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

Jan 2019

Project Reference Number

NIA_NGSO0024

Project Registration

Project Title

Enhancing Energy Flexibility from Wastewater Catchments through a Whole System Approach

Project Reference Number

NIA_NGSO0024

Project Licensee(s)

National Energy System Operator

Project Start

March 2019

Project Duration

1 year and 7 months

Nominated Project Contact(s)

Adam Simms

Project Budget

£225,000.00

Summary

With increasing deployment of variable, non-synchronous generation and the closure of conventional dispatchable generation, the GB electricity system is becoming more inflexible. Additional sources of flexibility are required to help operate the system.

National Grid Electricity System Operator (ESO) is exploring new ways to procure additional flexibility, including exploring the potential for flexibility from the demand side. The Power Responsive programme, which brings together stakeholders from a range of UK sectors, identified potential for additional demand-side flexibility from the water sector.

Water systems are built with headroom to protect against rare weather events such as storms, floods and droughts, and it is this 'system headroom' which could be used to provide additional flexibility services. However, it is unclear how large these system-wide opportunities from the water sector are, where they are, how to access them and whether there is a sufficiently strong business case to justify the necessary investment in new technology and processes. The research hypothesis of this project is that providing demand side flexibility through controlling a whole water system is more cost-effective than focussing on a single asset or process.

Preceding Projects

NIA_NGET0052 - Mathematics of Balancing Energy Networks Under Uncertainty

NIA_NGET0159 - Black Start Alternative Approaches

NIA_NGET0156 - DNO Investigation into Voltage Interaction and Dependency Expectation (DIVIDE)

Third Party Collaborators

United Utilities

Open Energi

Nominated Contact Email Address(es)

box.so.innovation@nationalgrid.com

Problem Being Solved

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National Grid Electricity System Operator (ESO) is exploring new ways to procure additional flexibility, including exploring the potential for flexibility from the demand side. The Power Responsive programme, which brings together stakeholders from a range of UK sectors, identified potential for additional demand-side flexibility from the water sector.

Water systems are built with headroom to protect against rare weather events such as storms, floods and droughts, and it is this 'system headroom' which could be used to provide additional flexibility services. However, it is unclear how large these system-wide opportunities from the water sector are, where they are, how to access them and whether there is a sufficiently strong business case to justify the necessary investment in new technology and processes. The research hypothesis of this project is that providing demand side flexibility through controlling a whole water system is more cost-effective than focussing on a single asset or process.

The Power Responsive programme promotes coordinated deployment of technologies that can provide needed flexibility. To do this, Power Responsive publishes and disseminates detailed case studies that raise awareness and technical understanding of how new technologies may be deployed. Learnings from this project will be published through NIA reporting as well as via a case study through Power Responsive to encourage deployment across GB and realise wider system benefits.

Method(s)

The project will require site surveys to be undertaken and data to be collected to understand how the wastewater assets are operating and how much energy they are consuming. Hydraulic models will be developed using weather data and knowledge of the physical constraints of the wastewater system. Outputs from such models will then be input into another model to determine areas of storage capacity and pump turn-down opportunities for a given duration.

Scope

This project will focus on assets within a single waste water catchment area operated by United Utilities, however the learning will be disseminated and applicable across waste water catchment areas across GB.

Objective(s)

The objectives of this project are:

- to assess the technical potential for demand-side flexibility within a single waste water catchment area when operating all assets as part of a wider system
- to identify technical enhancements needed to operate individual assets as part of a wider system
- to assess the business case for providing flexibility services via this systemic method of operating assets within a waste water catchment area
- to support dissemination of any learning to water utilities, as well as other networks, to encourage deployment of this technology across GB if the project demonstrates technical and commercial feasibility

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

n/a

Success Criteria

The outcome would be insight proving (or disproving) the technical and commercial feasibility of the concept and sharing learnings across the industry, outlining barriers to scaling.

Project Partners and External Funding

United Utilities, are contributing £59,827.
Open Energi

Potential for New Learning

This would represent the first time that ESO has collaborated directly on an innovation project with a partner from the water sector. It

would demonstrate whether there is potential to unlock additional demand-side flexibility from across GB and how this could be achieved. The systemic modelling of assets within a waste water catchment area to provide flexibility to the System Operator has never been explored within GB.

Scale of Project

This project would focus on a single waste water catchment within GB. It will last for 18 months and will not deploy new equipment on a GB network at either transmission or distribution scale.

Technology Readiness at Start

TRL3 Proof of Concept

Technology Readiness at End

TRL4 Bench Scale Research

Geographical Area

The learning from this project will be relevant across GB.

Revenue Allowed for the RIIO Settlement

Not applicable.

Indicative Total NIA Project Expenditure

The total indicative NIA expenditure for this project is £225,000

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)

A key priority of the Power Responsive programme is to grow participation in demand side response (DSR). The water sector has significant untapped potential to provide DSR (estimated total flexibility of between 370MW1 and 466MW2). Some of this potential could be realised through controlling wastewater catchments as a system, rather than as discrete assets or sites. Indeed, many smaller assets located in the outer reaches of the network are not cost beneficial in their own terms, but if considered as part of a wider network, and controlled in a way to enhance total system flexibility, the business case for DSR may improve, on a total catchment basis.

This project will demonstrate, for a single wastewater catchment, the benefit of operating holistically in terms of flexibility. The additional GB-wide flexibility that this could unlock is estimated at 63 – 93 MW, a significant amount of additional liquidity in flexibility markets available for ESO and DSOs.

1 – Open Energi White Paper – Water treatment industry March 16
2 – UK Water Industry Research paper on Demand Side Energy Management June 2015

Please provide a calculation of the expected benefits the Solution

This is not required for research projects.

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

The learnings from this project could potentially be applied to all waste water catchment areas in GB, which are present across all network licensee regions.

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

The estimated capital expenditure of accessing this additional benefit is between £13m and £44m. This is based on the additional MW flexibility estimated from a single wastewater catchment (Preston) and extrapolated to a UK wide figure using industry published data on population served by the largest wastewater treatment works in the UK. This project is intended to firm up these numbers and provide a detailed industry specific case study to Power Responsive to enable this additional flexibility to be unlocked.

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 learning could assist all other network licensees, particularly Distribution Network Operators, in identifying how use of this resource could be of benefit to their networks.

Or, please describe what specific challenge identified in the Network Licensee's innovation strategy that is being addressed by the project (RIIO-1 only)

This project addresses the following challenges within the NGSO Innovation Strategy:

- Unlocking flexibility
- Creating markets for the future

☑ 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.

This analysis has not been carried out before in GB and this represents the first collaboration between a network licensee and a water utility to explore this topic.

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

This project is the first time that the potential for demand-side flexibility from systemic management of assets within a waste water catchment area has been investigated in detail in GB. It has not been tried before as there has been limited incentive for water utilities to explore this application of technology.

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

Supporting individual projects to remove barriers to deployment of technologies to unlock flexibility on the demand side is not within the System Operator's core activities. While Power Responsive exists to foster collaboration among diverse sets of stakeholders, it does not extend to project-level activities to address specific barriers.

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

1. The use of NIA funding will help to overcome technical and operational risks in exploring the potential for water utilities to provide system services through advanced management of assets within waste water catchments. There are currently insufficient incentives for water utilities to explore the unproven potential and make the necessary investment. 2. It is in the interest of the System Operator to encourage national-scale deployment of this approach if proven to be successful, however collecting data in the appropriate level of detail and disseminating it across GB would place an additional burden on any water sector partner, which is not incentivized to carry out this activity for the benefit of other water utilities.

This project has been approved by a senior member of staff

☑ Yes