

Notes on Completion: Please refer to the appropriate NIA Governance Document to assist in the completion of this form. The full completed submission should not exceed 6 pages in total.

NIA Project Registration and PEA Document

Date of Submission

Jan 2021

Project Reference Number

NIA_CAD0068

Project Registration

Project Title

I0342 Cumbrian Hydrogen vision and pathway – Phase 1 Feasibility

Project Reference Number

NIA_CAD0068

Project Licensee(s)

Cadent

Project Start

January 2021

Project Duration

0 years and 7 months

Nominated Project Contact(s)

Cadent Gas Ltd – Helen Boyle

Project Budget

£43,158.00

Summary

The objective of this project is to create a vision and a pathway that assesses the key drivers for the creation of a hydrogen system in Cumbria.

Nominated Contact Email Address(es)

Innovation@cadentgas.com

Problem Being Solved

Development of a Hydrogen economy in Cumbria can dramatically reduce existing carbon dioxide emissions from within the County and support a pivot to a clean growth future. Cumbria has the potential to become a regionally and nationally significant supplier of Clean Energy and Hydrogen in tandem with the wider North through projects like HyNet and others. A Vision for Hydrogen in Cumbria can be a call to action for stakeholders and investors, and a Pathway of initial steps will direct the way forward. This project looks to create this initial vision and pathway which can be subsequently built upon in further work if needed.

Recent publications such as the UK Government's Ten Point Plan for a Green Industrial Revolution from UK Government identifies Hydrogen Generation as a key priority and commits to delivery of 5GW equivalent of hydrogen by 2030, driven by "SuperPlaces" at the forefront of technological development. Hydrogen will play an important part of the UK's plans for decarbonising heat, power and transport alongside Offshore Wind, Nuclear and CCUS. The scale of the task and the ambition required was clearly articulated in the recently published Committee on Climate Change's work with regards to the 6th Carbon Budget. This work points to the fact that there needs to be 68% reduction in carbon emissions compared to 1990 baseline by 2030 and a 75% reduction by 2035. To meet these targets there will need to be a wholesale shift in energy systems and hydrogen will be a central component of this shift.

Cumbria is potentially uniquely placed to be a forerunner in hydrogen technology, particularly with strong links to both off-shore wind and nuclear technology. Cumbria today contributes around 11% of the UK offshore wind and is set to significantly grow in the near future as a result of Crown Estate Round 4 which creates the opportunity of 7GW of additional wind capacity around the UK and

Cumbria is set to be a major benefactor of this. Alongside Offshore wind Cumbria is very well positioned in new nuclear to be one of the “Lead Sites” for UK-Small Modular Reactor (SMR) technology and the future development sites for both STEP Fusion and High Temperature Gas Reactors. This will also enable the large new build proposal for Moorside by EDF. The UK will need up to 50GW of new nuclear generation by 2050 alongside new offshore wind and hydrogen.

Due to the opportunities around off-shore wind and nuclear in Cumbria, hydrogen can also present a market opportunity and this project looks at the early potential of the region to move at pace and grasp the opportunity. This project looks at how initial hydrogen projects within Cumbria can be developed utilising existing technologies and evolve to become a net exporter of green hydrogen by building on developments in offshore wind and nuclear energy.

Method(s)

This project looks to use experienced contractors who have been responsible for initiating and subsequently developing the HyNet NW hydrogen/CCUS into one of the UK’s leading clusters to develop a vision and subsequent pathway for hydrogen in Cumbria. This vision will encompass hydrogen production, consumption, storage and infrastructure.

Subsequently the Pathway will lay out a credible and achievable plan in stages taking account of existing plans and projects in the county and NW, technology readiness, location availability, anticipated consenting challenges, and Government policy to support hydrogen and therefore underpin investment.

This project can be broken down into two main work packages which are:

1. An initial stage which will consider the future Vision for Hydrogen supply and demand in Cumbria, economic and technical viability, and the deliverability and potential economic viability of that Vision
2. A more detailed analysis of physical and natural assets, site locations, utilisation of existing distribution and transmission networks including potential repurposing and broader capability, leading to a proposed development Pathway of enabling policy, strategy, action and deliverable projects that will enable growth of supply and enable demand.
 - o Generate a Pathway of actions, enablers and projects that will form the future hydrogen economy for Cumbria
 - o Will propose how an integrated partnership of industrial and regional stakeholders and businesses can take forward the identified opportunities
 - o And quantify the regional economic and social value generated by the growth of a new hydrogen economy in Cumbria.

Scope

The Phase 1 initial study will comprise analysis of;

Potential hydrogen demand in Cumbria and the wider North / North West / UK

Preliminary options for Hydrogen production in Cumbria;

Blue hydrogen production

Green hydrogen production from offshore wind and other renewables

Hydrogen production from nuclear

Hydrogen storage opportunities and options

Hydrogen infrastructure – connecting the opportunities for repurposing/linking networks

Cumbria and beyond including connection to HyNet

Understanding the natural clusters in Cumbria and linkages

Identify Safety and Environmental concerns that are anticipated to be prevalent within the group of stakeholders and communities most affected, and how these will be addressed

Supply Chains, Skills and Capability – high level view of existing and future needs

High level view of the potential economic and social value for Cumbria

Creation of a Vision document that builds on this preliminary analysis, with the engagement of local stakeholders

Planning for the Part 2 Study to develop the forward Roadmap in more detail.

Subject to positive outcomes from the Phase 1 study a second subsequent phase, building on that work will be initiated. It will be funded separately and its scope will comprise of;

- To confirm the potential sub regional hydrogen demand in Cumbria and the wider North / North West / UK identifying how a Cumbrian hydrogen network would link with the wider NW;

- Provide a clear view of current infrastructure in the different parts of Cumbria which might be established or repurposed to enable supply, transport, storage and industrial use of hydrogen and associated carbon;
 - Based on the analysis of existing infrastructure, to determine which areas represent the most attractive for the development of sources of hydrogen supply and a hydrogen network;
 - Explore the technical and organisational issues associated with the use of hydrogen to reduce CO2 emissions from manufacturing industries and to provide guidance on its potential as an emissions reduction approach;
 - Determine how the use of hydrogen in industry might function as an enabler for the wider use of hydrogen in the natural gas network to supply both the commercial and domestic sectors;
 - Consider the alignment with R&D and Innovation activity associated with Hydrogen in the North that will enable the programme, in particular the NP11 Clean Growth Strategy and N8 Universities Hydrogen focus;
 - Determine the potential for the use of hydrogen in power generation (large and small local scale) and to give consideration to the role this might have in managing seasonal and daily supply and demand fluctuations;
 - Provide guidance on the most cost-effective configuration for low carbon hydrogen production, supply and transport in the selected area, recognising technical, commercial, market and financing issues;
 - Scope the practicality of CCS infrastructure for a standalone project not predicated on major infrastructure created as part of a major power generation scheme, given the uncertainty in current policy; and
 - Outline the next steps to advance towards first deliverable projects proposition;
- o Pathway of actions, enablers and projects that will form the future Hydrogen economy for Cumbria taking account of other Clean Energy developments (Offshore wind, nuclear, community energy)
 - o Will propose how an integrated partnership of industrial, academic and regional stakeholders and businesses can take forward the identified opportunities
 - o And quantify the regional economic and social value, and carbon and emissions reduction benefits generated by the growth of a new Hydrogen Economy in Cumbria.

Objective(s)

The objective of this project is to create a vision and a pathway that assesses the key drivers for the creation of a hydrogen system in Cumbria. This project's objectives are to look at and develop the following areas, which are:

The potential for substantial local value creation as a regional supplier of Hydrogen

The Irish Sea and coastline offer opportunities for generation at scale of "blue" hydrogen with CCUS and "green" hydrogen from intermittent renewables

The nuclear energy heritage, capability and presence of key stakeholders provides an opportunity to deploy new technology (eg SMR, AMR, HTR) for both baseload power and hydrogen generation

And, opportunities for hydrogen infrastructure given existing physical assets

- o Local hydrogen and CO2 storage site development in geological structures
- o Adjacency opens the potential to connect to HyNet being developed in the Cheshire-Liverpool-Manchester-North East Wales regions
- o National Grid Gas Transmission infrastructure running through the county could be repurposed for long distance hydrogen transmission in the future
- o And mitigation options given the relative weakness in the existing electricity power grid network

Clean Energy investments in offshore wind, nuclear and hydrogen will enable a whole energy system "Clean Energy Cluster" which will stimulate new growth in jobs, skills and investment throughout the Clean Energy and Hydrogen supply chains.

The objective to create an ambitious coherent Vision and Pathway towards a hydrogen economy in Cumbria, which will demonstrate the viability of hydrogen as a feasible and affordable route to decarbonising a predominantly rural and physically large county. The project will identify the actions for stakeholders and investors to accelerate progress towards making this happen and establish what next steps could look like.

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

n/a

Success Criteria

The success criteria for the project can be summarised as follows:

- The creation of a Vision and Pathway document which can be shared with relevant stakeholders.
- Align hydrogen in Cumbria with other projects that are being developed in N.Wales, the North West and the North of England more generally. This will ensure learning is shared and risks can be mitigated where necessary.
- Develop strong working relationships with key stakeholders in the region. This can be stakeholders who have involvement in the public and academic sector in Cumbria, also the private sector who are involved with offshore wind, nuclear and oil and gas, network operators and project development companies who are presently working in Cumbria.
Enable Cumbria to act quickly and confidently with strong project partners should a first step project be identified.

Project Partners and External Funding

This project will be funded via NIA and all the work will be completed in RIIO GD1. The project is being led by Cadent. The additional project partners are Northern Gas Networks and National Grid Gas Transmission.

The funding split is as follows:

Cadent – £20,000

Northern Gas Networks – XXX

National Grid Gas Transmission – XXX

Progressive energy are responsible for delivering the project

Potential for New Learning

To date, no vision or pathway has been set-up which investigates the potential of a hydrogen economy across the whole of Cumbria. However, there is some hydrogen learning that can be linked into such as EDF and Lancaster University's work at Heysham. This project therefore presents the opportunity for new learning

Scale of Project

This project is an entirely desk-based study. This study is a small-scale vision and pathway project which looks to describe the opportunities in Cumbria at a reasonably high-level. This project can therefore be considered a strategy project rather than a detailed engineering project. This project will form the basis for further, more in-depth, research should it be required and project partners are agreed.

Technology Readiness at Start

TRL2 Invention and Research

Technology Readiness at End

TRL3 Proof of Concept

Geographical Area

This study is centred upon the region of Cumbria in the North West of the England. Although this project is centred on Cumbria it

should be noted that this does not mean that links with other hydrogen/decarbonisation projects in the North West or North of England cannot be identified and made stronger.

Revenue Allowed for the RIIO Settlement

Not Applicable

Indicative Total NIA Project Expenditure

External Cost - £35,000

Internal Cost - £8,158.00

Contingency - £0

Total Cost - £ 43,158.00

Project Eligibility Assessment Part 1

There are slightly differing requirements for RIIO-1 and RIIO-2 NIA projects. This is noted in each case, with the requirement numbers listed for both where they differ (shown as RIIO-2 / RIIO-1).

Requirement 1

Facilitate the energy system transition and/or benefit consumers in vulnerable situations (Please complete sections 3.1.1 and 3.1.2 for RIIO-2 projects only)

Please answer **at least one** of the following:

How the Project has the potential to facilitate the energy system transition:

n/a

How the Project has potential to benefit consumer in vulnerable situations:

n/a

Requirement 2 / 2b

Has the potential to deliver net benefits to consumers

Project must have the potential to deliver a Solution that delivers a net benefit to consumers of the Gas Transporter and/or Electricity Transmission or Electricity Distribution licensee, as the context requires. This could include delivering a Solution at a lower cost than the most efficient Method currently in use on the GB Gas Transportation System, the Gas Transporter's and/or Electricity Transmission or Electricity Distribution licensee's network, or wider benefits, such as social or environmental.

Please provide an estimate of the saving if the Problem is solved (RIIO-1 projects only)

The potential benefits of this project look to identify early costings for hydrogen whether this is from green/blue hydrogen or the creation of hydrogen associated with electricity generation from nuclear power. There has been much work done on the relevant costs of different types of hydrogen by organisations such as Imperial College and Committee on Climate Change and work done by projects such as HyNet NW, H21 and H2HSaltend. This work has provided a strong foundation in hydrogen costs.

This project will look to build upon this costing work by identifying initial costs of hydrogen production in Cumbria. If initial costs are thought to be positive, then this can set the context for further work establishing hydrogen as a primary method of decarbonising Cumbria's CO2 emissions. This project in itself will not solve a problem, but instead look to provide more information on decarbonisation through the use of hydrogen in Cumbria.

Please provide a calculation of the expected benefits the Solution

N/A – this is an initial feasibility study that will look to develop a Vision and a Pathway for a hydrogen economy in Cumbria.

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

There are now 7 recognised industrial clusters in the UK. This includes Humberside, Merseyside, Teesside, South Wales, Grangemouth (Scotland), The Thames Estuary and Southampton. All of these clusters are at different stages of maturity with regards to decarbonisation plans and their ambitions with hydrogen. Now these main clusters are becoming increasingly more established other areas are being considered to look at and establish strong regional potential decarbonisation plans, one of these areas in Cumbria.

The knowledge created in Cumbria has the potential to be replicated in all industrial areas in the UK and new and emerging projects too. This is particularly the case were there is a large proliferation of offshore wind and nuclear energy as is seen in Cumbria.

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

N/A – you cannot directly replicate the work being done in Cumbria and use this as a basis to rollout hydrogen across the UK.

Requirement 3 / 1

Involve Research, Development or Demonstration

A RIIO-1 NIA Project must have the potential to have a Direct Impact on a Network Licensee's network or the operations of the System Operator and involve the Research, Development, or Demonstration of at least one of the following (please tick which applies):

- A specific piece of new (i.e. unproven in GB, or where a method has been trialled outside GB the Network Licensee must justify repeating it as part of a project) equipment (including control and communications system software).
- A specific novel arrangement or application of existing licensee equipment (including control and/or communications systems and/or software)
- A specific novel operational practice directly related to the operation of the Network Licensees system
- A specific novel commercial arrangement

RIIO-2 Projects

- A specific piece of new equipment (including monitoring, control and communications systems and software)
- A specific piece of new technology (including analysis and modelling systems or software), in relation to which the Method is unproven
- A new methodology (including the identification of specific new procedures or techniques used to identify, select, process, and analyse information)
- A specific novel arrangement or application of existing gas transportation, electricity transmission or electricity distribution equipment, technology or methodology
- A specific novel operational practice directly related to the operation of the GB Gas Transportation System, electricity transmission or electricity distribution
- A specific novel commercial arrangement

Specific Requirements 4 / 2a

Please explain how the learning that will be generated could be used by the relevant Network Licensees

This project looks to develop an outline hydrogen vision and pathway for Cumbria. Three network companies are involved in this project due to the relevant importance of Cumbria. The learnings from this project can be used in other projects that are positioned around the UK, particularly in relation to how offshore wind and nuclear can be utilised to enable early hydrogen projects.

Other regions which may have a similar energy landscape to Cumbria includes parts of the South West around Hinkley in Somerset and also East Anglia around the Sizewell nuclear installation. The learning generated from this project could relate well to other areas of the UK.

Or, please describe what specific challenge identified in the Network Licensee's innovation strategy that is being addressed by the project (RIIO-1 only)

N/A

- Has the Potential to Develop Learning That Can be Applied by all Relevant Network Licensees

Is the default IPR position being applied?

- Yes

Project Eligibility Assessment Part 2

Not lead to unnecessary duplication

A Project must not lead to unnecessary duplication of any other Project, including but not limited to IFI, LCNF, NIA, NIC or SIF projects already registered, being carried out or completed.

Please demonstrate below that no unnecessary duplication will occur as a result of the Project.

This is the first project to look at the potential of hydrogen throughout Cumbria.

The funding licensees involved with this project have discussed the project with other Network Licensees and can confirm that there is

no duplication with either other historic projects or those currently being considered.

If applicable, justify why you are undertaking a Project similar to those being carried out by any other Network Licensees.

n/a

Additional Governance And Document Upload

Please identify why the project is innovative and has not been tried before

The project will represent the first attempt by a network licensee to develop a Vision and early deployment Pathway for hydrogen in Cumbria. Much attention has been given to the more established industrial clusters and now this is being given to new areas inline with the UK's decarbonisation ambitions.

Relevant Foreground IPR

n/a

Data Access Details

n/a

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

This project will look at the development of hydrogen in Cumbria. It will involve looking at a range of different technologies, engaging with new stakeholders and will be reliant on new business models so it cannot be considered BAU activity. It is appropriately funded through NIA.

Please identify why the project can only be undertaken with the support of the NIA, including reference to the specific risks(e.g. commercial, technical, operational or regulatory) associated with the project

The project conforms to NIA requirements. Commercial risks to be overcome, which require NIA support include the current absence of a relevant support mechanism for CCS and hydrogen as a fuel. Mechanisms are currently under consideration by Government, but in the meantime, any network licensee would struggle to justify investment of this nature. However, support in the short-term for this project, under the NIA, will allow all licensees to manage commercial risk and then move quickly at the relevant time to deliver maximum benefits to customers in the form of lower costs of network deployment.

This project has been approved by a senior member of staff

Yes