national gas transmission

SIF Round 3 Project Registration

Date of Submission

Jun 2024

Project Reference Number

10104053

Initial Project Details

Project Title

Look NorthH2

Project Contact

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Challenge Area

Novel technical, process and market approaches to deliver an equitable and secure net zero power system

Strategy Theme

Net zero and the energy system transition

Lead Sector

Gas Transmission

Other Related Sectors

Electricity Transmission

Project Start Date

01/03/2024

Project Duration (Months)

2

Lead Funding Licensee

National Grid Gas Transmission

Funding Mechanism

SIF Discovery - Round 3

Collaborating Networks

National Grid Electricity System Operator

Technology Areas

Hydrogen

Electricity Transmission Networks

Project Summary

Offshore Energy Hubs (OEH) integrate electricity/hydrogen production offshorebetween the UK and other European countries. OEHs could stimulate UK offshorewind rollout potential and support the development of a hydrogen economy. ManyEuropean TSOs are exploring this concept, but the UK is yet to fully consider this.

This project will explore potential benefits and associated costs of developingOEHs in the UK, developing scenarios that quantify benefits such as curtailmentreduction, grid losses reduction and infrastructure optimisation.

Future phases will explore what commercial models and market designs areneeded to integrate OEHs into the whole energy system and with Europe.

Add Third Party Collaborator(s)

Neptune E&P UK Limited

Guidehouse

Orsted

Project Budget

£143,329.00

SIF Funding

£128,329.00

Project Approaches and Desired Outcomes

Problem statement

The creation of Offshore Energy Hubs (OEH) could further stimulate thedeployment of UK offshore wind and support the development of a hydrogen economy.

It is yet uncertain:

What are the benefits and costs of developing Offshore Energy Hubs for the UKenergy transition and energy security.
What commercial models and market designs are needed to successfullyintegrate offshore energy hubs into the whole energy system.
What level of coordination would be required between the UK and otherEuropean countries on codes and regulations to enable the development ofcross-country Offshore Energy Hubs.
Look NorthH2 (https://www.youtube.com/watchv=sPZltsWnN_I&feature=youtu.be&themeRefresh=1) (https://youtu.be/sPZltsWnN_I) aims to address these across the three SIF phases:

In the Discovery phase, a detailed Cost-Benefit Analysis (CBA) will be carried outto test the costs and benefits of deploying cross-zonal Offshore Energy Hubsbetween the UK and EU member states, with a particular focus on the role theycan play in reducing electricity curtailment, optimising gas and electricityinfrastructure development, accelerating offshore wind deployment and improvingenergy security in the UK.

In Alpha and Beta phases, this project will explore how to enable and support thedeployment of cross-zonal Offshore Energy Hubs through optimal design ofcommercial and market frameworks.

Throughout all phases of this project, novel market approaches will be explored tosupport the development of Offshore Energy Hubs. These hubs can providesignificant offshore wind curtailment reduction, thanks to the opportunity for wind producers to have an alternative use for excess electricity in the form of Power-to-Hydrogen, and a potential opportunity to trade across bidding zones.

Offshore Energy Hubs present an opportunity to better coordinate cross-zonalelectricity and hydrogen systems offshore, to reduce the whole system cost ofintermittent renewable integration and improve the processes needed tooperate a heavily integrated onshore and offshore net-zero power system.

This project benefits future users:
Offshore wind developers: Creates new revenue opportunities to strengthentheir business case.

Electricity and hydrogen network operators: Provides clarity on commercialcodes and market mechanisms needed to integrate offshore power andhydrogen development into both grids.

Networks consumers: Access to greater volumes of clean and affordableenergy with higher levels of supply security.

This project builds on previous whole systems work conducted by National Gas (Gas and Electricity Transmission Infrastructure Outlook (2050)). Learnings from NGNs Hydrogen Cost Reduction project with National Gas, will be leveraged toextend insights into market and regulatory gaps assessments.

Video Description

https://www.youtube.com/watch?v=sPZltsWnN_I&feature=youtu.be&themeRefresh=1

Innovation justification

Innovative Aspects

The design of novel market approaches to govern and harmonize the integrationof Offshore Energy Hubs (OEH) into the UK and EU systems are the coreinnovative aspects. This will involve new market framework design, newprocesses, and potentially new

market tools.
While the EU-UK Trade and Cooperation Agreement recognises the benefits ofoffshore energy production in the North Sea, there are currently no jointcommercial frameworks in place that optimise the governance and integration ofoffshore cross-zonal electricity/hydrogen grids development. This project is novelin how it considers offshore hydrogen-electricity interaction and EU/UKharmonization by identifying regulatory gaps and risks between the UK and EU.
Beyond incremental innovation.

The Cost-Benefit-Analysis (CBA) methodology, as well as market frameworksdeveloped for the North Sea Wind Power Hub (NSWPH) will be leveraged andadapted to the UK context.

Readiness Levels

TRL: 1 progressing 2
The concept of OEHs is still nascent for the UK. Through initial research includingtesting several concepts designs, their location and their feasibility, this Discoveryphase project will be progressing the concept to Basic Research (TRL 2).

IRL: 2 progressing 3
This project is compatible with existing technological research, such as the
Hydrogen Turbine 1 (HT1) pilot project, as well as the European research effortsthrough the NSWPH. By exploring how UK OEHs could integrate existingtechnological research, the discovery phase will demonstrate the compatibilitybetween technologies and framework to orderly and efficiently integrate andinteract (IRL 3).

CRL: 1 progressing 3
The current product is not functional without a clear route to market (CRL 1). Theaim of this project, throughout all phases, is to develop all the elements enablingthe commercialisation of OEHs, thus progressing CRL to 6. In Discovery, CRL isexpected to progress to 3.

Size and Scale
By exploring the concept and benefits of OEHs, as well as the processes neededto enable its implementation, this project is sized to progress the solution towardscommercialisation and unlock the SIF objectives such as curtailment reduction,without incurring the budget needed to implement it.

BAU
This project investigates how energy networks should adapt to potential long-termsystem development. Thus, this cannot be funded as part of price control or short-term BAU activities.

Counterfactual
The proposed innovation is novel, therefore has risk associated with the delivery. Itis dependent on the development of a future UK hydrogen network, but alsosimilar developments in Europe

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 – indirect CO2 savings per annum

Revenues - creation of new revenue streams

New to market – products

New to market – processes

New to market - services

Impacts and benefits description

Further work is required to progress the commercial codes and regulations required to unlock the development of a cross-zonal offshore whole systemeconomy. For this project, the key metrics used will be financial cost savingsstemming from curtailment reductions (£ associated with MWh saved), reductionin grid losses (£ associated with MWh saved), and in infrastructure overbuildreduction thanks to the development of Offshore Energy Hubs in the UK (£associated with MW of infrastructure saved).

Financial - future reductions in the cost of operating the network:
The supply-side optionality provided offshore to developers through Power-to-Hydrogen and greater interconnection with Europe, could significantly reduceoffshore wind curtailment, hence reducing constraints payments for theelectricity system operator, that are foreseen to reach over £2.5bn/year over thenext decade.
Better coordination between offshore hydrogen development and onshorehydrogen grid would facilitate and optimise hydrogen TSO operation.

Financial - cost savings per annum on energy bills for consumers:
As mentioned, a significant decrease in constraints payment will reduceconsumers bill across the UK.
Better coordination between offshore and onshore hydrogen infrastructuredevelopment could reduce the potential for overbuilding infrastructure, henceproviding savings on non-energy costs for customers.
Increased supply-side flexibility for offshore wind developers could helpsignificantly reduce wholesale price volatility. Thus, reducing peak energy pricesthat particularly impact vulnerable consumers.

Revenues - creation of new revenue streams:

Offshore Energy Hubs can provide additional revenue streams for offshore winddevelopers through power-to-hydrogen, as well as the potential to export energyto Europe.

Environmental - carbon reduction -- indirect CO2 savings per annum:
Additional revenue streams for offshore wind projects could accelerate the paceand scale of such developments by strengthening developers' business case.

New to Market -- Product, Process and services
This project will focus on the creation of new market products, processes and/orservices that unlock the above benefits through enabling and optimising thedevelopment of cross-zonal Offshore Energy Hubs. The direct benefits realisedthrough project delivery are the creation of new to-market products (e.g., joint orinterlinked Offshore Bidding Zones), processes (e.g., co-optimised maritimespatial planning and permitting), and/or services that create new revenuestreams for offshore wind developers, incentivising them to invest into OffshoreEnergy Hubs.

Teams and resources

Guidehouse Europe Limited--Project Partner
is the primary project deliverypartner and will work with the project partners to deliver the innovation.Guidehouse has experience designing and delivering innovation funded projectsacross SIF, NIA and NIC, including technical, market and regulatory basedprojects on the topics of hydrogen and whole system planning. Guidehouse's UKenergy market experience, energy economics project management, and use ofdata analysis tools, coupled with their established working relationship withNational Gas Transmission strengthens the cohesiveness of our team. Throughother innovation work (e.g.,Gas and Electricity Transmission InfrastructureOutlook 2050), Guidehouse demonstrates deep expertise in whole systemplanning and stakeholder engagement. Guidehouse is supporting the
EuropeanNorth Sea Wind Power Hub
programme and will be able to leverage relevantEuropean expertise.

Orsted-- Project Partner is a global leader in renewable energy and has builtmore offshore wind farms than any other developer in the world -- including theworld's first and largest. Orsted's experience in developing offshore renewableassets, including hydrogen, will be significantly valuable for the Discovery phaseby providing relevant insights and data on Offshore Energy Hubs. Together withNeptune Energy, Ørsted explores powering integrated energy hubs with offshorewind.

Neptune Energy -- Project Partner is an Exploration & Production companyprogressing to become a leader in the development of offshore low-carbonsolution. Neptune's integrated energy hub strategy aims to utilise existinginfrastructure to facilitate CO2 storage and hydrogen production, using windpower.

National Grid ESO --Project Partner is the electricity system operator for GBand is transitioning into the Future System Operator (FSO). ESO plays a centralrole in the management of energy supply within GB. As an independent expertbody, the FSO will drive the evolution of market arrangements, facilitating wholeenergy security of supply at the lowest sustainable cost for consumers whilstenabling the transition to net zero. It will provide government and industry withstrategic direction holistically across energy vectors, lead market participants indeveloping market strategy and opportunities and drive action on marketinteraction solutions. ESO involvement across power and gas system planningand market development is key for this project to have an impact and informexisting knowledge gaps.

The discovery phase will be predominately desktop based.

The project will set up a stakeholder advisory group to support the project team indelivering the proposed project outputs and enable the project to enter Alpha.

Project Plans and Milestones

Project management and delivery

Project Management Processes:
The LookNorthH2 project managementprocesses will be grounded in the Project Management Institute's ProjectManagement Body of Knowledge methodology and our collective team'sexperiences delivering projects and programmes. The project will be led by a NGTproject manager (PM) from the Innovation Team and supported by a GuidehousePM. Together they will implement the project management processes forgovernance, finance, and stakeholder management.

Governance:
We will develop a project charter and stand-up project governance,including a Steering Committee. As per previous projects, weekly all partnersessions project review session will be held to manage activities and ensureprogression against the project plan. In these sessions detailed financialassessment and risk reviews will occur.

The project will be managed around 6 work packages that have severaldeliverables, the PMB describes these in full:
1.Data Collection and previous study assessment -- Guidehouse
2.UK Offshore Energy Hubs ideal location assessment -- Orsted

3.UK Offshore Energy Hubs Cost Benefit Analysis -- Guidehouse
4.Market and regulatory gap assessment -- Guidehouse
5.Stakeholder Engagement-- NGT
6.Project Management and reporting -- Guidehouse

Further detail is shown within the PMB and Gantt chart provided as part of theresponses to Q7.2 and Q7.3, respectively.

Finance:
We will ensure no less than monthly reporting on actual spend vs.budgeted and regular invoicing to promote transparency and cost-effectiveness.

Stakeholder Management:
We will proactively engage internal and externalstakeholders and execute activities defined in a regularly updated stakeholderengagement plan.

Dependencies:
There are no dependencies for this project.

Risk Management Strategy:
The Look NorthH2 management approach aims tomitigate the effects of uncontrollable circumstances and reduce their impact, whilede-risking the project where possible before future project phases. Risks andmitigation measures have been provided in the PMB. The project meetings willtake stock of progress against the project plan and the risks associated.

Policy & Regulatory Challenges:
The UK does not yet have a position on cross-zonal and integrated offshore electricity/hydrogen regulation. This project aims toinform a position but is subject to unexpected changes in policy and potentiallyoccurring throughout the project. This risk is mitigated by the direct participation ofpartners at the forefront of the development of offshore energy hubs in the UK.

Supply interruptions:
There will be no supply interruptions associated with thedelivery of this project.

Interaction with consumers:
This project will not interact with consumers.

Key outputs and dissemination

Discovery Phase Deliverables
The Discovery Phase will give the project partners the opportunity to shareknowledge and experience from prior work on Offshore

Energy Hubs (OEH),hydrogen and whole energy systems.
The key output for the project will be a Cost Benefit Analysis (CBA) as well as aregulatory and policy gap analysis for OEHs. As per the PMB, the project partnerswill be working through 6 work packages of which their key outputs are:

WP1: Data Collection and previous study assessment: a data workbook toenable output number 3 - Guidehouse
WP2: UK Offshore Energy Hubs ideal location assessment: a report detailingmost suitable OEHs locations and archetypes/configurations includingjustification -Orsted
WP3: UK Offshore Energy Hubs CBA: a CBA for UK OEHs - Guidehouse
WP4: Market and regulatory gap assessment: a report that contains a high-levelview of the commercial framework and market codes needed to enable offshoreenergy hubs - Guidehouse
WP5: Stakeholder Engagement: UK/EU energy system engagement to providerobust outputs, implementation approach and identification of gaps to supportoutput number 4 -- National Gas Transmission
WP6: Project Management and reporting: continuous project management andSIF Alpha application - Guidehouse

Responsibilities
Guidehouse will be responsible for bringing together all the partner outputs andcombining them into a single output document.
1.Guidehouse and National Gas will lead on the Alpha application, taking theoutputs from the project and determining the route to Beta required.
2.Guidehouse will be responsible for the benchmarking, the CBA and the policygap analysis, supported by Orsted.
3.Orsted will be responsible for assessing ideal OEH location.
4.Guidehouse and National Gas will be responsible for stakeholder engagement,National Gas will be responsible for implementation, safety and competitivenessoutputs.
National Gas will be responsible for ensuring implementation post the Beta phase.

Dissemination of key outputs and lessons learned
National Gas will take the lead on ensuring the project outcomes are publicised viathe Smart Networks Portal, Social Media and Discovery Show and Tell, with support from the project partners. Lessons learnt will be shared in any other futureor parallel projects to ensure the successful delivery of future activities.

Competitive markets
The outputs of the project will enable the progression of regulatory and policyframeworks for the UK and for OEHs. Whilst working with specific partners in thisproject, the implementation of this across the UK will be subject to competitivetender.

Commercials

Intellectual Property Rights (IPR) (not scored)

Default Arrangement.
For SIF projects, each Project Partner shall own all Foreground IPR that itindependently creates as part of the Project, or where it is created jointly then itshall 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 projectpartners to enable it to be recorded and ownership agreed in line with the contractterms.
Also if the party appoints a sub-contractor, the agreement with that sub-contractorshould have similar IP provisions to those in this agreement and which at leastachieve the same aims as the agreement regarding IP. Once the Project iscompleted, Relevant Background IPR will be licensed for use by the ProjectPartners in connection with another Project Partners' Foreground IPR solely to theextent necessary to use that Foreground IPR, upon terms to be agreed.
We intend to ensure each Project Partner will comply with Chapter 9 SIFGovernance 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 total project costs are £143,329, this includes £15,000 in contributions fromNGT and also £11,000 and £2,000 in-kind contributions from Guidehouse and NGESO respectively. The funding requested is £128,329. The funds are split:

National Gas Transmission
- £29,233 (20% total project) (£15,000contribution) seeking £14,233 for project management support, stakeholderengagement activities and requirements development.

Guidehouse
- £98,968 (68% total project) (£11,000 in-kind contribution)seeking £98,968 for project lead delivery, the cost-benefit analysis, andidentification of existing market and regulatory gaps.

National Grid ESO
- £5,128 (5% total project) (£2,000 in-kind contribution)seeking £5,128 for whole system and future system operator advice, as well ascontribution to the identification of existing market and regulatory gaps.

Orsted
- £5,000 (3.5% project total) for offshore wind development expertise

Neptune
Energy
- £5,000 (3.5% project total) for offshore energy hubsdevelopment expertise

Contributions
£15,000 contribution will be provided between by National Gas which meets the10% financial contribution requirement for this phase.

Partner support
Guidehouse is committed to the successful delivery of this project and providingvalue for money for GB consumers. Hence, £11,000 of additional expertise,resources and time will be contributed across all six work packages. This results inan extra 10 days to be spent on the project at no additional cost.
The funding across partners is balanced by the responsibilities of the activity, withthe size of the funding representing the level of responsibility. Hence, Guidehousewill be delivering the key deliverables across the project with a fair contribution ofeffort from Orsted and Neptune on gathering insights and data and NGT'sengagement and programme management. The ESO will provide subject matterexpert guidance, data if/when needed, as well as be tasked to challenge the workoutput for it to be as innovative as possible to inform their system planning work.Project partner involvement will be conducted through hourly weekly calls and ad-hoc workshops to use time and budget most effectively on the project. This willensure that the project benefits from a wide range of expertise and resources toensure the best outcome and value for money.
No subcontractors are required.
No additional funding is coming from other innovation funds.
By ensuring robust business case development in Discovery and tools, marketand commercial framework design in Alpha, the project will endeavour toimplement the tools, codes and frameworks into the enduring regime in the Betaphase.

Supporting documents

File Upload

LookNorthH2 - End of Phase Report.pdf - 3.2 MB
20240502_LookNorthH2 - Show & Tell.pdf - 701.8 KB
SIF Round 3 Project Registration 2024-06-06 3_47 - 93.2 KB
Look NorthH2 Application - Innovation Funding Service.pdf - 326.1 KB

Documents uploaded where applicable?

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