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

Aug 2024

Project Reference Number

NIA_WWU_02_63

Project Registration

Project Title

OptiFLOW

Project Reference Number

NIA_WWU_02_63

Project Licensee(s)

Wales & West Utilities

Project Start

September 2024

Project Duration

0 years and 7 months

Nominated Project Contact(s)

Henry James

Project Budget

£171,211.00

Summary

The Climate Change Committee predicts we'll need at least 100GW of offshore wind by 2050 to meet our Net Zero targets and the ambition is that 1GW will come from Floating Offshore Wind (FLOW). The integration of green hydrogen production and FLOW requires significant investment; there is a need to truly articulate both the financial and wider benefits.

In complement to the South Wales Industrial Cluster (SWIC), HyLine Cymru, and previous work under the Milford Haven Energy Kingdom programme, we are now preparing for the delivery of a package of work under the newly formed, Launchpad-funded Milford Haven Hydrogen Kingdom (MHHK) programme.

OptiFLOW will answer the crucial question of how it is best to connect offshore hydrogen production to the onshore HyLine pipeline to fuel industrial processes in the SWIC region. OptiFLOW will investigate the options to bring hydrogen onshore from multiple assets cost effectively, whilst bringing wider economic benefits to the UK and the region.

Preceding Projects

NIA_WWU_2_01 - SWIC Hydrogen Supply Pipeline Infrastructure

NIA_WWU_2_03 - SWIC Market-Accelerating Hydrogen Distribution and Storage

NIA_WWU_2_07 - SWIC: Assessment of potential hydrogen demand in 2030 - 2050

NIA_WWU_2_08 - SWIC - Hydrogen Peaking Plant Feasibility Study

Third Party Collaborators

Arup

Nominated Contact Email Address(es)

innovation@wwutilities.co.uk

Problem Being Solved

The UK has committed to a target of 10GW of hydrogen production by 2030, with at least 5GW coming from electrolytic hydrogen sources.

The Climate Change Committee predicts we'll need at least 100GW of offshore wind by 2050 to meet our Net Zero targets and the ambition is that 1GW will come from Floating Offshore Wind (FLOW). FLOW is also expected to contribute to the creation of more than 29,000 UK jobs and deliver an anticipated £43.6bn in UK gross value add (GVA) by 2050 against a 100GW offshore wind deployment scenario.

Celtic Sea FLOW represents a huge opportunity to establish the area amongst the best in the world for offshore wind. However, intermittency as well as curtailment and grid constraints are challenges. Green hydrogen production represents a potential solution that could play a significant role in energy storage, future transportation, and industrial processes in the nearby South Wales Industrial Cluster (SWIC).

The integration of green hydrogen production and FLOW requires significant investment and therefore there is a need to truly articulate both the financial and wider benefits. This includes how the hydrogen is transported in pipelines to shore and connected to the local gas distribution network. For the Celtic Sea FLOW, connecting the to the proposed WWU HyLine pipeline across South Wales is vital to support industry in the SWIC.

Method(s)

FLOW projects are subject to known challenges surrounding intermittency and curtailment, however, more recently challenges with onshore electricity network constraints have increasingly become a concern. Offshore hydrogen production can help to overcome these. Piping hydrogen to shore could result in lower transmission losses, scalability with the installed infrastructure, avoidance of the requirement to meet grid specifications and substation requirements.

In complement to the South Wales Industrial Cluster (SWIC), HyLine Cymru, and previous work under the Milford Haven Energy Kingdom programme, we are now preparing for the delivery of a package of work under the newly formed, Launchpad-funded Milford Haven Hydrogen Kingdom (MHHK) programme.

OptiFLOW will answer the crucial question of how it is best to connect offshore hydrogen production to the onshore HyLine pipeline to fuel industrial processes in the SWIC region. OptiFLOW will investigate the options to bring hydrogen onshore from multiple assets cost effectively, whilst bringing wider economic benefits to the UK and the region.

The work will consider how the current technical status quo for network entry could be challenged, and answer the question 'What is the most cost-effective means to maximise the number of production assets connected to a regional onshore export pipeline, for the purpose of providing hydrogen producers with a route to market whilst providing WWU's downstream customers with a flexible and resilient source of hydrogen?' It will also seek to provide credible industrial research-based evidence about the cost benefit to the demand-side consumer and savings that could result from green hydrogen generating flow projects in the Celtic Sea.

Measurement Quality Statement and Data Quality Statement

Technoeconomic modelling

For all the modelling work that Arup conducts, including the spatial mapping and technoeconomic modelling included in this proposal, all the data inputs and outputs are subject to internal quality assurance.

We seek datasets which are robust and relevant to facilitate high-quality modelling and planning and use referenceable standards to compare our results.

We will also perform a sensitivity analysis on the data we use, to check what is needed in different scenarios to check the results.

The FAST modelling standard is a set of rules providing guidance on the structure and design of efficient spreadsheets for modelling. We will comply with this standard making our models Flexible, Appropriate, Structured and Transparent throughout this project.

Data handling

Established roles of data owner, steward and custodian enable us to initiate the requests, log incoming data and inform users of the status of the data throughout its lifecycle. One option might be to use a data catalogue, which is a secure online tool with access controlled via Microsoft Azure's Multi-Factor Authentication, which we can provide stakeholders access to throughout the project as required. At project close, we will provide a copy of the data catalogue including all relevant data sources, data tables and files we have used in the analysis for your project (excluding any proprietary information and background IP (such as our modelling tool ESOP)).

Data transformation

We will document the transformation processes used, via workflow diagrams for all datasets. We will work with you to understand if there are existing data standards and formats to align with in addition to following any government standards. Where needed, we will create and adopt a project-wide set of data management standards, which we will apply throughout our data transformations. We propose to develop project-specific data standards that cover elements such as data naming convention, taxonomy, metadata, coordinate systems, and versioning methods.

Data governance

For the project, we will set up data governance to manage the data through its lifecycle. Data governance roles (including data stewards, owners and custodians) have different levels of responsibility for the data. This enables us to provide an appropriate audit trail of data management so that we can demonstrate the evidence for the recommendations produced are sound. This will include records of changes to data, and the ability to track where, when and how we received the data, what has been done to the data and where. We will tag our data with its metadata, to allow us to track the licensing, copyright and usage rights for the dataset, how long we can keep the data for and how we can use the data.

The project is rated low in the common assessment framework detailed in the ENIP document after assessing the total project value, the progression through the TRL levels, the number of project delivery partners and the high level of data assumptions. No additional peer review is required for this project.

Scope

Definition of supply scenarios (WP1 Task 1)

Using the data for the variability in hydrogen production from Celtic Sea FLOW, Low/Medium/High supply scenarios will be agreed with and tested with stakeholders. These scenarios will serve as a key input for the techno-economic analysis of connecting the hydrogen producers to market and ensuring resilience of supply to WWU's customers.

The design will consider the phasing of additional entry points to produce the most economical design.

Determine solutions for supply and demand optimisation (WP1 Task 2)

Based on the defined supply scenarios ARUP will conduct a multi-criteria assessment (MCA) to determine the most cost-effective solutions to manage production variability and resilience of supply, achieving maximum value for the hydrogen producers in the network.

Baseline (single network entry) pre-FEED and AACE Class 5 cost estimation (WP1 Task 3)

The preliminary design deliverables will be produced by process, process safety, civil, mechanical, pipeline and electrical engineers contributing to the project. The infrastructure will include:

- Hydrogen reception facility at RWE Pembroke Net Zero Centre, including pig receiver from ERM DolpHyn launcher.
- Pipeline from site boundary to HyLine injection point (maximum distance 200m)
- Quality and pressure measurement control, filtration and compression systems
- Fiscal metering package
- Process safety equipment and isolation
- Supply and demand optimisation including potential storage facility (outcome of Supply & Demand Balancing)

Review pre-FEED and cost for multi-point network entry (WP1 Task 3)

The deliverables produced in the baseline design will be developed and modified for multi-point network entry, including a review of the outputs of the HAZID study. The additional entry points will be located at two other locations along the HyLine pipeline, giving a total of three entry points being considered in the project, which will serve as a basis for the collaborative development of a control interface that provides the best solution to the hydrogen producers.

Evaluate options (WP1 Task 4)

Arup will develop the initial proposed criteria (cost, engineering design and stakeholder engagement), and agree additional criteria to assess concept options against. A multi-criteria RAG analysis will be carried out of the options identified in previous stages, using agreed criteria.

This will allow comparison and identification of the preferred option, allowing WWU to select the concept that will be used for subsequent design stages through the comprehensive understanding of each concept provided.

Literature Review (WP2 Task 1)

Arup will carry out an initial literature review to develop case studies of similar energy infrastructure projects and identify the economic impacts and scale measured. This is an important starting point for understanding the wider benefits of onshoring of green hydrogen, including understanding alternative methodologies and benchmarking results from the economic analysis.

The literature review will help to inform scenarios. For example:

- Based on published reports and information on the project, we will establish a base case for the deployment of green hydrogen infrastructure. Published plans, project information, national and regional policy information would be collected and reviewed.
- Another scenario could reflect heavy industry receiving sufficient investment to decarbonise, maintaining a comparative advantage and market share.

Gross Value Added (GVA) analysis (WP2 Task 1)

ARUP will assess the potential GVA (labour-led) for FLOW, green hydrogen and onshore network entry facilities, as well as any overlaps for a combined project such as OptiFLOW, by estimating the number of direct, indirect and induced jobs that will be generated by each option, as set out below:

- Direct - employment directly generated through the construction and/or day-to-day operation
- Indirect - employment created and/or sustained in suppliers. These jobs represent the cumulative effect through the supply chain as initial suppliers make purchases from their suppliers and so on.
- Induced – Employment supported by the wages and salaries of workers employed both directly and indirectly by suppliers.

This will be used to will be used to assess and compare the different options for identification of the best value proposition for network entry of hydrogen from multiple assets using HyLine as a case study, with learnings being applicable to any similar hydrogen pipeline.

Report (WP2, Task 3)

Review of the pre-FEED outputs will be conducted throughout the project. ARUP will deliver one draft report on economic impact for review. Upon issue of the draft pre-FEED outputs, a workshop to share the outputs will be held, to give WWU a thorough understanding of the work completed.

A final technical report including recommendations, as well as annexes (supporting assumptions, calculations and data as annex) will be produced, as well as a single graphically designed public executive summary report for publication.

Objective(s)

To explore the optimisation of green hydrogen production sources as a result of the initial 4.5GW of Celtic Sea leasing for Floating Offshore Wind (FLOW).

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

An assessment of distributional impacts (technical, financial and wellbeing related) for this project has been carried out using a bespoke assessment tool, which assesses the project as having a positive, negative or neutral effect on consumers in vulnerable situations. To help inform the assessment, this tool considers the categories of consumers identified in the Priority Services Register.

This project has been assessed as having a neutral impact on customers in vulnerable situations.

Success Criteria

To provide credible industrial research-based evidence about the cost benefit to the demand-side consumer and savings that could result from green hydrogen generating FLOW projects in the Celtic Sea.

Project Partners and External Funding

The project partner is ARUP. The total external cost of this project is £203,408.00. This project has external funding from Innovate UK, who

will contribute £75,000, the remaining contribution will come from NIA funding.

Potential for New Learning

This project will seek to provide credible industrial research-based evidence on the cost benefit to the demand-side consumer and savings that could result from green hydrogen generating FLOW projects in the Celtic Sea. Project learnings will be disseminated via the smarter networks portal and through in person events throughout the year.

Scale of Project

This is a desktop study, which is the appropriate level of scale for this project. The project will inform future work, the scope of which is unknown until this project is complete.

Technology Readiness at Start

TRL2 Invention and Research

Technology Readiness at End

TRL3 Proof of Concept

Geographical Area

The project itself is a desktop study, so will take place at ARUP offices. The project is using Celtic Sea FLOW as a basis of the study but learnings will be applicable to other areas.

Revenue Allowed for the RIIO Settlement

N/A

Indicative Total NIA Project Expenditure

External Cost: £128,408.00 Internal Cost: £42,803 Total Cost: £171,211 The 10% minimum contribution will be met by the IUK funding

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 seek to provide credible industrial research-based evidence about the cost benefit to the demand-side consumer and savings that could result from green hydrogen generating FLOW projects in the Celtic Sea.

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

This project will calculate the economic direct and indirect benefits. However, it is believed that FLOW will have a positive impact on the economy and job creation by supporting delivery of net zero targets.

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

The project is using Celtic Sea FLOW as a basis of the study but learnings will be applicable to other areas.

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

This is unknown 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

The project is using Celtic Sea FLOW as a basis of the study but learnings will be applicable to other areas.

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.

All networks have been made aware of this project and no concerns of duplication have been raised.

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

Celtic Sea FLOW represents a huge opportunity to establish the area amongst the best in the world for offshore wind. However, intermittency as well as curtailment and grid constraints are challenges. Green hydrogen production represents a potential solution that could play a significant role in energy storage, future transportation, and industrial processes in the nearby South Wales Industrial Cluster (SWIC).

The integration of green hydrogen production and FLOW requires significant investment and therefore there is a need to truly articulate both the financial and wider benefits. This includes how the hydrogen is transported in pipelines to shore and connected to the local gas distribution network.

Relevant Foreground IPR

The foreground IP generated will be the final report.

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'. WWU 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 here
- Via our managed mailbox innovation@wwutilities.co.uk
- Details on the terms on which such data will be made available by Wales & West Utilities can be found in our publicly available "Data sharing policy relating to NIC/NIA projects" here

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

Ofgem published its final determinations which included a variety of provisions to enable necessary development work on Net Zero projects but also to ensure vulnerable customers are thought about in any decision making. This project has the potential to facilitate the energy system transition, and is therefore eligible to use the NIA funding mechanism.

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

The project would only be undertaken with support from NIA funding, it is in the interests of gas customers, the regulator and the UK government and the realisation of any benefits are outside the control of the gas networks. There is no allowance in BAU business plans for this type of work and there is a risk that if hydrogen is not accepted as a means for transport in 2050 that this work is no longer valid.

This project has been approved by a senior member of staff

☑ Yes