

Acorn Hydrogen

Public Summary

Produced as part of the Low Carbon
Hydrogen Supply Competition Phase 2

May 2021

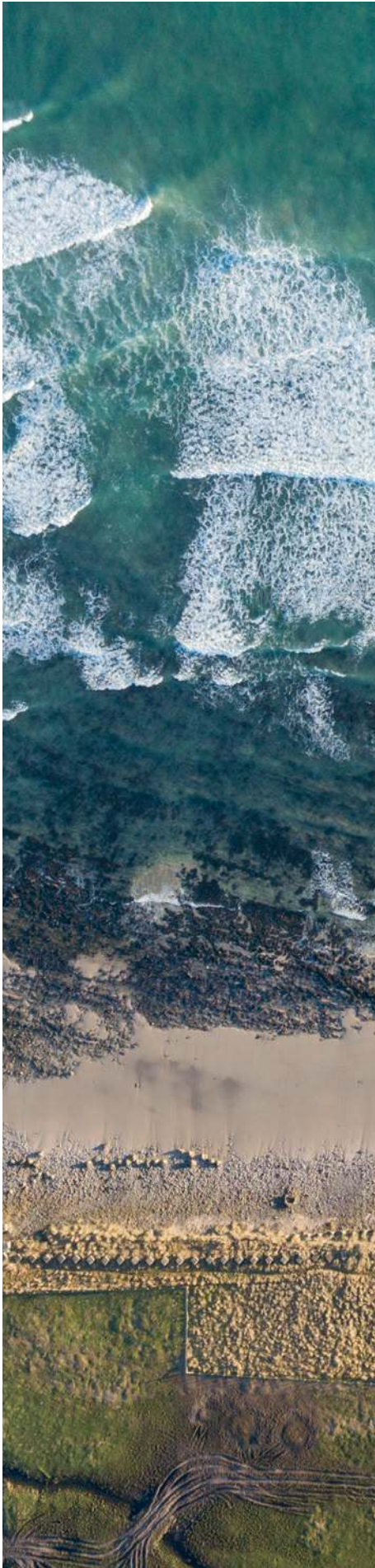


Department for
Business, Energy
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Foreword



The Acorn Hydrogen Project plans to build a full-scale hydrogen generation facility at the St Fergus Gas Terminal and could be a significant contributor to the Scottish and UK Governments targets to deploy 1GW of hydrogen production by 2025 and 5GW by 2030. If the current timescales are met, then the Acorn Hydrogen facility could be one of the first operational large-scale clean hydrogen plants in Europe.

For the last 2 years, the Acorn Hydrogen Project team has been working hard to deliver the feasibility and concept selection work programmes for the project as part of the UK Government's Low Carbon Hydrogen Supply Competition. This support has allowed us to progress all aspects of the project, from the technical Basis of Design and HSE factors through to the commercial Route to Market and establish the project's potential for the UK economy.

This phase of the Project has created new materials of relevance for other hydrogen projects as well as building on work that has already been conducted by other major projects in the UK, such as the other recipients of the Hydrogen Supply Competition fund.

The Low Carbon Hydrogen Supply Competition has been instrumental in progressing the Acorn Hydrogen project through its concept evaluation and selection phases and we are delighted to now take the project forward into Front-End Engineering Design and progress it towards a Final Investment Decision in early 2023.



Tim Dumenil

**Acorn Hydrogen
Project Manager**

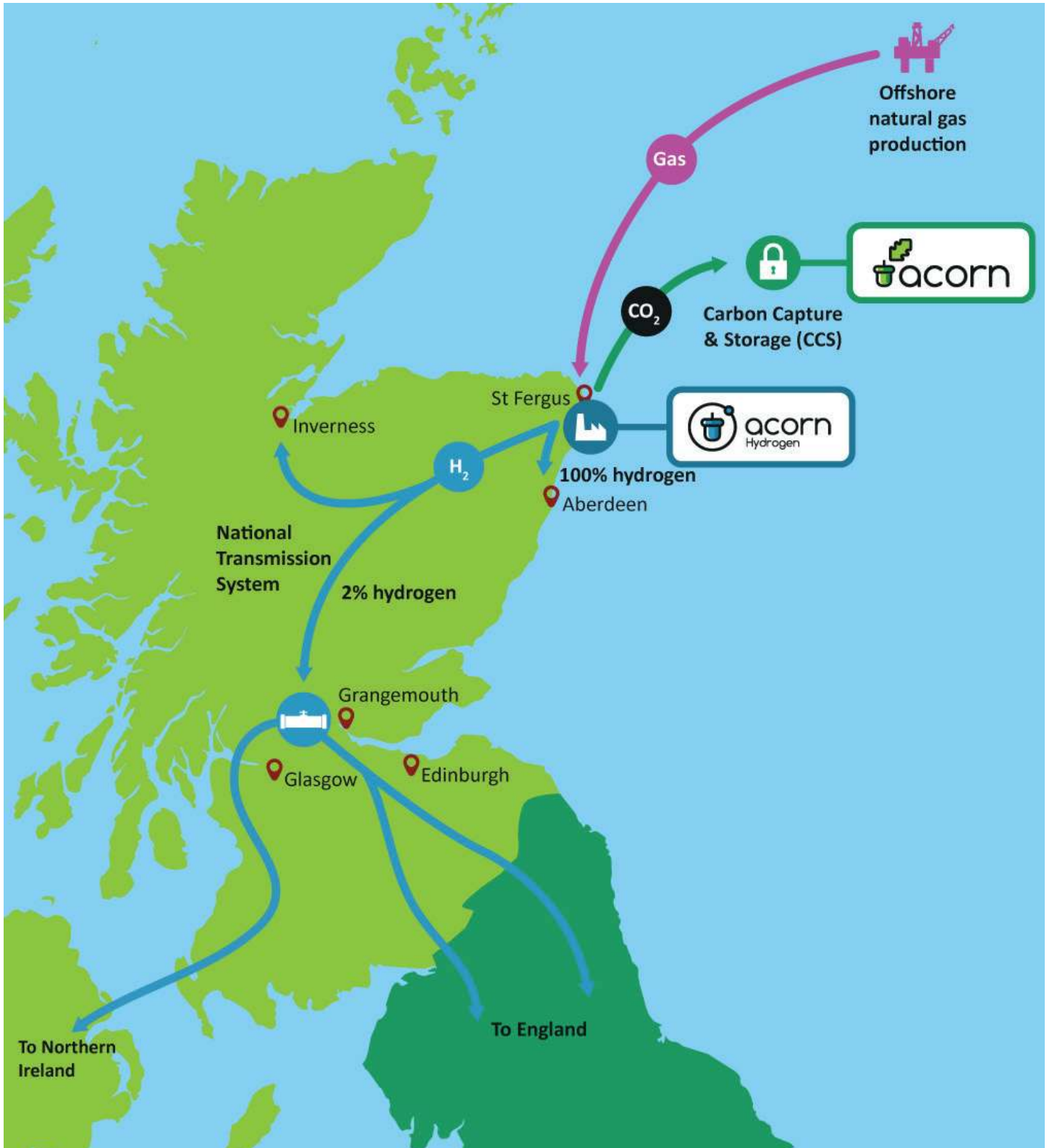


Figure 1: Acorn Hydrogen will supply as an initial 2% hydrogen blend by volume into the natural gas National Transmission System at St Fergus and 100% clean hydrogen to Aberdeen via the Aberdeen Vision Pipeline.
 Alt text: Map of Scotland showing how Acorn Hydrogen will convert natural gas landing at St Fergus through a hydrogen reformer into CO₂ for sequestration via Acorn Carbon Capture and Storage and into hydrogen to supply an initial 2% hydrogen blend by volume into the natural gas National Transmission System at St Fergus and 100% clean hydrogen to Aberdeen via the Aberdeen Vision Pipeline.

Under the Hydrogen Supply Competition Phase 2, the work undertaken consisted of sixteen deliverables: six technical deliverables, five non-technical deliverables, and five project management focused deliverables. The following summary contains highlights from some of these deliverables.



Acorn Hydrogen Concept Evaluation

- Building on the work undertaken during the first phase of the Hydrogen Supply Competition fund, the development concept in phase 2 was based around Johnson Matthey's Low Carbon Hydrogen technology.
- The estimated capital expenditure of the base case scenario is £426m, and the operating expenditure over a 25-year operating life is £1.6bn.
- First hydrogen production is scheduled for the start of 2026.



Technology Assessment and Recommendations

- Concept evaluation activity has been completed on reformer technology and reformer balance of plant including oxygen supply, CO₂ processing (separation, compression and conditioning) and hydrogen purification. Based on the findings, the recommendations include:
 - The Basis of Design and Technical Input to enable a Call for Tender for the reformer technology and its balance of plant prior to progressing with Front End Engineering Design for the project's entire battery limit.
 - The requirements for all the interfaces for the reformer (Unit 1) including supplies of natural gas, electricity and water and the arising hydrogen, CO₂ and waste water, and resulting safety considerations.
 - Further optimisations for completion during Front End Engineering Design on these interfaces for the site location of Unit 1 and the staged deployment of subsequent modular reformer units.
 - Further assessment required to optimise the reliability, availability and maintainability of operation.
 - The direction to be taken to further mature the route to market and associated design for subsequent build out phases.



Progressing to Final Investment Decision (FID)

- A Statement of Requirements has been concluded for the next stage of project development which has outlined all the Technical and Non-Technical detailed study work and its associated resource and schedule.
- The programme of work is underway aimed at achieving Final Investment Decision in the first quarter of 2023 to subsequently deliver first hydrogen production at the start of 2026.



The Role of Acorn Hydrogen in Enabling Net Zero

- Building on the foundations established by Acorn Hydrogen, Scottish hydrogen production could reach between 19 to 121 TWh per year by 2050. By 2030 Acorn Hydrogen could provide £130m of GVA per annum and provide up to 1600 jobs.
- The associated peak job creation/retention would amount to between 13,000 and 28,900 jobs by around 2040.
- The proposed scenarios could see a cumulative GVA of £8.6 to £22.5 billion added to the UK economy between 2020 and 2050.



Route to Market Report

- Acorn Hydrogen is a key step in the UK transition to Net Zero. It is targeting hydrogen production at scale in the mid 2020's and would be a key part of achieving the UK's ambition of 1GW of production capacity in this timeframe.
- Hydrogen development across the UK could add up to £18bn per year to the UK economy with total employment of 221,000 by 2050.
- A 2% blend by volume of hydrogen into the National Transmission System is the primary route to market for phase 1 of Acorn Hydrogen, delivering a CO₂ emissions reduction of 400,000 tonnes a year. A 10% blend by volume by 2030 in the natural gas flowing through St Fergus could enable over 2 million tonnes a year of carbon removal from the gas network.

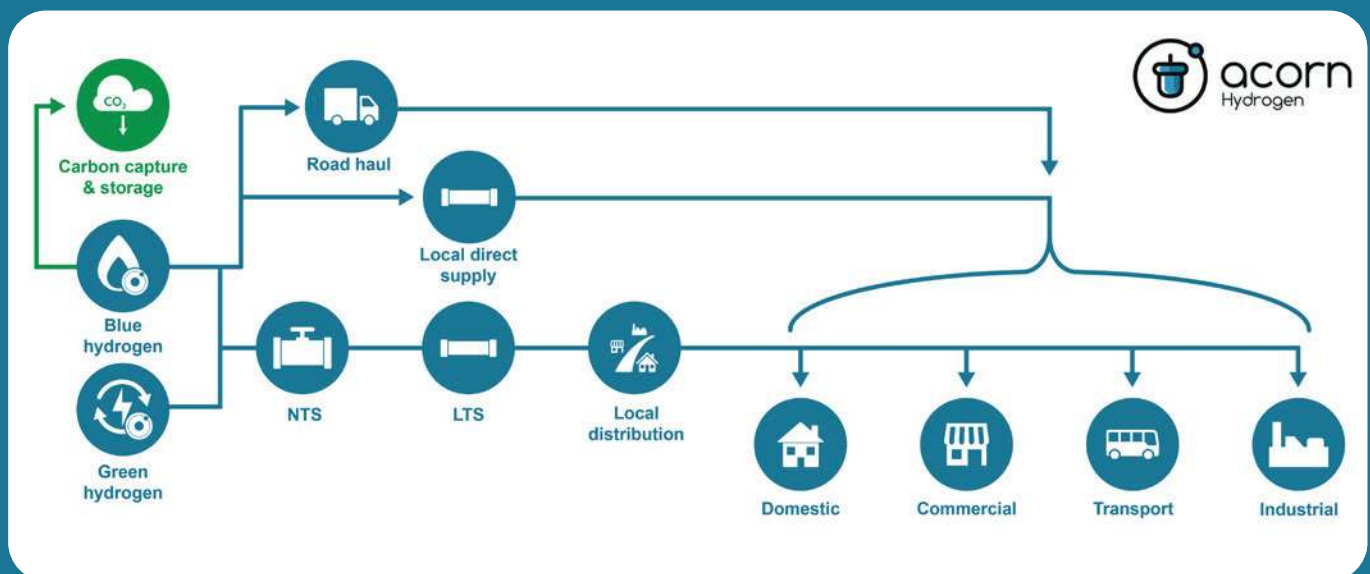


Figure 2 Hydrogen supply chain.

Alt text: visual illustration of the supply chain elements of the hydrogen route to market



What's next for Acorn Hydrogen?

The next stage of the Acorn Hydrogen Project will be completed as part of the Scotland Net Zero Infrastructure (SNZI) suite of activity, co-funded by the Acorn Development Agreement and part of Innovate UK's Industrial Strategy Challenge Fund - a UK Government fund focussed on providing money to kick start clean growth projects. SNZI brings together academic and industrial partners to develop a major package of work designed to progress a national low carbon infrastructure.

The Acorn Hydrogen Project will progress through to a Final Investment Decision, seeking parallel completion of technical, including Front End Engineering Design (FEED), and non-technical work scope to enable a Final Investment Decision in early 2023. Building on the work completed in the Concept Evaluation study, the necessary consents, commercial model development, transfer of hydrogen and CO₂, and stakeholder engagement that enables the project to reach a Final Investment Decision (FID) will be developed. A successful FID outcome, including the securing of funding will enable the project to move into detailed design, construction and operation.

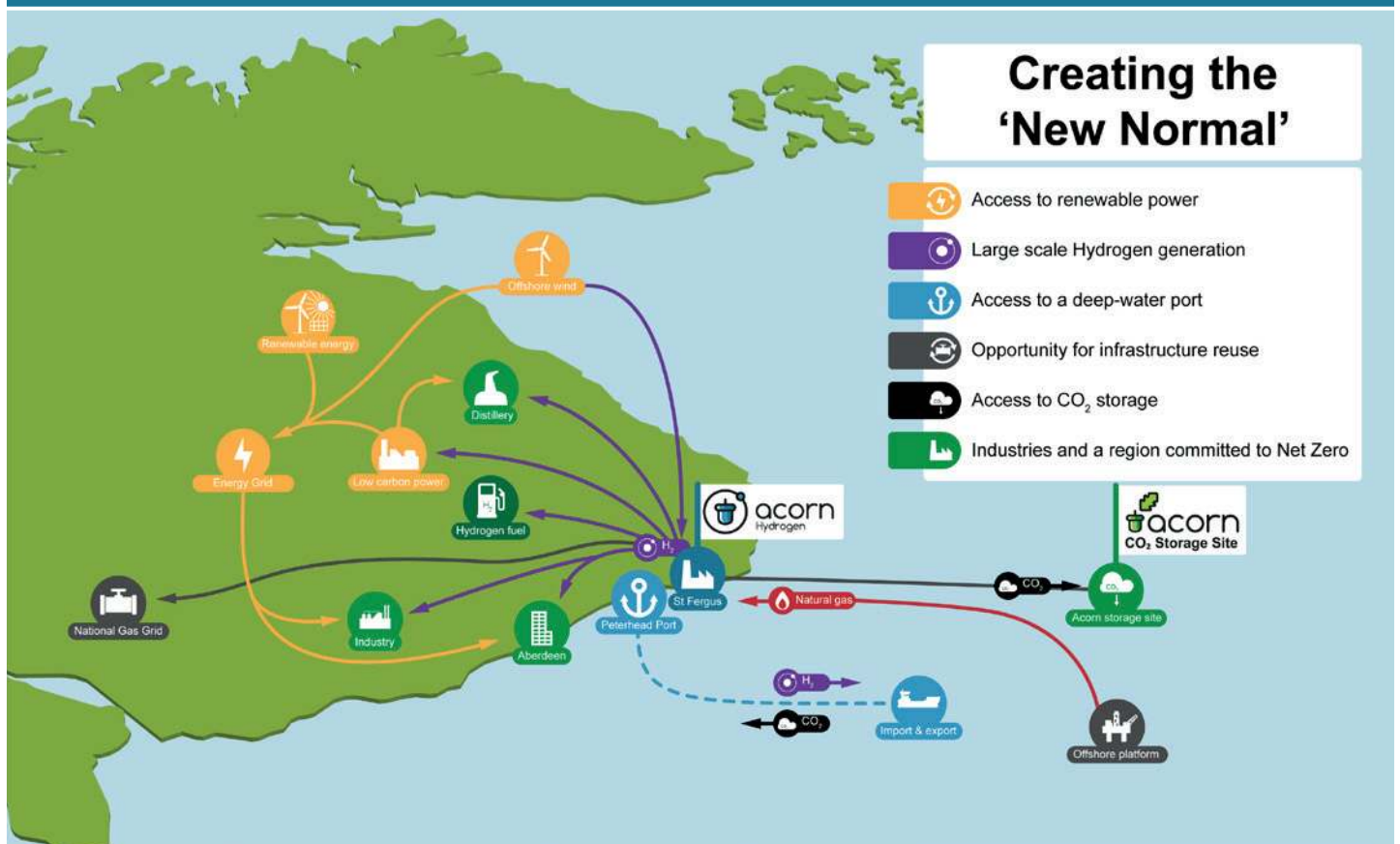


Figure 3 The full chain infrastructure elements for Acorn Hydrogen and its build out.

Alt text: A map showing how hydrogen infrastructure could be connected around St Fergus and throughout Scotland via the Acorn project.



Scotland has in abundance all the raw ingredients necessary for the production of low-cost, clean hydrogen.

Paul Wheelhouse, Former Minister for Energy, Connectivity and the Islands. Extract from the Foreword of Scottish Government's Hydrogen Policy Statement (December 2020)

