SIF Alpha Round 2 Project Registration

Date of Submission

Jan 2024

Project Reference Number

REF:10079341

Initial Project Details

Project Title

HyCoRe (Alpha)

Project Contact

David Lynch

Challenge Area

Improving energy system resilience and robustness

Strategy Theme

Net zero and the energy system transition

Lead Sector

Gas Distribution

Other Related Sectors

Electricity Distribution

Project Start Date

01/10/2023

Project Duration (Months)

6

Lead Funding Licensee

Northern Gas Networks

Funding Mechanism

SIF Alpha - Round 2

Collaborating Networks

Northern Powergrid

National Gas Transmission PLC

Technology Areas

Asset Management

Hydrogen

Offshore Transmission

Distributed Generation

Electricity Transmission Networks

Energy Storage

Energy Storage and Demand Response

Resilience

Environmental

Gas Distribution Networks

System Security

Green Gas

Project Summary

HyCoRe will identify UK regions with strong potential for green hydrogen, produced from offshore-wind and injected into the onshore gas network, to offer a more economic and deliverable solution than offshore wind farms producing electricity directly. To achieve this, HyCoRE will focus on three key research areas:

National modelling: identifying high-potential areas based on offshore/onshore constraints and opportunities.

Modelling of a selected regional specific solution: understanding infrastructure solutions that will provide connectivity between offshore wind production areas and energy consumers/gas network.

Technical challenge assessment: identifying technical challenges that may impede deployment and design/optimisation of test/validation solutions to de-risk technology pathways

Add Preceding Project(s)

NGN_9021_SIF_R2_Discovery (UKRI_10058442) - HyCoRe - Hydrogen Cost Reduction

Add Third Party Collaborator(s)

Arup

Offshore Renewable Energy Catapult

Project Budget

£593,133.00

SIF Funding

£499,787.00

Project Approaches and Desired Outcomes

Problem statement

HyCoRe's overarching aim investigates key options/considerations for exporting offshore wind power, focusing on existing gas/electricity networks in transporting green hydrogen from offshore wind-powered electrolysis.

HyCoRe focuses on promising hydrogen technology areas, with the aim of bringing greater clarity on market evolution giving increased energy networks and offshore wind developer confidence to create the market.

Successful hydrogen integration into existing energy networks will prevent stranded infrastructure assets, therefore reducing capital expenditure to support net-zero, ultimately benefitting the consumer.

The hydrogen switch-over will be gradual with hydrogen regions growing, thus needing subsequent additions of hydrogen generation capacity. HyCoRe enables foresight of where industrial-scale green hydrogen could be generated and/or supplied. This allows network operators to better plan initial pilot-scale hydrogen networks that could turn into much larger networks. Ultimately, this uncovers hydrogen network enablers/blockers.

HyCoRe problem perception has evolved from Discovery phase knowledge regarding future energy system preferred options, optimal electrolyser placement, and energy storage devices. Discovery WP2 highlighted that offshore hydrogen production costs will fall in the coming years and will be competitive for longer distance offshore wind farms (\>150km offshore). This means hydrogen as an alternative offshore wind energy vector is a viable option for future energy systems. WP2 also highlighted significant benefit of enhancing existing testing/demonstration infrastructure to support new technology development/modelling validation. Furthermore, WP3 and WP4 indicated the importance of analysis tools/modelling for the development of energy carrier options and cost drivers for onshore/offshore energy system development. WP5 highlighted the impact on gas/electricity systems might be best served by the identification and development of energy zones; this activity would benefit from a

deeper cost benefit analysis to better inform network investments and energy system infrastructure upgrades.

HyCoRe has evolved in two key areas: the importance of market regulation; and the use of modelling tools in the project. Firstly, market regulation importance became highly apparent during Discovery phase (from a gas and electrical perspective). Subsequently, we have dedicated a WP to this topic in Alpha, led by Arup. Secondly, HyCoRe has adopted existing modelling and software tools (Arup, Unasys) in Alpha to complement Kinewell's capability from the Discovery phase.

Alpha will still consider onshore/offshore implications in the new WP2, but will combine existing tools/methods from Arup (SCALE) and Unasys with Kinewell's outputs from the Discovery phase.

Regardless of the evolution of HyCoRe, it continues to meet the primary Innovation Challenge to improve energy system resilience/robustness; the evolution is more concerned about how we do it rather than whether we do it. When considering the specific theme (strengthening the UK's energy system robustness to support efficient roll out of new infrastructure), the project continues to focus on how new offshore wind infrastructure can be efficiently rolled out and how we utilise multi-energy solutions (hydrogen and electricity) whilst combining gas/electricity networks to strengthen the robustness of the UK's energy solution.

The direct users of HyCoRe innovation will be gas/electricity system operators (at national and regional level). Their needs include network regulatory requirement compliance and knowledge of how we might combine these networks is evolving. However, the indirect users of the HyCoRe innovations are the end-users (domestic and industrial). Their needs are primarily an affordable and reliable energy supply, but providing this in a green/sustainable way is a key driver in this primary need.

The investment sheet provided (please see Appendix_Q7_Project_Management_Book) lists other public/network innovation-funded work undertaken (and in progress) that supports HyCoRe. This is enhanced by new partner involvement from Arup, Unasys and Newcastle University and includes TIGGOR, HII SEED, CLUE, HI-ACT, CESI and more. This 'leveraged' funding total is upwards of £8 million.

Innovation justification

HyCoRe proposes novel/ambitious innovation for future energy systems well aligned with: the challenge area of improving energy system resilience and robustness; and the theme of strengthening energy system robustness to support efficient new infrastructure roll out for the following reasons:

It will analyse resilience through Monte Carlo modelling and propose diversification of energy options (hydrogen and electricity) for offshore wind energy. Solutions involving decentralisation and grid flexibility (including minimising offshore wind curtailment) are also considered. HyCoRe explores several technical challenges (energy storage impact analysis, storage facilities, and enhanced interconnections between energy vectors and the wider electrical and gas networks used for energy transmission/distribution). HyCoRE will achieve this through multiple stakeholder collaboration/coordination (including electricity grid and gas network companies).

HyCoRe's Discovery phase provided several takeaways to inform the Alpha phase scope: the benefits of enhancing existing testing and demonstration infrastructure (for optimisation in WP4); further development/use of analysis tools (for WP2 offshore/onshore zone considerations); and deeper cost benefit analysis value (feeding WP3 technical challenges work and WP4 infrastructure optimisation).

Discovery also highlighted the need for detailed routes to market considerations (including WP5 markets and regulation studies).

HyCoRE's Discovery phase allowed the project to work openly with an Advisory Board. As well as supporting a webinar and Show and Tell promotional activities, the Advisory Board interaction led to full partner inclusion of Arup and Unasys in the Alpha phase. The use of their modelling tools/methods alongside Kinewell's WP2 input provides an opportunity for accelerated (not incremental) innovation in modelling of offshore/onshore zone considerations.

Innovative aspects of HyCoRe are largely covered in WP2 to WP4 inclusive. WP2 allows HyCoRe to combine modelling capability from Arup/Kinewell/Unasys (further details in Appendix_Q3_Innovation_justification). Arup's SCALE tool will be used to combine offshore and onshore modelling for zone considerations at a National level for the first time. Kinewell will use these findings to consider infrastructure solutions through regional level modelling. In WP3, OREC will analyse innovation in offshore wind hydrogen production in the areas of optimised integration, ancillary service provision, hydrogen compression and offshore maintenance. WP4 focuses on enhancement of validation and demonstration infrastructure and focuses particularly on existing infrastructure of OREC and NGN. Compared to current state of the art, Arup's SCALE tool will be enhanced to consider onshore and offshore zone consideration modelling at a National level.

Similarly, OREC's grid emulation infrastructure and NGN's Low Thornley site design will be optimised for hydrogen-based technology validation and demonstration. The ability to virtually connect the sites will also be investigated; a clear step beyond state of the art. The TRL status of software tool activities (e.g., SCALE) and the validation/demonstration infrastructure will be enhanced by the Alpha phase. SCALE is already commercially ready, but its capability will be enhanced by Alpha. The IRL of the validation and demonstration infrastructure will be progressed by the investigation to virtually connect infrastructure as part of WP4's facility specification and costing tasks.

HyCoRe believes National modelling coupled with regionally-based infrastructure for validation/demonstration is an appropriate size/scale to gain investor and wider stakeholder confidence in the innovations presented. Subsequently, regional demonstration can be replicated/scaled to a National level if successful under SIF. As a new-to-market technology development project, an Alpha phase project would be more risky to fund by other means, particularly when building from the Discovery phase. The project involves diversification of partner business as usual activities, thus requiring SIF-type funding. HyCoRe has considered counterfactual solutions such as market-led organic growth of offshore wind producing hydrogen. This has been disregarded as it risks ongoing curtailment problems for offshore wind, siloed technology development and non-optimised solutions from a wider, holistic energy systems perspective.

Impact and benefits (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

Impacts and benefits description

The current position is that there are plans to integrate a large scale roll out of offshore renewable energy, to 50 GW by 2030, using the electrical network. Plans for this have been outlined in National Grid ESO's Holistic Network Design, which has an estimated investment requirement of £32bn.

By minimising network upgrade costs via identifying the most strategic locations to generate hydrogen from offshore wind and integrate it with the gas network, HyCoRe will contribute to a lean energy system, reducing the risk of building a sub-optimal system, with underutilised components. This will also reduce the gas/electricity network's capital/operational costs, and consumer bills.

Based on the high-level analysis in the CBA spreadsheet, using hydrogen technology has the potential to have substantial savings on network costs and have a net present value of about £19bn. An understanding of the costs of hydrogen systems has come through project delivery.

Revenues--creation of new revenue streams

Presently, there are few links between the gas and power networks, other than gas fired power stations. With electrolysis allowing electrical energy to be transferred to the gas network, new revenue streams will be created, so that one can support the other, further improving network resilience. Additionally, energy storage services could be provided by new companies, at various UK locations where hydro-power is not possible. During low UK demand periods, there is potential to export hydrogen abroad; an export opportunity that does not currently exist and that will open revenue streams for all companies involved.

Revenues--improved access to revenues for users of network services

For industrial scale green hydrogen from offshore wind to supply the gas network, the market regulation must be set-up, from scratch, to enable it in a safe, efficient, and fair way. HyCoRe will seek a detailed understanding of existing regulation to

advise policymakers on the regulatory changes required to provide greater confidence to both the energy networks and offshore wind developers and to allow the development of the market. This will ultimately benefit the consumer.

Further, some traditional network service users could become network providers (e.g., small-scale distributed generation allowing users to sell surplus energy back to providers). In this case, users could install a hydrogen electrolyser and provide energy storage capacity that could be sold back to the traditional energy provider in the form of new services.

New to market--products, processes, and services

Energy storage devices are becoming more common on the network. HyCoRe will highlight where they can best contribute in terms of scale, location, etc., supporting favourable business model development and reducing time-to-market. It will also highlight where additional enabling technologies in the energy networks (e.g., converters/control-systems/monitoring solutions) are required in the system (windfarm/electrolyser/wider gas and electricity network) and support their validation/commercialisation.

Teams and resources

Northern Gas Networks (NGN): the lead Gas Distribution business who will leverage gas industry knowledge to provide overall oversight to the project, ensuring project deliverables are met and OFGEM SIF governance is complied with. Provision of key industry insights and information into workshops and supporting evidence gathering across the project.

OREC--UK's flagship innovation and research centre for offshore renewables, with vast experience of de-risking technology innovation for the sector and managing/delivering innovation projects. A key delivery partner who will provide overall project management , in addition to leading the: onshore zone analysis(WP2); analysis of technical barrier to offshore-wind/hydrogen(WP3); validation facility design/optimisation(WP4); supply chain maturity review(WP5); stakeholder engagement/dissemination activity(WP7), which will be supported by all partners.

Kinewell Energy (Kinewell)---Developer/owner of software solutions including KLOC, which designs and optimises offshore wind inter-array cable layouts, and KDOTS, which designs and models offshore transmission systems to support decisions around technology choices for offshore transmission infrastructure. A key delivery partner who will lead the work on regional infrastructure modelling(WP2) and modelling to understand required storage capacities and ensure resilience(WP5).

Ove Arup & Partners (ARUP)---Leading independent advisors to government and industry on the energy transition with extensive expertise in hydrogen and the offshore energy transition, A key delivery partner who will lead the: national modelling of offshore zones(WP2); market and regulatory analysis(WP5); and development of the vision/route map(WP6).

UNASYS-Creator of digital models of topsides and subsea facilities, in a real time visual. Owner/operator of a mature 2-tier digital platform(Digital North Sea) that maps the North Sea and onshore infrastructure. Unasys will lead on the development of a digital model mapping offshore infrastructure, which will include proposed infrastructure changes and an associated a timeline (WP2).

Newcastle University (NCL)--Research expertise in power systems/energy storage/hydrogen integration into the future energy system. Leading on water constraints analysis(WP2) and the resilience/robustness improvement assessment(WP3) WP4.

National Gas Transmission (NGT)--NGT own, manage and operate the national gas transmission network in Great Britain, and will act as advisory partners, leveraging expertise in hydrogen compression to support WP3, and their insight into network capability and future requirements to ensure the end solution can be deployed as business-as-usual at the end of the project.

Norther Power Grid (NPG)--Electricity network operator acting as advisors, providing insight into electricity network requirements.

Carbon Trust (CT)---A not-for-profit aiming to accelerate the transition to Net Zero. Acting as advisors and supporting WP7 activity via integration with their R&D partners, comprising leading offshore-wind developers.

Lhyfe-- Renewable hydrogen project developer with UK subsidiary in Northeast England to identify opportunities to deploy production facilities. Expertise in green hydrogen from offshore-wind will be used to advise the project and provide insight into requirements of project developers.

Team Changes--All Discovery partners bar one(SGN), continue to support HyCoRe into Alpha. After a review of skills gaps, additional partners have been added: NCL, for expertise in hydrogen/energy system integration; NPG for insight into electricity network requirements; and CT for insight into offshore-wind developer perspectives. All new partners have existing relationships with one or more Discovery partners. UKPN will join the team as external advisors.

Resources, Equipment and Facilities:

ARUP---SCALE: digital tool providing rapid assessment of cost, site comparison, and consenting risk assessment(WP2).

Kinewell---KLOC/KDOTS/KWOTA: design/optimisation software tools(WP2).

OREC---Knowledge of/data from 18MVA/2MVA grid emulation and hardware-in- the-loop facilities and 5 kW HyFi electrolyser test facility(both WP4).Time domain/series data from 7MW Levenmouth Demonstration Turbine (provided to Kinewell for resilience work in WP5).

UNASYS--Digital North Sea platform.

Missing Skills--No additional parties are required; inputs from a broad range of stakeholders will be actively sought via WP7.

Project Plans and Milestones

Project management and delivery

This six-month Alpha project comprises seven work packages. A detailed work package description, schedule, and risk-register are provided in Appendix_Q7_Project_Management_Book.

WP1-Project Management and Coordination(Lead--OREC) £28,463 SIF Funding Requested/41days: The project will be led and co-ordinated by Michelle Hitches, Senior Project Manager at OREC, who is an APM Project Professional Project Manager (PPQ), according APM principles.

Key success criteria: *M1.1-Project complete on time and within budget*, and delivery of *D1.1-A report summarising project findings and Beta phase plan*.

WP2-Offshore and onshore zone considerations(Lead--ARUP) £232,038.80 SIF Funding Requested/454days:

Identification of suitable UK baseline locations and suitable UK onshore and offshore locations for the next hydrogen from offshore wind zone, followed by a regional specific case study, including digital mapping of the regional infrastructure to inform changes and associated timelines.

Key success criteria: *M**2.1**-*Suitable baseline offshore locations for the next hydrogen from offshore wind zone identified; M2.2-Suitable onshore and offshore locations for the next hydrogen from offshore wind zone identified; M2.3-Regional modelling complete and project specific inter-array and export system design finalised, M2.4- Detailed understanding of the infrastructure needs for all hydrogen offtakes and storage in selected region; M2.5- WP2 findings summarised in concise report and delivery of *D2.1-Report chapter summarising WP2 findings.*

WP3-Technical challenges to hydrogen project delivery(Lead--OREC) £52,360.10 SIF Funding Requested/87days:

A study of the key technical challenges associated with delivering a hydrogen from offshore wind project and proposed mitigation strategies.

Key success criteria: *M3.1-*Key technical challenges associated with delivering a hydrogen from offshore wind project determined*,* and delivery of *D3.1 -Report chapter summarising WP3 findings.*

WP4-Validation and demonstration infrastructure optimisation*(Lead--OREC)

£33,945.80 SIF Funding Requested/49 days:

Development of plans to validate enabling technologies.

Key success criteria: M4.1- est facility design and proposed test plans finalised, and delivery of *D4.1-Report chapter summarising WP4 findings.*

WP5-Routes to market considerations*(Lead--Kinewell) £97,089 SIF Funding Requested/123days:

Addressing the barriers to route to market identified in HyCoRe Discovery, including resilience, markets and regulations and supply chain maturity.

Key success criteria: *M5.1 -* Optimal storage capacity identified*, M5.2 -* Regulatory Workshop delivery, *M5.3 -* Barriers and solutions with existing frameworks identified*, M5.4-*Supply chain analysed*, and delivery of D5.1 -Report chapter summarising WP5 findings.*

WP6-Combining all zone considerations*(Lead--ARUP) £28,220 SIF Funding Requested/39days:

Creation of a vision and route map setting out the pathways by which green hydrogen production from offshore wind can support net zero ambitions.

Key success criteria: M6.1-to agree the vision for transitioning from the Alpha project to rollout via a BETA demonstration project, M6.2-Production of Vision report, and delivery of D6.1-Vision report setting out the phasing of moving from the current development stage to rollout via a demonstrator project.

WP7-Stakeholder engagement, dissemination, and Beta bid planning(Lead-- OREC) £28,408 SIF Funding Requested/62days:

Engagement with key stakeholders to promote project activity and garner support for subsequent phases.

Key success criteria: *M7.1 -Public webinar delivery,* M7.1 -- White Paper published, and *M7.3 -Beta plan finalised*, and delivery of *D7.1 - White paper, and*

D7.2 -Report chapter detailing Beta phase project plan.

The ***main risk*** during Alpha is that poor project management will result in failure to deliver on schedule (R2). Mitigation is achieved via a robust project management plan with agreed tolerances.

The PM will create a risk matrix to prioritise actions and mitigate those with the highest risk level according to a traffic light system. These will be monitored by the PM and reviewed with the partners on a weekly basis, with corrective or mitigating actions being taken as appropriate.

As a short, desk-based study, no stage-gates are required to mitigate risks, there is no potential for supply interruptions and no impact on existing/future energy consumers currently anticipated.

Key outputs and dissemination

At the end of the Alpha project, the team will present ***a vision illustrating how industrial scale hydrogen production from offshore wind can be deployed in the UK, delivering economically efficient outcomes for consumers and de- risking delivery of net zero.***

The steps required to achieve this will be outlined, including: a proposed strategy to overcome the current technical barriers to deployment; technology development requirements and a proposal to support these via the development and optimisation of existing technology validation infrastructure; recommendations to mature the supporting UK supply chain; and a proposal for overcoming current regulatory barriers. Further, the vision will highlight areas of the UK (onshore and offshore) that are most likely, from a strategic perspective, to be high potential hydrogen-from-offshore-wind zones, and will propose a Beta-phase demonstration in one such area, integrating all of the above to demonstrate the concept, promote business-as-usual adoption post Beta and accelerate towards industrial scale rollout.

Arup will be responsible for developing the vision, with support from all project partners via the delivery of a series of discrete project outputs that will form its basis. These are:

Identification of suitable UK baseline locations and suitable UK onshore and offshore locations for the next hydrogen from offshore wind zone identified. *(**Responsibility: Arup** supported by OREC, NCL)*

Regional specific project selected; inter-array and export system designed and costed. ***(Responsibility: Kinewell)***

Development of a digital model of regional onshore infrastructure with map and timeline for proposed changes ***(Responsibility: Unasys)***

A detailed understanding of the key technical challenges associated with delivering a hydrogen from offshore wind project acquired and mitigation plans proposed. *(**Responsibility: OREC** supported by NCL)*

A detailed business case outlining the required optimisation of existing validation infrastructure to support novel UK technology development, and the associated costs. *(**Responsibility: OREC** supported by NCL)*

A detailed understanding of the optimal storage capacity required for different sized hydrogen zones to ensure resilience.

(Responsibility: Kinewell)

A detailed understanding of current regulatory and market frameworks, identification of the barriers to developing green hydrogen from offshore wind projects and proposing options to overcome these barriers e.g., changes to codes, licences or primary legislation. ***(Responsibility: Arup)***

A detailed understanding of the UK supply chain maturity, and proposals to address the key supply-based issues. ***(Responsibility: OREC)***

The HyCoRe team recognise that achieving industrial scale hydrogen from offshore wind to supply the gas network will require support from the whole industry and its supply chain, and from consumers. To acquire the required support, ***OREC will lead a dedicated stakeholder engagement and dissemination work package***, and will engage with offshore wind and hydrogen industry stakeholders, and the associated supply chains, to acquire knowledge/insight that could influence the direction of the work and to support dissemination of project outcomes. This will involve:

-Advisory team engagement. The project team members acting as advisors will be engaged at regular intervals throughout the Alpha phase to discuss project findings and lessons learnt and to acquire input into Beta planning.

-Wider stakeholder engagement. Partners will leverage their extensive network of energy sector contacts to disseminate project outputs in a targeted way. This will include holding workshops with groups including the offshore wind developers involved in the Carbon Trust Integrator programme, and the Hydrogen Integrator for Accelerated Energy Transitions (HI-ACT) project stakeholder groups.

-Public dissemination. OREC will lead a public dissemination programme, which will include at least one website article published and delivery of at least one open access webinar, both accompanied by promotional activities. - Publication of a white paper. A publicly available white paper will be created summarising project findings/lessons learnt.

APPENDIX_Q7_Project_Management_Book(Project Plan;WP7 Description),contains more detail on dissemination activities.

Commercials

Intellectual property rights, procurement and contracting (not scored)

Kinewell: Kinewell Energy brings background IP related to their products/software/inventions/models called KLOC, KDOTS and KWOTA (see AppendixQ3-Innovation). KLOC is Kinewell's offshore wind inter-array cable layout optimisation tool. KDOTS is Kinewell's planning tool for offshore wind (hydrogen and electrical) transmission system technology choices under severe uncertainty. KDOTS includes IP licensed to Kinewell Energy from ORE Catapult and Durham University. KWOTA is Kinewell's turbine layout optimisation tool (note: confidential and not yet launched).

OREC: OREC bring background IP in the form of techno-economic modelling tools that will be used to deliver HyCoRE, provision of data, and know-how around e.g., test and validation protocol development.

ARUP: The SCALE offshore wind deployment and LCOE/LCOH digital model is a pre-existing Arup proprietary software funded and developed internally. Arup retains all Intellectual Property or proprietary rights in the tool and for any modifications and/or upgrades made to the tool in order to produce the project outputs. Only the outputs of the SCALE offshore wind deployment and LCOE digital model will be provided as a project deliverable and/or output, which will not require the use of SCALE to be accessed by the client and therefore no licenses will be granted for this project. The tool itself and any modifications and/or upgrades will be treated as Arup's Pre-Existing Intellectual Property and remain owned by Arup.

Unasys: Unasys bring relevant background IP, namely software code, know-how and extensive data sets, which are maintained as confidential.

IP Arrangements: Whilst IPR arrangements for Discovery were aligned with the default arrangements in the SIF Governance document, for Alpha, project partners would like to propose alternative arrangements. Please find a description of these in AppendixQ9_IPR_Arrangements. The project team are available to discuss this with the SIF governance team upon request.

Procurement/Contracting: no procurement, tendering, subcontracting is required to deliver HyCoRe Alpha.

Commercialisation, route to market and business as usual

HyCoRe focuses on identifying areas where hydrogen technology looks promising, with the aim of bringing much greater clarity on how the market will evolve giving increased confidence to both the energy networks and offshore wind developers to create the market. Outputs will benefit offshore-wind/green hydrogen project developers, gas/electricity network operators(e.g.

NGN/NGG/UKPN), and the associated supply chains(e.g.--Lhyfe/Kinewell Energy/Arup/OREC).

HyCoRe will enable foresight of where industrial scale green hydrogen would be generated and/or supplied, allowing network operators to better plan the initial pilot scale hydrogen networks that could feasibly turn into much larger hydrogen networks. Project success will be used to generate/increase customer interest and support reduced time-to-market-acceptance, as described below.

Phase1(Completed)--Discovery(April--June.2023): The team acquired new knowledge around optimising energy network flexibility/offshore-wind farm configurations and optimising overall system efficiency. An industry advisory board was included throughout the project to engage stakeholders and promote early buy-in, with the aim of accelerating business as usual adoption post-Beta. The Alpha phase plan was reviewed, and has pivoted from developing a digital tool to detailing a zone for the next hydrogen project from offshore wind. This change in focus was largely due to ensuring greater value for gas and electricity network customers and business activities.

Phase2--Alpha(October.2023--March.2024): Identifying that the hydrogen switch- over will be a gradual process, this phase seeks to narrow down, identify and detail a first hydrogen from offshore wind zone, with a view to subsequent additions of hydrogen generation capacity. This work will give clarity on existing or new infrastructure requirements at landfall to accommodate offshore wind, on both a national and regional level. Furthermore, for onshore assets, the project will gain an understanding of their proximity to electrical or gas grids, and what that looks like for rural communities. Target customers (additional to project partners) will be engaged via a dedicated dissemination work package to ensure buy-in for future delivery of the identified area and project.

Phase3--Beta (July.2024--Dec.2027): The Beta Phase will take forward the project zone identified in Alpha, and conduct the next steps required for delivery. This might include small-scale demonstration projects or more detailed design work.

The consortium will expand to include developers (e.g. offshore-wind/additional green hydrogen) with capacity to support full-scale physical demonstrations, undertaken in collaboration with customers, using OREC assets and gas network

operators. Foreground IP will be protected in preparation for commercialisation,

e.g. patents and/or confidential information restrictions.

Phase-Yr1 post-Beta(Jan.2028--June.2029): Full-scale physical demonstrations of identified projects, to build case studies and ensure learnings for subsequent additions of hydrogen generation capacity to the network. This will prevent the current infrastructure assets from becoming stranded and accelerate business as usual adoption of the ideas developed in Phases 1-3.

Target customers will benefit from new revenue streams, and from CAPEX/OPEX reduction, which will reduce network operating costs and network service costs, ultimately benefiting the consumer via reduced energy costs. Successful development of a UK customer base(including global companies) presents an export opportunity that does not currently exist. Direct/indirect CO2 savings will also benefit society.

All project partners have access to the tools required to deliver the work and are appropriately resourced with capacity for scale.

NGN's Head of Systems Development and Energy Strategy was engaged throughout Discovery, and will continue to support Alpha via: attendance at project meetings; reviewing project progress and shaping activity based on gas network knowledge.

HyCoRe aims to provide the best possible planning advice to clients regarding which zone is most appropriate for their project. The core project team are not incentivised to inappropriately promote hydrogen at the expense of other viable options, or vice versa, and, therefore, will not undermine the development of competitive markets.

Policy, standards and regulations (not scored)

No derogations will be required as part of the Alpha phase of the project as no physical trials will be undertaken. As no derogations are required for the Alpha phase no stage gates are proposed.

Within WP5 of the Alpha phase we will be undertaking a review of the economic regulatory and market frameworks, identify any barriers both to physical trials and wider rollout and identify options for addressing these barriers.

The rollout potential of the HyCoRe method is likely to be informed by Government policy decisions that are yet to be made which learning from the Alpha phase will be able to inform. This includes Government's upcoming decision relating to hydrogen for domestic heat that is expected in 2026.

With regards to HSE standards and GSMR standards, there is no expectation that any challenges will be encountered during the Alpha phase, significant work has already been undertaken by NGN and the wider gas industry under programmes, such as H21, to provide the required evidence to demonstrate the safety case for future hydrogen networks. Longer term deployment and scaling of the solution will be impacted by the UK Government's upcoming decision relating to hydrogen for domestic heat that is expected in 2026.

Notwithstanding the fact the project will develop learning that will inform Government decision making, Government already has a target of 10GW of hydrogen production by 2030. This project will contribute to achieving this target

Value for money

HyCoRe Alpha offers value for money in that project success will clearly illustrate how industrial scale hydrogen production from offshore wind can be integrated into the gas network in the UK, delivering economically efficient outcomes for consumers and de-risking delivery of net zero. Based on project findings, a Beta- phase demonstration will be proposed to demonstrate the concept, with the aim of promoting business-as-usual adoption post Beta and accelerating towards industrial scale rollout. Longer-term, HyCoRE will reduce costs associated with offshore-wind/hydrogen production and its integration into the energy network.

This will reduce the gas/electricity network's capital/operational costs, leading to lower consumer bills. Wider project impacts directly benefitting the consumer/taxpayer include:

- Novel IP created/held in UK with export potential;
- CO_2 reduction-contribution to UK 2050 net-zero targets;
- Supporting UK based SME's (Kinewell/Unasys) to increase international competitiveness;

- Improved energy system robustness/resilience e., reduced reliance on non UK- based energy suppliers where geopolitical developments may put the energy source at risk.

Tax/revenue from the above.

Associated Innovation Projects

○ Yes (Please remember to upload all required documentation)
◉ No

Supporting documents

File Upload

Show and Tell HyCoRE Alpha.pdf (1) - 1.9 MB
SIF-HyCoRE-Alpha-WP5-Combined_PUBLIC.pdf (1) - 1.2 MB
HyCoRe WP3 - Executive Summary.pdf (1) - 624.0 KB
HyCoRe Alpha Work Package 4.pdf (1) - 2.7 MB
Alpha End of Phase Report.pdf (1) - 300.1 KB
2024-05-24 HyCoRe Alpha Phase WP2 Summary report_PUBLIC.pdf (1) - 806.0 KB
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SIF-HyCoRE-Alpha-WP5-Combined_PUBLIC.pdf - 1.2 MB
HyCoRe WP3 - Executive Summary.pdf - 624.0 KB
HyCoRe Alpha Work Package 4.pdf - 2.7 MB
Alpha End of Phase Report.pdf - 300.1 KB
2024-05-24 HyCoRe Alpha Phase WP2 Summary report_PUBLIC.pdf - 806.0 KB
SIF Alpha Round 2 Project Registration 2024-01-18 2_33 - 103.7 KB

Documents uploaded where applicable?

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