SIF Round 3 Project Registration

Date of Submission

Mar 2024

Project Reference Number

10098733

Initial Project Details

Project Title

HyNTS Maritime

Project Contact

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Challenge Area

Whole system network planning and utilisation to facilitate faster and cheaper network transformation and asset rollout

Strategy Theme

Net zero and the energy system transition

Lead Sector

Gas Transmission

Project Start Date

01/03/2024

Project Duration (Months)

3

Lead Funding Licensee

NGT - National Gas Transmission PLC

Funding Mechanism

SIF Discovery - Round 3

Collaborating Networks

National Gas Transmission PLC

Technology Areas

Carbon Emission Reduction Technologies

Hydrogen

Gas Transmission Networks

Project Summary

This project will determine how the National Transmission System (NTS) could support UK maritime ports in providing links to large scale hydrogen infrastructure across the UK. The project will consider export and import of hydrogen through UK ports, in addition to potential maritime infrastructure decarbonisation. We will be looking to consider the technical requirements for links between ammonia cracking facilities for imported hydrogen to enable access to users across the UK. Whilst also considering how hydrogen can be moved from UK production facilities to ports for use either directly, or for Export via hydrogen carriers such as ammonia/LOHCs.

Add Third Party Collaborator(s)

H2SITE

Gemserv

University of Warwick

WSP UK Ltd

IKIGAI Capital Limited

Port of London Authority

Carbon280 Pty Ltd

Project Budget

£165,202.00

SIF Funding

£150,000.00

Project Approaches and Desired Outcomes

Problem statement

Whilst the UK has a long-term ambition to be an energy exporter, there are many countries with excess solar and wind energy for their requirements. Accessing this energy in the transition could help us accelerate to Net Zero and build our own supply chains more quickly. Maritime ports will be a hub for this incoming energy; in the same way that liquid natural gas is imported we could look to import and/or export ammonia, methanol or liquid organic hydrogen carriers.

This project looks at how this energy can be taken from ports and distributed to users across the UK. It will also consider the future opportunity to export energy via the same ports and support maritime fuel applications.

On July 7th 2023, International Maritime Organization announced their Green House Gas (GHG) Strategy, which represents a framework for Maritime with a future vision for international shipping, targets for emissions reduction and guiding principles for mid and long-term activities and their impacts.

There are 1.8m metric tons of freight movement across UK ports today and many maritime organizations such as Moller-Maersk are agreeing to decarbonize their entire fleet by 2040. For shipping, a hard to abate sub-sector of transport to decarbonise, rapid innovation, new sustainable fuel infrastructure and supplychain stakeholder engagement and collaboration are required to meet theseambitions targets.

Primary Challenge
Whole system planning for faster asset rollout; Supporting consumers to make cost effective decarbonisation choices co-ordinated with wider local area orregional plans. This opportunity will enable consumers to access the lowest cost decarbonisation options available.

Users
There are several stakeholders for this project including maritime transport applications, UK and global ports, connected gas networks and the wider global energy system. This project will determine the opportunity in terms of volumes both for import and export and identify any technical constraints to providing that energy to the end user.

Other Related Projects
NIA project (NIA_NGGT0200) looked into the opportunity of the NTS to support transport decarbonisation through which Aerospace and Maritime applications showed a need for access to green hydrogen which at present is not being sourced in the UK.
We have been supporting a project application for SA-PACT funding to consider the opportunity of bringing ammonia from South Africa to the UK as a source of Hydrogen. We will use learning with regards to volumes and approaches in this project.

Video Description

https://youtu.be/cS61iyaqCMc

Innovation justification

Innovative Aspects & State of the Art

Today liquid natural gas is transported across the globe to ports in the UK andtransitioned back into natural gas and injected into the UK gas networks. We believe that in the future this opportunity could be seen through the transportation of ammonia, ethanol or liquid organic hydrogen carriers (LOHCs); with their subsequent cracking prior to injection of hydrogen into the UK gas networks. Whilst cracking has been investigated, the scale, volumes and processes required for the future have not yet been fully understood and demonstrated. The production of ammonia or other LOHC's is an opportunity for the UK if excess hydrogen is produced. Consideration of the technologies and connections requiredbetween Ports and the UK Gas Networks is required. The ports of Rotterdam and Antwerp are on a similar journey to us and we are ensuring shared learning as we develop our understanding of this opportunity.

Beyond Incremental Innovation

Integration of energy systems at ports for the UK has not been undertaken and requires a novel approach for net zero energy sources that are unlikely to be located directly at Ports (Offshore wind etc...).

Readiness Levels
The Ammonia cracking technologies are in development (TRL4) and have been demonstrated at smaller scales, we will be benchmarking work from industrial processes today to ensure an optimised solution.

Integration of port systems with the UK transmission network has not been done and therefore we are at IRL1 & CRL1, we hope to achieve IRL/CRL7 by the end of Beta.
Size and Scale

We have brought together stakeholders from across the maritime industry both within the project team and through the advisory board. At the Discovery phase we have not included specific port partners as we will be determining the optimum location for demonstration with the ports through Discovery. This approach supports the innovation challenge of whole system planning for faster asset roleout as we will be developing an approach that can be copied across the UK.

BAU
The proposed innovation is novel with low readiness levels, therefore has risk associated with the delivery. Hydrogen projects are not currently possible to fund through BAU.

Counterfactuals
This project will consider the counterfactuals surrounding ammonia and other liquid hydrogen carriers use within the Maritime industry and their impact on the network to determine that the Beta demonstration of scaled cracking facilities is relevant for the UK consumer.

Impacts and benefits selection (not scored)

Financial - future reductions in the cost of operating the network

Financial - cost savings per annum on energy bills for consumers

Financial - cost savings per annum for users of network services

Environmental - carbon reduction – direct CO2 savings per annum

Environmental - carbon reduction – indirect CO2 savings per annum

Revenues - improved access to revenues for users of network services

Revenues - creation of new revenue streams

New to market – products

New to market – processes

New to market - services

Others that are not SIF specific

Impacts and benefits description

Financial

This project will support the reduction in cost for the consumer of future energy bills through providing access the global energy market, where other countries may have the ability to produce lower cost hydrogen through abundant solar etc. Further to this if the UK becomes a excess producer of hydrogen in the future, this energy could then be sold globally to provide financial benefit to the UK.

Alongside the opportunity for the energy system, this project could provide cost savings to the maritime industry in enabling them to access UK wide hydrogen production instead of relying on local production or imports.

This project will determine the potential volumes and costs associated to a range of options, prior to demonstration in Beta.

Environmental

This project supports carbon reduction both directly and indirectly. There are 1.8m metric tons of freight movement across UK ports today with an estimated 30.8TWh of energy demand predicted in 2050. Whilst electrification will support maritime decarbonisation, hydrogen and hydrogen derivatives will be vital to decarbonising this sector. Connecting our future offshore green hydrogenproduction supply to key ports across the UK is going to be key to enabling the volumes required without reliance on import.

This project will determine the carbon savings that could be supported by the UK network and production. Alongside considering the carbon savings to be seen from using imported hydrogen from other global producers.

Revenues

Export of hydrogen across the globe could be a key revenue for the UK. Although we are not yet considered a mass exporter, with the UK hydrogen industry growth and abundant wind and tidal energy sources this could change.

New to market

The technologies to be considered in this project for ammonia cracking are novel and require scaling for our application. This could be a new opportunity for the UK.

Others

We will be engaging with global ports and understanding their work and future scenarios, this could provide benefit back to the UK energy system and maritime industry. The ports of Antwerp and Rotterdam are key players in this space and have requested us to join their most recently funded activity to understand their approach. We are also engaged in the SA-PACT project to consider import of ammonia from South Africa to the UK as a source of Hydrogen.

Teams and resources

WSP have experience across the energy sector in consultancy projects and in particular in 2022 undertook a piece of work consider the opportunities for hydrogen in the Maritime sector. This will give us a good base of data and a stakeholder landscape to progress this project quickly through its deliverables. WSP is a globally recognized professional services firm providing strategic advisory, engineering and design services to clients in the transportation, infrastructure, environment, building, power, energy, water, and mining sectors. Their 68,000 trusted professionals are united by a shared goal: to create positive, long-lasting impacts on the communities we serve.

GemServ have been leading the Ammogen ammonia cracking demonstration at Tysley Energy Park and will support the project with key information from this project and their wider knowledge of energy transition technologies. GemServ have a deep understanding of emerging technologies, data management and market arrangements to support clients to design and deliver compliant and secure solutions within the myriad of market rules. Their team helps assure and understand performance, and they support their clients as they build confidence operating within these multifaceted arrangements.

H2Site are the SME owner of conversion systems for ammonia and other hydrogen carriers which will be scaled up for demonstration in the Beta phase. H2Site also have technologies for purification and deblending of hydrogen.

UK-HyRES are a hydrogen research hub in the UK and we are engaging their Alternative Liquid Fuels team to peer review our work and provide insight intoother projects across the globe.

Carbon280 provide an insight into alternative hydrogen carriers that could be considered such as their Hydrilyte(R) option.

Ikigai will join the project to provide customer requirements from the SA-PACT project and wider activities.

Port of London Authority will provide insight and links into the key ports in the UK and help us confirm our demonstration site.

The Discovery phase will be predominately desktop based with teams from each of the above suppliers engaged.

We have also engaged with the British Ports Association, Industrial Clusters, Solent Cluster, Free Port East and Global Ports projects regarding ammonia and ethanol. This will continue through Discovery to finalise the demonstration site andensure we

have robust customer requirements in the project.

We will be setting up an stakeholder advisory group to support the project team indelivering the proposed project outputs and enable us to further refine ourspecification during Alpha.

Project Plans and Milestones

Project management and delivery

During Discovery phase all partners will need to work in parallel to enable delivery of the outputs, in this we will manage the project through Agile mechanisms. As per previous projects we will hold weekly all partner sessions to manage activities and ensure progress through the project. Alongside this we will undertake detailed finance and risk reviews monthly with any key changes raised in weekly meetings as required.

The project will be managed around 5 work packages that have several deliverables, the PMB describes these in full:
1. Project Management - WSP & NGT
2. Business Case & Requirements Development - WSP, NGT & UK-HyRES
3. Ammonia and Hydrogen Carrier Investigation - WSP, Gemserv, H2Site & Carbon280
4. NTS Connection Design - WSP & NGT
5. Stakeholder Engagement, Strategy & Implementation - WSP, NGT, Ikigai & Port of London Authority

There are 4 key milestones across these work packages:
1. Project Kick Off - 01/04/2024
2. Mid Project Review - 01/05/2024
3. End of Technical Activity - 31/05/2024
4. Alpha Application - 30/06/2024

Links or dependencies
The key link and dependency will be with WP2 which will build the key requirements for the other phases to utilise in their concept design development and business case. The requirements will be built in the first month, alongside benchmarking and baseline data gathering across the other work packages. The second month will then be utilised to then use this data to progress thetechnologies and approach ready for us to build into the Alpha application in June 2024.

Risk management
Risks will be monitored throughout the project by National Gas and any changes raised through the weekly project meetings. At kick off, mid point and close a full risk review will be undertaken and any new risks added to the log.

Policy and regulatory risks
At present there are policy and regulatory risks associated to the deployment ofhydrogen across the UK. The latest National Infrastructure Commission reportregarding hydrogen infrastructure in the UK is very positive and reduces the risk to looking into projects associated to the NTS. Ports across the globe will be decarbonising with hydrogen/hydrogen carriers, this hydrogen source if we do not start to consider UK supply will come from other global producers.

Supply interruptions for consumers
There are no planned or potential supply interruptions to the current NTS consumers in Discovery or Alpha phases.

Key outputs and dissemination

Discovery Phase Deliverables
The Discovery Phase will give the project partners the opportunity to share knowledge and experience from prior work on hydrogen within maritime applications.

The key output for the project will be a concept design for the interface between UK ports and the UK gas networks with a view of volumes, scale and opportunities for demonstration at key ports in the UK. As per the PMB we are working through 5 work packages of which their key outputs are:
1. Project Management - SIF Alpha application
2. Business Case & Requirements - Maritime scenarios for Export and Import including energy use, Global benchmarking, Demonstration location determination and Business Case Development
3. Ammonia and Hydrogen Carrier Investigation - Conversion technologiesidentified for hydrogen to carrier and carrier to hydrogen, including determination of scale and cost required for the UK
4. NTS Connection Design - NTS Connection concept design

5. Stakeholder Engagement, Strategy & Implementation - Global energysystem engagement to provide robust outputs, implementation approach andreview of safety and competitiveness

Responsibilities
WSP will be responsible for bringing together all the partners outputs and combining them into a single output document.
1. National Gas will lead on the Alpha application, taking the outputs from theproject and determine the route to Beta required.
2. WSP will be responsible for the benchmarking, requirements and demonstrationplan, National Gas will be responsible for the business case and UK-HyRES willpeer review the outputs.
3. National Gas will be responsible for the concept connection design with thetechnical project partners.
4. WSP will be responsible for stakeholder engagement with Ikigai and Port ofLondon Authority, National Gas will be responsible for implementation, safety and competitiveness outputs.

National Gas will be responsible for ensuring deliverability and implementation post the Beta phase.

Dissemination of key outputs and lessons learned

National Gas will take a lead on ensuring the project outcomes are publicised via the Smart Networks Portal, Social Media and Discovery Show and Tell, with support from the project partners. Lessons learnt will be shared into other future or parallel projects to ensure successful delivery of future activities.

Competitive markets

Whilst we are working with specific partners in this project, the implementation of this across the UK will be subject to competitive tender. The outputs of the project will enable a standard design for connections between ports and gas networks which could be replicated across various networks and ports.

Commercials

Intellectual Property Rights (IPR) (not scored)

For SIF projects, each Project Partner shall own all Foreground IPR that it independently creates as part of the Project, or where it is created jointly then it shall be owned in shares that are in proportion to the work done in its creation.The exact allocation of Foreground IPR ownership will be determined during thecontractual negotiations with the Project Partners on the agreement for the project. On creation of Foreground IPR the creator of the IPR will notify the project partners to enable it to be recorded and ownership agreed in line with the contract terms.

Also if the party appoints a sub-contractor, the agreement with that sub-contractor should have similar IP provisions to those in this agreement and which at least achieve the same aims as the agreement regarding IP. Once the Project is completed, Relevant Background IPR will be licensed for use by the Project Partners in connection with another Project Partners' Foreground IPR solely to the extent necessary to use that Foreground IPR, upon terms to be agreed.

We intend to ensure each Project Partner will comply with Chapter 9 SIF Governance Document through the contractual terms governing the project. However, precisely how this is done will be subject to contractual negotiations withthe Project Partners on the agreement for the project.

Value for money

The project will cost £165,202, which is split between the project partners based on the level of activity in the alpha phase of the project. The project partners are contributing a total of £15,202 to the project, and we are therefore requesting funding of £150,000.

The costs are split as follows:
National Gas: £26,316 to provide the project reporting, approach to future phasesand demonstration, NTS business case and approach to connection the the NTS. National Gas are contributing £15,202 from private funds to the project costs.
GemServ: £34,680 to provide the hydrogen carrier techno-economic comparison to feed the other project activities.
WSP: £49,628 to provide stakeholder engagement, project management anddevelopment of the approach for hydrogen across UK ports.
H2Site: £29,982 to provide insight into hydrogen carrier cracking technologies and their scalability.
University of Warwick representing HyRES: £14,971 to provide peer review and benchmarking from across UK liquid carrier work.
Carbon 280: £5,000 to provide information on alternative carriers that are entering the market for the future.
Ikigai: £2,000 to provide customer insight from a potential hydrogen importer intothe UK.
Port of London Authority: £2,625 to provide customer insight from the UK ports in particular London whom have begun to consider options for decarbonisation.

The project provides value for money for the consumer in enabling an opportunity to access global sources of energy whilst also providing a future option to export energy. This first phase will enable a clear roadmap and vision for ports across the country and identify opportunities for demonstration. Feedback to date from ports is that they don't want to invest in the wrong solution, providing insight to these stakeholders will be a key part of this project. As we progress into Alpha and Beta we will demonstrate the options further improving confidence in the decarbonised UK maritime energy system.
There are no subcontractors in this phase of project we will however be engaging directly with several UK Ports. There is no additional funding from other innovation funds, we will however use learning from the InnovateUK Ammogen project and potentially visit their demonstrator.

There are no other business-as-usual (BAU) financial mechanisms to cover these costs as hydrogen activity is not covered in the RIIO-2 business plan, nor is it likely to be in RIIO-3. Aligning sectors across the UK is key to enabling Net Zero for UK consumers

Supporting documents

File Upload

HyNTS Maritime Show and Tell Slides.pdf - 1.0 MB
HyNTS Maritime Technical Report v2.pdf - 3.0 MB
SIF Round 3 Project Registration 2024-03-27 11_36 - 91.1 KB
HyNTS Maritime Application - Innovation Funding Service.pdf - 359.5 KB

Documents uploaded where applicable?

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