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

Oct 2024

Project Reference Number

NIA2_NESO090

Project Registration

Project Title

Strategic Case for Tidal Range

Project Reference Number

NIA2_NESO090

Project Licensee(s)

National Energy System Operator

Project Start

September 2024

Project Duration

0 years and 9 months

Nominated Project Contact(s)

innovation@nationalenergyso.com

Project Budget

£350,000.00

Summary

This project aims to establish a strong and holistic knowledge base around the potential development, and impacts of, tidal range energy in Great Britain, with a priority placed on grid operability. This work is intended to serve as a Strategic Outline Case (SOC), focussing on the strategic and economic case for tidal range energy. We also propose to conduct high-level assessments for the Commercial, Financial, and Management cases, with the objective of offering a potential solution related to tidal range energy.

Nominated Contact Email Address(es)

box.so.innovation@nationalgrid.com

Problem Being Solved

Previous studies on GB tidal range have focussed on energy generation potential, and Levelised Cost of Energy (LCOE). There is a need for a holistic assessment of tidal range energy potential, specifically including grid operability considerations.

Method(s)

This project will be delivered through three main work packages, set out in detail below. To support the development of these work packages, a workshop will be delivered at the outset of the project to agree on the number (between 5 and 15) and locations (on the GB energy system) of potential tidal range project sites to be considered.

Work Package 1: Strategic Case

The strategic case work package will conduct a thorough analysis of the strategic context surrounding tidal energy in the UK, and the

potential role of tidal range generation in the GB energy mix. This will explore the public policy landscape, provide an overview of current proposals for tidal range energy in the UK, give a qualitative assessment of the potential benefits of tidal range deployment, and analyse the key risks deployment may present. PLEXOS modelling of agreed will also be completed, focussed on the agreed study sites to assess the potential impacts tidal range projects may have on grid operability (including constraints), and investigate the likely effects on wholesale electricity prices.

Work Package 2: Economic Case

Conduct a thorough analysis of the economic case, including undertaking a high-level cost-benefit assessment of the socio-economic impact of building tidal range projects at the agreed study locations. This will include building a project profile for each site, using a bespoke modelling tool, to consider high-level engineering concept design, energy generation modelling and a capital cost breakdown. This analysis will allow a thorough cost-benefit analysis to be undertaken, assessing tidal range projects against parameters such as economic value of energy production, reduction of greenhouse gas emissions (compared to conventional energy sources), associated socio-economic impacts, and Grid connection saving costs. Ultimately, this workstream will provide a calculation of Net Present Value in accordance with Green Book Guidance, and an assessment of the Levelised Cost of Energy (LCOE) associated with Tidal Range deployment on the GB system.

Work Package 3: Commercial, Financial and Management Cases

This work package will provide high-level narrative commentaries on the commercial, financial and management cases for tidal range deployment in GB. The commercial case will explore the impacts of potential government support mechanisms, referencing existing mechanisms for other generation types and noting that government supported route to market is currently in place for tidal range. The financial case will go in to more detail on how different interventions may impact government (and taxpayers) and consumer finances. Finally, the management case will set out a high level view of potential future roles and responsibilities key stakeholders (e.g. NESO), next steps and stakeholder engagement.

In line with the ENA's ENIP document, the risk rating is scored Low.
TRL Steps = 1 (2 TRL steps)
Cost = 1 (£302,300k)
Suppliers = 1 (1 supplier)
Data Assumptions = 2
Total = 5 (Low)

Scope

Over a period of 4 months the main emphasis of the project is to establish a strong case for the development of tidal range energy in the GB. It will involve carrying out high-level assessments for Commercial, Financial and Management cases, with the objective of offering a potential solution related to tidal range energy. Potential benefits of this project will be determined by the insights gathered, however could include:

- Establishing a more holistic approach for tidal range energy potential in decarbonising the grid by 2035 or sooner.
- Allowing the NESO to assess potential grid constraints from assumed tidal projects.
- Allow the NESO to establish the potential for further tidal range schemes, allowing more informed dialogue with potential developers or government-led proposals.
- Accelerating zero-carbon transition

Objective(s)

- Offer a potential solution related to the deployment of tidal range energy facilities in GB which covers a holistic view of strategic, socio-economic and operability cases.
- Investigate the high-level feasibility of operating tidal range energy facilities on the GB energy and their potential contribution to grid constraints and other system services.
- Investigation into how tidal range facilities can be spatially planned to achieve "optimal" commercial and system operability benefits, also contributing to accelerating the achievement of a zero-carbon electricity system, at a competitive whole energy system cost.
- Remain technology neutral in the post assessment phase to ensure that viability of other technologies and optimal use of seabed deployment are considered against the outputs of the project.

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

NESO does not have a direct connection to consumers, and therefore is unable to differentiate the impact on consumers and those in vulnerable situations.

Success Criteria

The success of this project will be determined if the following questions can be answered:

- What is the role of tidal range energy facilities and what will be the contribution be to decarbonising the GB electricity system?
- What are the likely impacts on the wider energy system, including any effect on electricity system balancing costs, wholesale prices, transmission costs, impact on CO2, system inertia and security of supply from the assumed tidal projects assessed in the innovation project?
- How can the right investment signals be provided to tidal range facility developers and government policy makers given strategic, locational, and operational considerations?

The answers to the questions will allow NESO to be able to better understand the fundamentals of tidal range energy facilities and their role in the GB electricity system.

Project Partners and External Funding

Arup will be the sole project partner who will be carrying out the work and no external funding will be required.

Potential for New Learning

While other projects have looked at the value of tidal range energy facilities in a specific location or in other ways such as the LCoE against other offshore renewable technologies, this project will look at the optimal technical, system operability and commercial case for the deployment of tidal range energy facilities in GB, and not been investigated in detail before.
With constraints rising sharply to 2030 and beyond, understanding the potential for this technology to reduce costs for consumers is vital if the NESO is to encourage the optimal placement and operation of this technology.
All the above will be published in a final report on the ENAs Smarter Networks Portal. Dissemination of learnings will be pushed through engagement with relevant internal teams/subject matter experts, and external stakeholders

Scale of Project

The project spans four months with one project partner. The project consists of desktop-based research, workshops and development work with the relevant teams across the NESO.

Technology Readiness at Start

TRL2 Invention and Research

Technology Readiness at End

TRL3 Proof of Concept

Geographical Area

The project will be based upon the GB NESO area of operation.

Revenue Allowed for the RIIO Settlement

None

Indicative Total NIA Project Expenditure

£350,000

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:

This project will help to establish a more holistic approach for tidal range energy potential in decarbonising the grid by 2035 or sooner. This project will assess the viability of tidal range energy as a resource for GB with a focus on the proposed strategic and economic cases, and high-level assessments of the commercial, financial and management cases for GB tidal lagoons. The strategic case will be supplemented with PLEXOS modelling to assess the implications on the wider electricity system, including, the analysis on future electricity demand and supply evolution, and estimated forecast wholesale electricity price with assumed tidal projects.

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)

n/a

Please provide a calculation of the expected benefits the Solution

Not required as this is a research project

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

This research project will examine the potential for tidal range energy facilities to optimally contribute to the wider electricity system. The research project will deliver a PLEXOS model output presenting data on the potential for tidal range energy facilities potential across the GB energy network – this will help to identify the number of sites/areas suitable for tidal range energy facilities aimed at optimising deployment of the best suited generation technology mix. The results will be shared with industry and other networks to feed into their own planning.

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

The project will research costs, benefits, and challenges that are associated with the deployment of tidal range energy facilities onto the GB electricity system. The work on the commercial model in this project will help facilitate future estimates of the cost to roll out large scale tidal range energy facilities, and along with other NESO work will help identify the potential scale of capacity which is cost effective. This information will be disseminated with industry and other networks to feed into their own planning and would likely be hosted by the ENA portal and NESO website. We cannot provide an estimate for costs to roll out the outputs at this stage.

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

Learnings will allow for electricity transmission and distribution licensees to understand locations where there is the potential for tidal range energy facilities to be built to alleviate constraints on the electricity transmission network. The findings could feed into the whole system network plan assumptions where high-level transmission investments and needs are considered.

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.

There are no projects currently completed or registered on the Energy Networks Association portal which specifically aim to establish a strong case for the development of tidal range energy in the UK, where the priority is placed on grid operability. However, there are a number of relevant GB tidal range energy projects, commissions, and studies that this project would seek to build on, such as:

Industry

Welsh Government Tidal Lagoon Research Challenge

Tidal Lagoon research challenge programme launched to fund research projects that will help address the barriers that have so far prevented the development of the tidal lagoon technology and give more insight into the benefits it could specifically bring to Wales. Winners of the challenge were announced in March 2024 and include:

Environment category: Swansea University, in partnership with Fish Guidance Systems Ltd, Natural England, Batri Ltd & DST Innovations Ltd with the Enabling tidal lagoon consents: providing fish migration data and developing and validating an acoustic fish deterrence system for twaite shad project. The project will use fish tagging and monitoring to test the effectiveness of acoustic fish deterrence (AFD) as a mitigation measure for tidal range deployment.

Engineering and Technical category: Offshore Renewable Energy Catapult, in partnership with Cardiff University, Intertek and Western Gateway, with the FLOMax Flexible Lagoon Operation for Maximal Value project. The project will use modelling to quantify the value of developing tidal range power.

Socio-economic and Finance category: Cardiff University, in partnership with Western Gateway and British Hydropower Association Ltd with the Tidal Lagoon Schemes: Ownership, Equity and Finance project. The project will consider how different ownership and development/financing models for tidal lagoons could have positive impacts on the Welsh economy.
This programme focusses on tidal lagoon technologies that could be deployed in Welsh waters. The innovation project would add to this project by providing an additional objective view of socio-economic consideration, as well as technical modelling of the operating behaviour of a plant, with wider electricity system benefits in mind.

Severn Estuary Commission

The commission will look specifically at the Severn Estuary and bring together a diverse group of experts from scientific, engineering, environmental backgrounds, to ensure that the correct level of expertise and independence can explore whether using the Severn Estuary to create sustainable power is attainable and viable. The areas for further research by the commission will be on the following:

contribution to grid stability and other energy system benefits (for example working with green hydrogen production facilities)
understanding, through whole system analysis, marginal cost of tidal power over its lifetime and potential benefits to future generations
developing a model application for using innovative forms of funding and financing for large tidal power projects, such as Regulated Asset Base (RAB) financing or other alternatives
taking a more nature centric approach to project evolution
understanding the potential socio-economic effects from the development of tidal power, including potential supply chain benefits but also attitudes and needs to inform better policy support.
understanding non-technical barriers in the development of tidal power
development of low cost/high impact support mechanisms to facilitate tidal power development.
reviewing “stranded asset” and “end-of-life” decommissioning options
developing a greater understanding of environmental challenges and potential solutions.

The commission focusses on tidal range technologies that could be deployed in the Severn Estuary area. The innovation project would add to this project by providing an additional objective view of the contribution to grid stability and other energy system benefits in other areas of GB.

British Hydropower Association: Tidal Range Levelised Cost of Energy Study

The British Hydropower Association published a study on Levelised Cost of Energy for Tidal Range in February 2024. The purpose of this study was to analyse how tidal range generation could best contribute to the renewable and low-carbon generation mix to meet the UK’s net zero objectives by 2035 and 2050. The prime objective was to determine the Levelised Cost of Energy (LCoE) for tidal range generation for a range of tidal range sites across the UK and compare these with the LCoE of other renewable or low-carbon generation sources. The report included a small section on wider considerations beyond the LCoE. The report details the additional benefits of tidal range, calling out the “unique advantages relative to other renewables in terms of its high levels of predictability and operational capability, whilst also providing wider benefits such as coastal protection and habitat mitigation, particularly against sea level rise”. The study was conducted by Jacobs U.K. Limited.
The innovation project could support the outputs of the study on the points raised around the financial modelling scenarios by demonstrating the actual system benefits of deploying large scale tidal range projects in GB waters.

NESO

Future Energy Scenarios 2024

The NESO Pathways to Net Zero represent different, credible ways to decarbonise the energy system in line with the 2050 target. The Future Energy scenarios publication considers the potential deployment of tidal technologies and a key takeaway from the FES 2024 report is that tidal range is a well-established technology that can be deployed at scale but requires additional government support. Tidal range is, therefore, deployed at large scale during the early 2040s in the FES pathways.
This complements the innovation project as it helps provide context in that tidal technologies could be part of a credible way to decarbonise the energy system. The FES report does not go into detail about how tidal range energy facilities would operate with the GB electricity system and therefore no duplication will occur.

If applicable, justify why you are undertaking a Project similar to those being carried out by any other Network Licensees.

This innovation project will conduct an independent review of the deployment case of tidal range across the GB and will not be focussing on a particular locational area as is completed by the above commissions. The outputs will complement other industry work programmes but will not duplicate work. The outputs will allow the NESO, the Crown Estate, other network operators and policy makers to understand potential system impacts (benefits and challenges) from assumed tidal projects and allowing the NESO to engage in more informed dialogue with potential developers or government-led proposals.

Additional Governance And Document Upload

Please identify why the project is innovative and has not been tried before

Tidal technology is well developed and not in itself innovative, but its deployment in GB waters is limited to c.10MW of tidal steam. Using a business case will allow the NESO to deliver a holistic view of tidal range energy potential, with a focus on grid operability considerations.

Relevant Foreground IPR

The following foreground IPR is expected to be generated in the course of the project:

- An overall report to include dedicated sections on the outcomes of each of the referenced work packages; strategic, economic, commercial, financial and management.
- Excel-based workbook that will summarise the key inputs and outputs for each of the work packages outlined (including dashboard).
- Internal workshops and teach-ins will be organised to provide training and a demonstration of how the outputs from the project could be incorporated into existing PLEXOS modelling processes.

Data Access Details

Data for this project and all other projects funded under the Network Innovation Allowance (NIA), Network Innovation Competition (NIC) or the new Strategic Innovation Fund (SIF) can be found or requested in a number of ways:

- A request for information via the Smarter Networks Portal at https://smarter.energynetworks.org, to contact select a project and click 'Contact Lead Network'. NESO already publishes much of the data arising from our innovation projects here so you may wish to check this website before making an application.
- Via our Innovation website at Innovation | National Energy System Operator (neso.energy)
- Via our managed mailbox innovation@nationalenergyso.com

Details on the terms on which such data will be made available by NESO can be found in our publicly available "Data sharing policy relating to NIC/NIA projects" at 80797503.1 (neso.energy)

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

As this project will be assessing methods not previously demonstrated in the GB electricity system operation environment with high levels of uncertainty and risk, this would not fall into business as usual activities. It is also not clear how large-scale tidal projects would interact with the electricity system and what the scale of the market would be for tidal range energy facilities to provide services to the NESO. We are not aware of a GB approach being considered elsewhere and there are many unknowns due to the large-scale tidal sector in the UK being in very early stages of development. Ultimately the project could prove it is too costly or complex to implement and there are better suited alternatives.

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

Innovation funding is more suitable for exploring the implication of GB Tidal Range projects on system operability before moving into the NESO's business as usual activities. It is not yet clear to what extent the viability of the market for tidal range energy facilities will be and there are many unknowns due to the Tidal Range sector in the UK being in very early stages of development. The project could provide useful information to policy makers as well as the NESO in understanding the role of the technology.

This project has been approved by a senior member of staff

☑ Yes