

Project details

Application team

National Gas Transmission PLC (Lead)

Organisation details

Type	Business
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Team members

Full name	Email	EDI survey
Philip Hamilton	Philip.hamilton@nationalgas.com	Complete
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ORSTED POWER (UK) LIMITED

Organisation details

Type	Business
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Team members

Full name	Email	EDI survey
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NATIONAL GRID ELECTRICITY SYSTEM OPERATOR LIMITED

Organisation details

Type	Business
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Team members

Full name	Email	EDI survey
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GUIDEHOUSE EUROPE LIMITED

Organisation details

Type	Business
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Team members

Full name	Email	EDI survey
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NEPTUNE E&P UK LIMITED

Organisation details

Type	Business
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Team members

Full name	Email	EDI survey
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Application details

Competition name

Ofgem R3D: Novel approaches to deliver a secure power system

Application name

Look NorthH2

When do you wish to start your project?

1 March 2024

Project duration in months

3 months

Has this application been previously submitted to Innovate UK?

No

Public description

Public description

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

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

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

Innovation Challenge aims

Select the primary Strategic Innovation Fund (SIF) Innovation Challenge aim that your Project is focusing on.

reduce at GWh scale the amount of renewable energy curtailed annually, at a cost lower than current constraint payments

Innovation Challenge focus theme

Select the primary Strategic Innovation Fund (SIF) Innovation Challenge focus theme that your Project is targeting.

Theme 1: novel market and technical approaches to cost effectively minimise renewable energy curtailment

Application questions

1. Lead Network (not scored)

Lead Network

National Gas Transmission Plc (NGT)

2. Problem statement

Problem statement

The creation of Offshore Energy Hubs (OEH) could further stimulate the deployment 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 UK energy transition and energy security.
- What commercial models and market designs are needed to successfully integrate offshore energy hubs into the whole energy system.
- What level of coordination would be required between the UK and other European countries on codes and regulations to enable the development of cross-country Offshore Energy Hubs.

[Look NorthH2 \(https://www.youtube.com/watch?v=sPZItsWnN_I&feature=youtu.be&themeRefresh=1\)](https://www.youtube.com/watch?v=sPZItsWnN_I&feature=youtu.be&themeRefresh=1) (https://youtu.be/sPZItsWnN_I (https://youtu.be/sPZItsWnN_I)) aims to address these across the three SIF phases:

In the Discovery phase, a detailed Cost-Benefit Analysis (CBA) will be carried out to test the costs and benefits of deploying cross-zonal Offshore Energy Hubs between the UK and EU member states, with a particular focus on the role they can play in reducing electricity curtailment, optimising gas and electricity infrastructure development, accelerating offshore wind deployment and improving energy security in the UK.

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

Throughout all phases of this project, novel market approaches will be explored to support the development of Offshore Energy Hubs. These hubs can provide significant 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-zonal electricity and hydrogen systems offshore, to **reduce the whole system cost of intermittent renewable integration** and improve the **processes needed to operate a heavily integrated onshore and offshore net-zero power system**.

This project benefits future users:

- **Offshore wind developers:** Creates new revenue opportunities to strengthen their business case.
- **Electricity and hydrogen network operators:** Provides clarity on commercial codes and market mechanisms needed to integrate offshore power and hydrogen development into both grids.
- **Networks consumers:** Access to greater volumes of clean and affordable energy 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 to extend insights into market and regulatory gaps assessments.

3. Innovation justification

How does your Project demonstrate novel and ambitious innovation in the energy networks?

Innovative Aspects

The design of novel market approaches to govern and harmonize the integration of Offshore Energy Hubs (OEH) into the UK and EU systems are the core innovative aspects. This will involve new market framework design, new processes, and potentially new market tools.

While the EU-UK Trade and Cooperation Agreement recognises the benefits of offshore energy production in the North Sea, there are currently no joint commercial frameworks in place that optimise the governance and integration of offshore cross-zonal electricity/hydrogen grids development. This project is novel in how it considers offshore hydrogen-electricity interaction and EU/UK harmonization by identifying regulatory gaps and risks between the UK and EU.

Beyond incremental innovation

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

Readiness Levels

TRL: 1 progressing 2

The concept of OEHs is still nascent for the UK. Through initial research including testing several concepts designs, their location and their feasibility, this Discovery phase 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 efforts through the NSWPH. By exploring how UK OEHs could integrate existing technological research, the discovery phase will demonstrate the compatibility between technologies and framework to orderly and efficiently integrate and interact (IRL 3).

CRL: 1 progressing 3

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

Size and Scale

By exploring the concept and benefits of OEHs, as well as the processes needed to enable its implementation, this project is sized to progress the solution towards commercialisation 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-term system 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. It is dependent on the development of a future UK hydrogen network, but also similar developments in Europe

[SIF Application Look NorthH2 - Q3 Appendix.pdf \(opens in a new window\)](#)
(/application/10104053/form/question/36580/forminput/99771/file/628127/download).

4. Impacts and benefits selection (not scored)

Impacts and benefits selection

- *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*

5. Impacts and benefits description

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 system economy. For this project, the key metrics used will be financial cost savings stemming from curtailment reductions (£ associated with MWh saved), reduction in grid losses (£ associated with MWh saved), and in infrastructure overbuild reduction 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 reduce offshore wind curtailment, hence reducing constraints payments for the electricity system operator, that are foreseen to reach over £2.5bn/year over the next decade.
- Better coordination between offshore hydrogen development and onshore hydrogen 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 reduce consumers bill across the UK.
- Better coordination between offshore and onshore hydrogen infrastructure development could reduce the potential for overbuilding infrastructure, hence providing savings on non-energy costs for customers.
- Increased supply-side flexibility for offshore wind developers could help significantly reduce wholesale price volatility. Thus, reducing peak energy prices that particularly impact vulnerable consumers.

Revenues - creation of new revenue streams:

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

Environmental - carbon reduction -- indirect CO2 savings per annum:

- Additional revenue streams for offshore wind projects could accelerate the pace and 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/or services that unlock the above benefits through enabling and optimising the development of cross-zonal Offshore Energy Hubs. The direct benefits realised through project delivery are the creation of new to-market products (e.g., joint or interlinked Offshore Bidding Zones), processes (e.g., co-optimised maritime spatial planning and permitting), and/or services that create new revenue streams for offshore wind developers, incentivising them to invest into Offshore Energy Hubs.

6. Team and resources

Who is in the Project team and what are their roles and responsibilities?

Guidehouse Europe Limited -- *Project Partner* is the primary project delivery partner and will work with the project partners to deliver the innovation.

Guidehouse has experience designing and delivering innovation funded projects across SIF, NIA and NIC, including technical, market and regulatory based projects on the topics of hydrogen and whole system planning. Guidehouse's UK energy market experience, energy economics project management, and use of data analysis tools, coupled with their established working relationship with National Gas Transmission strengthens the cohesiveness of our team. Through other innovation work (e.g., *Gas and Electricity Transmission Infrastructure Outlook 2050*), Guidehouse demonstrates deep expertise in whole system planning and stakeholder engagement. Guidehouse is supporting the *European North Sea Wind Power Hub* programme and will be able to leverage relevant European expertise.

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

Neptune Energy -- Project Partner is an Exploration & Production company progressing to become a leader in the development of offshore low-carbon solution. Neptune's integrated energy hub strategy aims to utilise existing infrastructure to facilitate CO2 storage and hydrogen production, using wind power.

National Grid ESO -- Project Partner is the electricity system operator for GB and is transitioning into the Future System Operator (FSO). ESO plays a central role in the management of energy supply within GB. As an independent expert body, the FSO will drive the evolution of market arrangements, facilitating whole energy security of supply at the lowest sustainable cost for consumers whilst enabling the transition to net zero. It will provide government and industry with strategic direction holistically across energy vectors, lead market participants in developing market strategy and opportunities and drive action on market interaction solutions. ESO involvement across power and gas system planning and market development is key for this project to have an impact and inform existing knowledge gaps.

The discovery phase will be predominately desktop based.

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

7. Project management and delivery

How will you manage your Project effectively? What is your Project plan? What are your milestones? What are the risks associated with your Project?

Project Management Processes: The LookNorthH2 project management processes will be grounded in the Project Management Institute's Project Management Body of Knowledge methodology and our collective team's experiences delivering projects and programmes. The project will be led by a NGT project manager (PM) from the Innovation Team and supported by a Guidehouse PM. Together they will implement the project management processes for governance, 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 partner sessions project review session will be held to manage activities and ensure progression against the project plan. In these sessions detailed financial assessment and risk reviews will occur.

The project will be managed around 6 work packages that have several deliverables, 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 the responses 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 external stakeholders and execute activities defined in a regularly updated stakeholder engagement plan.

Dependencies: There are no dependencies for this project.

Risk Management Strategy: The Look NorthH2 management approach aims to mitigate the effects of uncontrollable circumstances and reduce their impact, while de-risking the project where possible before future project phases. Risks and mitigation measures have been provided in the PMB. The project meetings will take 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 to inform a position but is subject to unexpected changes in policy and potentially occurring throughout the project. This risk is mitigated by the direct participation of partners at the forefront of the development of offshore energy hubs in the UK.

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

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

[Look NorthH2 Project Plan.pdf \(opens in a new window\)](#)
(/application/10104053/form/question/36584/forminput/99795/file/630772/download).

[Project Management Book Template R3D SIF version - Look NorthH2.xlsx \(opens in a new window\)](#)
(/application/10104053/form/question/36584/forminput/99795/file/630775/download).

8. Key outputs and dissemination

What are the expected key outputs of your Project and your plan for disseminating them along with any lessons learned?

Discovery Phase Deliverables

The Discovery Phase will give the project partners the opportunity to share knowledge 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 a regulatory and policy gap analysis for OEHs. As per the PMB, the project partners will be working through 6 work packages of which their key outputs are:

- **WP1:** Data Collection and previous study assessment: a data workbook to enable output number 3 - *Guidehouse*
- **WP2:** UK Offshore Energy Hubs ideal location assessment: a report detailing most suitable OEHs locations and archetypes/configurations including justification - *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-level view of the commercial framework and market codes needed to enable offshore energy hubs - *Guidehouse*
- **WP5:** Stakeholder Engagement: UK/EU energy system engagement to provide robust outputs, implementation approach and identification of gaps to support output number 4 -- *National Gas Transmission*
- **WP6:** Project Management and reporting: continuous project management and SIF Alpha application - *Guidehouse*

Responsibilities

Guidehouse will be responsible for bringing together all the partner outputs and combining them into a single output document.

1. Guidehouse and National Gas will lead on the Alpha application, taking the outputs from the project and determining the route to Beta required.
2. Guidehouse will be responsible for the benchmarking, the CBA and the policy gap 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 competitiveness outputs.

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 via the Smart Networks Portal, Social Media and Discovery Show and Tell, with

support from the project partners. Lessons learnt will be shared in any other future or parallel projects to ensure the successful delivery of future activities.

Competitive markets

The outputs of the project will enable the progression of regulatory and policy frameworks for the UK and for OEHs. Whilst working with specific partners in this project, the implementation of this across the UK will be subject to competitive tender.

9. Intellectual Property Rights (IPR) (not scored)

Intellectual Property Rights (IPR)

Default Arrangement.

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 the contractual 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 with the Project Partners on the agreement for the project.

10. Value for money

How much will the Project cost for the Discovery Phase and how does it represent value for money for the consumer?

The total project costs are £143,329, this includes £15,000 in contributions from NGT and also £11,000 and £2,000 in-kind contributions from Guidehouse and NG ESO respectively. The funding requested is £128,329. The funds are split:

- **National Gas Transmission** - £29,233 (20% total project) (£15,000 contribution) seeking £14,233 for project management support, stakeholder engagement 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, and identification 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 as contribution 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 hubs development expertise

Contributions

£15,000 contribution will be provided between by National Gas which meets the 10% financial contribution requirement for this phase.

Partner support

Guidehouse is committed to the successful delivery of this project and providing value for money for GB consumers. Hence, £11,000 of additional expertise, resources and time will be contributed across all six work packages. This results in an 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, with the size of the funding representing the level of responsibility. Hence, Guidehouse will be delivering the key deliverables across the project with a fair contribution of effort from Orsted and Neptune on gathering insights and data and NGT's engagement and programme management. The ESO will provide subject matter expert guidance, data if/when needed, as well as be tasked to challenge the work output 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 will ensure that the project benefits from a wide range of expertise and resources to ensure 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, market and commercial framework design in Alpha, the project will endeavour to implement the tools, codes and frameworks into the enduring regime in the Beta phase.

The finances of all project partners are included in the [milestones summary \(/application/10104053/milestones-summary\)](/application/10104053/milestones-summary).

	Total costs (£)	Funding sought (£)	Contribution to project (%)	Contribution to project (£)	Contributions in kind (£)
National Gas Transmission PLC Lead organisation	29,233	14,233	51.31%	15,000	0
ORSTED POWER (UK) LIMITED Partner	5,000	5,000	0.00%	0	0
NATIONAL GRID ELECTRICITY SYSTEM OPERATOR LIMITED Partner	5,128	5,128	0.00%	0	2,000
GUIDEHOUSE EUROPE LIMITED Partner	98,968	98,968	0.00%	0	11,000
NEPTUNE E&P UK LIMITED Partner	5,000	5,000	0.00%	0	0
Total	£143,329	128,329		15,000	13,000

Funding breakdown

	Total	Labour (£)	Materials (£)	Subcontracting (£)	Travel and subsistence (£)	Other costs (£)
National Gas Transmission PLC Lead organisation View finances (/application/10104053/form/FINANCE)	£29,233	27,233	0	0	0	2,000
ORSTED POWER (UK) LIMITED Partner	£5,000	5,000	0	0	0	0
NATIONAL GRID ELECTRICITY SYSTEM OPERATOR LIMITED Partner	£5,128	5,128	0	0	0	0
GUIDEHOUSE EUROPE LIMITED Partner	£98,968	98,968	0	0	0	0
NEPTUNE E&P UK LIMITED Partner	£5,000	5,000	0	0	0	0
Total	£143,329	141,329	0	0	0	2,000

SIF Governance Document

SIF Governance Document

Partner	SIF Governance Document
National Gas Transmission PLC (Lead)	Third Party (/application/10104053/form/terms-and-conditions/organisation/14713/question/36519)
ORSTED POWER (UK) LIMITED	Third Party (/application/10104053/form/terms-and-conditions/organisation/11432/question/36519)
NATIONAL GRID ELECTRICITY SYSTEM OPERATOR LIMITED	Third Party (/application/10104053/form/terms-and-conditions/organisation/34764/question/36519)
GUIDEHOUSE EUROPE LIMITED	Third Party (/application/10104053/form/terms-and-conditions/organisation/75112/question/36519)
NEPTUNE E&P UK LIMITED	Third Party (/application/10104053/form/terms-and-conditions/organisation/104386/question/36519)

