, SGC lead, all partners support): It is critical to begin by engaging with water networks to assess the app icability of the use cases and commercial agreement for operational flexibility identified in the FLOWERS NIA project for each network. This will include briefings and workshops with key experts in each utility. Any additional challenges and requirements will be identified and consensus gained on the commercial arrangements that will be developed.

WP2. Trial site development (23% expenditure, SGC lead, all partners support): It will be investigated which sites on each water network would provide ideal locations for trialling the use cases discussed in WPI. A criteria for assessing suitability of sites will be defined, and engagement with water networks will be carried out to apply these criteria and produce a list of sites best suited for development and trial in Alpha/Beta.

WP3. Technical assessment (54% expenditure, SGC lead, all partners support): Using the FLOWERS NIA approach, the potential flexibility capacity and synergies from each Of the use Cases will be estimated for each network. The systems and control architecture each use case will interact with will be captured. Next steps for development and the roadmap through Alpha/Beta will be documented.

Deliverables/Success Criteria: The primary deliverables will be three reports outlining the findings of each work package, with an evidenced judgement of the use cases and trial sites to be developed in Alpha, a reasoned estimation of the size Of the potential opportunity and a roadmap through Alpha and Beta that is clear about the challenges ahead.

Risks/Constraints: There are a variety Of risks/constraints to be managed in Discovery for Shifting Currents. The largest risks are:

• Low engagement from one or more water networks

• Issues with the access to and quality of water network data

• Lack of consensus on the commercial arrangements to be developed

• Significant divergence in the technical requirements between water networks

Regulatory Barriers (not scored)

As a collaboration between electricity and water utilities, this project will be operating under the purview of two regulators — Ofgem and Ofwat. This has been considered in the FLOWERS NIA project and engagement with both regulators in Alpha and Beta will be necessary.

FLOWERS in its final deliverables will be producing a commercial proposal, with potential actions, for the regulators. This will be used as the template for the approach in Shifting Currents. The final version Of this document is expected to be published in or before January 2023.

Commercials

Route To Market

BAU adoption: If successful, the Alpha and Beta phases of the project will develop the agreements, operational policies and technical standards required to unlock water operational flexibility. These standards will be shared with electricity network and water utility peers to allow them to embed the principles in their own internal policy.

As part of the Beta roadmap, a path to market will be developed for any bespoke technical solutions that may be required (e.g. APIs) to enable the above.

Competition: As described in question 8, the regulators will be engaged to ensure the commercial terms agreed with water networks are not considered anti-competitive to the flexibility market. This engagement has already begun in the FLOWERS NIA study and the concept has so far been received positively, as the water industry is a vital utility used by almost everyone nationwide and the widespread benefits to everyone outweigh the limited impact experienced by just a few.

Responsibility for innovation: A variety of stakeholders will be responsible for different aspects of the innovation. NGED and UKPN have overall responsibility for the challenge associated with embedding flexible operation in distribution networks. SGC will be the solution developer and responsible for the technical and operational design and commercial model. Water company partners will be responsible for embedding the new flexible processes in their operations.

Customer segment: The main customer segment is electricity networks and water utilities. However, as noted in question 5 similar industries such as gas utilities are potential future customer segments.

Value proposition: Shifting Currents will deliver efficiency savings, decarbonisation and a whole system approach which double stacks these benefits for customers. Specific benefits include:

- Reducing the cost of flexibility in existing constrained electricity network zones
- Reducing the growth of new constrained zones
- Increasing penetration of distributed energy resources
- Enabing the connection of renewable generation at water network sites

Funding strategy: We would intend to fund a large trial in later SIF phases. This will be a live technical demonstration that will necessarily involve the development of the required the agreements, operational policies and technical standards. As such, scale up will be funded via BAU mechanisms to roll out these agreements, poicies and standards to existing water utility connections that wish to participate.

Intellectual property rights (not scored)

Foreground Intellectual Property

The only foreground IP developed in Discovery will be the 3 work package report deliverables. These will be published publically as per SIF governance.

Background Intellectual Property

Each water utility will be the sole IP owner of the data provided on its own network. The exact data required will be defined and agreed in work package 3, but is likely to include:

- Site geographical locations
- Site main function (e.g. wastewater treatment, drinking water distribution)
- Half-hourly consumption data

Each electricity network will be the sole IP owner of the data provided on its own network. The exact data required will be defined in work package 3, but is likely to include:

- Network connectivity data
- Substation and circuit graphical locations
- Network capacity and constraint data

Costs and value for money

The overall project cost is £99,040.

Value for money: NGED has benchmarked partner costs against its wider pool of suppliers and partners, ensuring that delivery costs offer value for money. As demonstrated in questions 5 and 6, there are large potential benefits for consumers that will most likely offer excellent cost benefit versus the current counterfactual. Each partner has offered contributions to the Discovery costs, demonstrating commitment to the project and the appropriate use of customer money.

Document Upload

Documents Uploaded Where Applicable

Yes

Documents:

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Shifting Currents End of Discovery Phase Report.pdf

Shifting Currents Project Conditions Supplementary Report.pdf

WP1 D1 Use case definition report V2.pdf

WP2 D1 Trial site development report V1.1.pdf

WP3 D1 Technical assessment report V2.pdf

This project has been approved by a senior member of staff

☑ Yes