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Unlocking the system value of hydrogen

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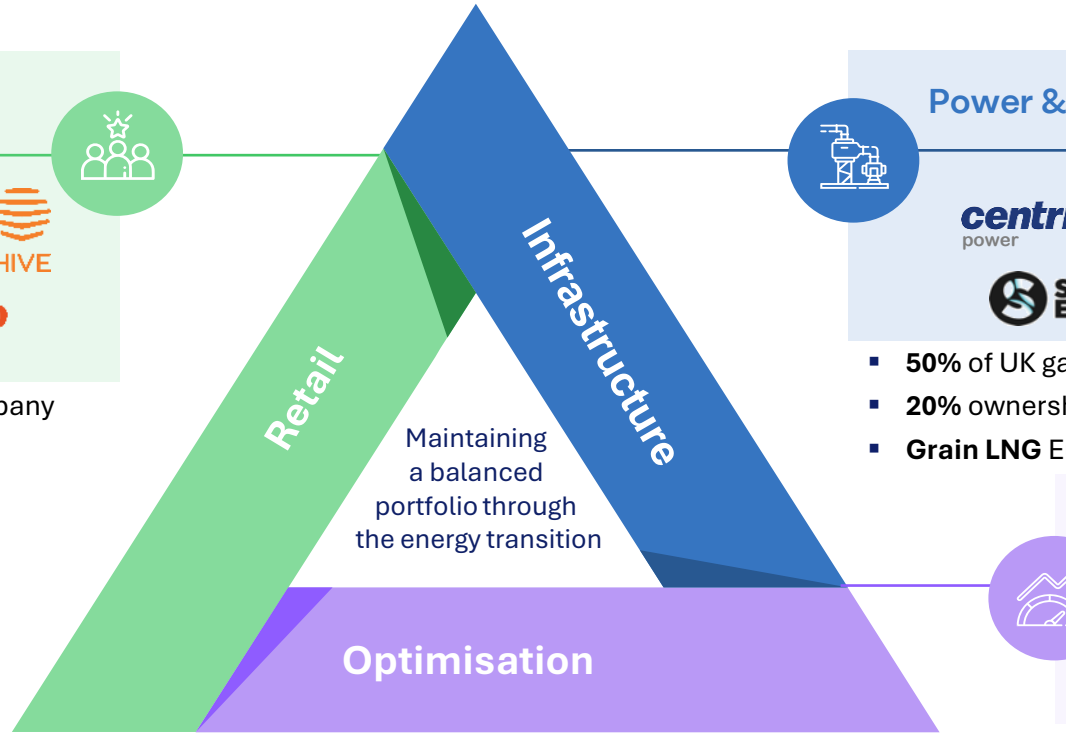
Centrica is an integrated energy and services company founded on a 200-year heritage of developing assets across the energy value chain

10m+ Retail customers

British Gas · Bord Gáis Energy · HIVE · phjones · DYNO-ROD

- UK's largest heating installation company
- **7,000** heating engineers



Power & Gas Infrastructure

centrica power · centrica energy storage+ · SPIRIT ENERGY

- **50%** of UK gas storage capacity via Rough
- **20%** ownership of the UK Nuclear fleet
- **Grain LNG** Europe's largest LNG terminal

Leading Optimisation capability

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- **Over 19.5GW** renewable and flex capacity managed
- **260** LNG cargoes traded globally

22,000	Employees Worldwide	**10m+**	Residential Customers	**CDP A**	Ranking on climate change

In 2025 Centrica outlined an accelerated Climate Transition Plan with low carbon molecules critical to meeting our decarbonisation ambition

Climate Transition Plan: be a **net zero business by 2040*** and help our **customers be net zero by 2050**

Our entire value chain (all scopes) represent 28 mtCO$_2$e per year (c.7% of net UK territorial emissions)

Net Zero Centrica:

Scope 1 & 2 = 1.5 mtCO$_2$e

- Establish a **zero-emission fleet** of 9,000 LCVs
- Reduce our **property emissions** in the UK by 50% by 2030
- Grow our **low carbon asset portfolio** (solar, batteries, H_2 etc)

Net Zero Customers:

Scope 3 = 26.5 mtCO$_2$e

- Roll out **energy efficiency** and **energy management solutions**
- Deliver **low carbon technologies** (EV charging, electrification, H_2 etc)
- Supply energy from renewable assets (RES, biomethane and H_2)

Centrica Group illustrative H_2 fuel switching demand:

Gas Terminals

Thermal Power Generation

I&C CHPs

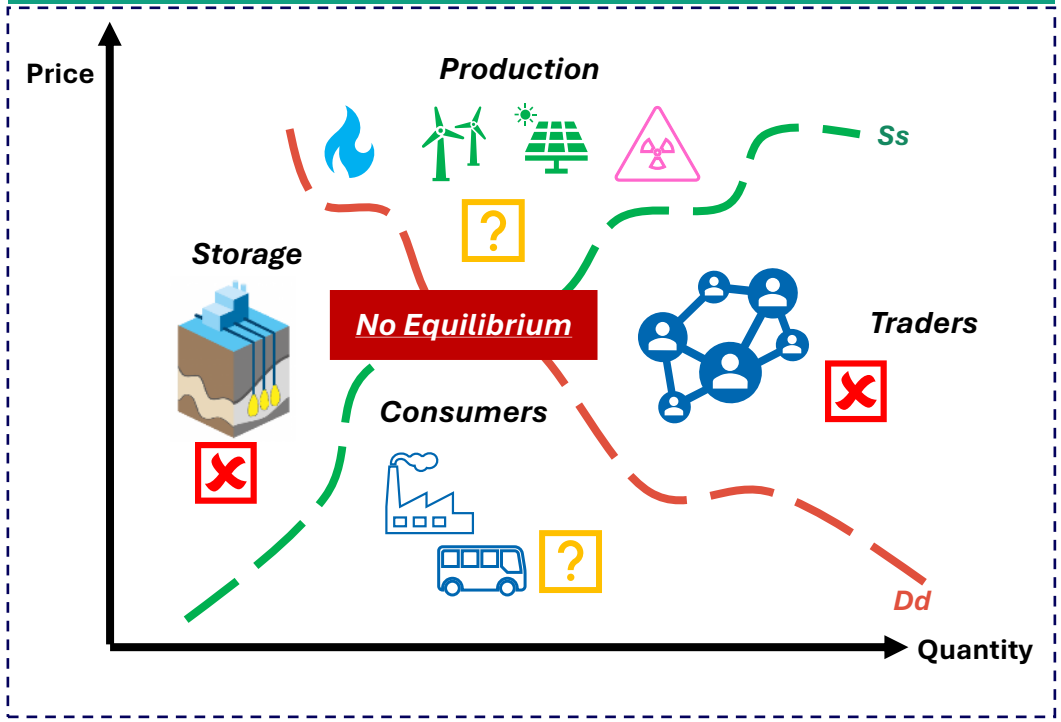
Additional demand

- British Gas fleet
- Domestic heating

* Net Zero Business target was accelerated by 5 years from 2045

Our long run vision is that the hydrogen economy can be co-ordinated by market signals across all parts of the value chain

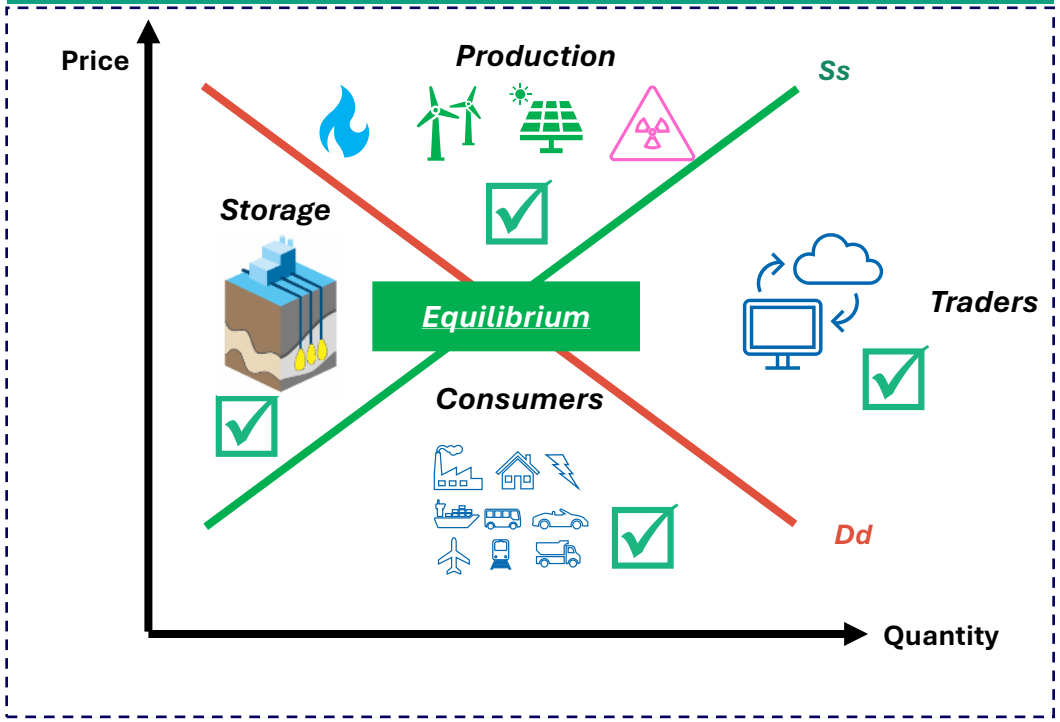
But today there is a 'chicken and egg' problem requiring policy intervention…



- Today, it's uncertain how demand and supply for H_2 will evolve
- We need to get on the technology learning curve and scale up

Evolution of the H_2 economy via infrastructure build-out

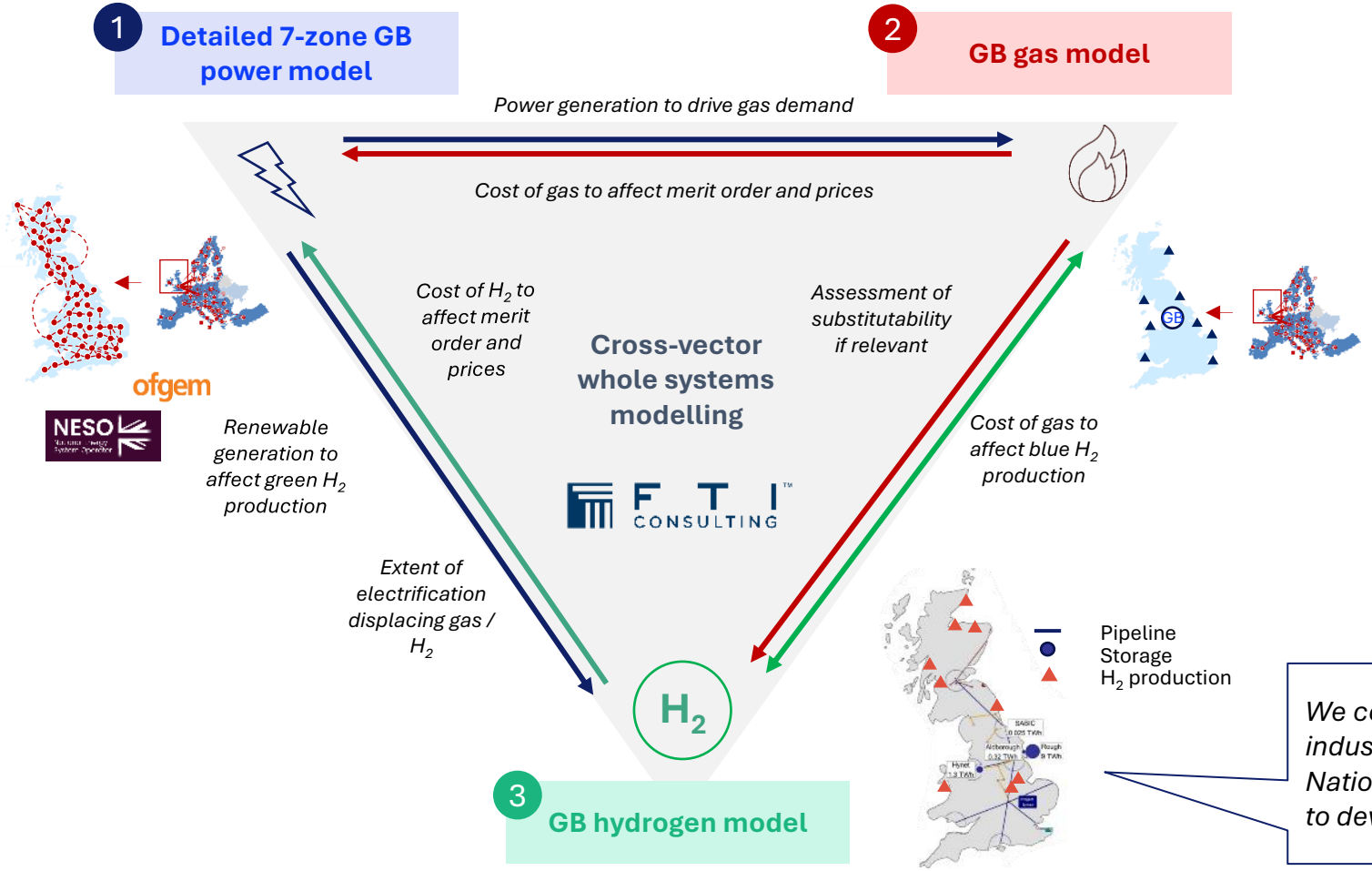
A functioning market will have interaction of demand and supply of H_2 determining spot market price…



- A fully functioning market with clear demand and supply signals
- Allows all parts of the value chain to function and thrive

To help us understand value of hydrogen pipelines and storage we commissioned one of the largest and most comprehensive UK energy system models

Co-developed a new whole-systems model including H_2



Our objective has been to understand the interplay among multiple energy vectors to assess key **policy, strategy** and **investment questions**.

- ✓ **Inform our policy stance** by assessing the overall role and value of H_2
- ✓ **Help us understand market interactions** and the development of the H_2 market
- ✓ **Support our investment decisions** including assessment of locational deployment of H_2 assets and market entry points

We collaborated with industry partners, including National Gas and NESO, to develop our approach

national gas

NESO National Energy System Operator

Department for Energy Security & Net Zero

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The model enables us to study the evolution of the energy markets and the financial impact on assets and consumers

Modelling outputs

Prices
- Hourly power prices (by zone)
- Daily gas prices
- Daily hydrogen prices

Elec outputs
- Generation by technology type
- Emissions
- Interconnector flows

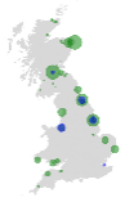
Gas outputs
- Gas entry and exit flows
- Interconnector flows

H2 outputs
- Hydrogen production by type (green/blue)
- Hydrogen storage and end use

Range of analyses

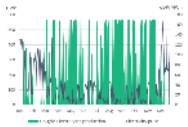
1) Market development and operations

a The **optimal size and locations for each asset type** from a system perspective

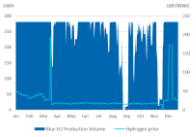


Green and blue hydrogen assets size and location in 2050 (core scenario)

b **How assets operate** in response to input prices and market prices



Green hydrogen output vs elec prices



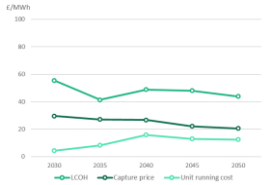
Blue hydrogen output vs hydrogen prices

c **How energy flows across the system** with respective to network configurations and limits

Net hydrogen flows in 2050 (core scenario)

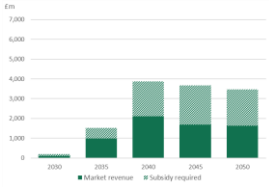
2) Financial impact on assets, government and consumers

a The **wholesale revenues** received by each asset[1]…



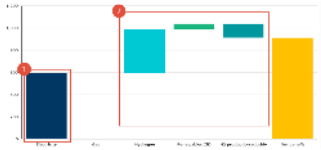
Green H2 revenues and LCOH

b …and the **potential "missing money"** that could be covered by business models



Green hydrogen revenues and subsidy requirements

c **Consumer and system impact** of different infrastructure scenarios



System cost impact of reduced storage

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It shows us that hydrogen storage can reduce whole system-costs and underpin secure, low-carbon power when we need it most in a net zero scenario

1

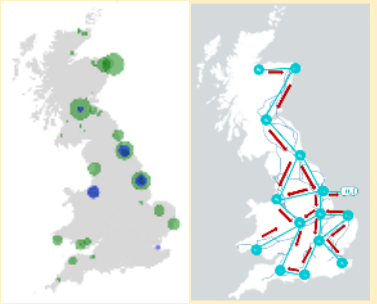
Storage unlocks cheaper green hydrogen… and cheaper electricity

- ✓ Storage decouples supply and demand → electrolysers can run when power is cheapest
- ✓ Capturing surplus wind/solar + reducing curtailment → materially reduces green H_2 and power cost

2

Transport enables optimal siting

- ✓ Electrolysers can locate at high-renewables nodes (esp. Scotland and NE England)
- ✓ Lowers system costs and relieves power network congestion



3

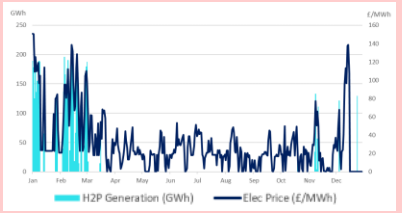
Strengthens seasonal balancing

- ✓ Stores low-cost hydrogen in summer for winter peaks
- ✓ Boosts the economics of additional renewables by providing a guaranteed offtaker

4

Lowers cost of H_2-to-Power and improves security

- ✓ Stored hydrogen fuels flexible generation during peak power periods
- ✓ Reduces reliance on unabated gas as it phases out → higher resilience and lower volatility



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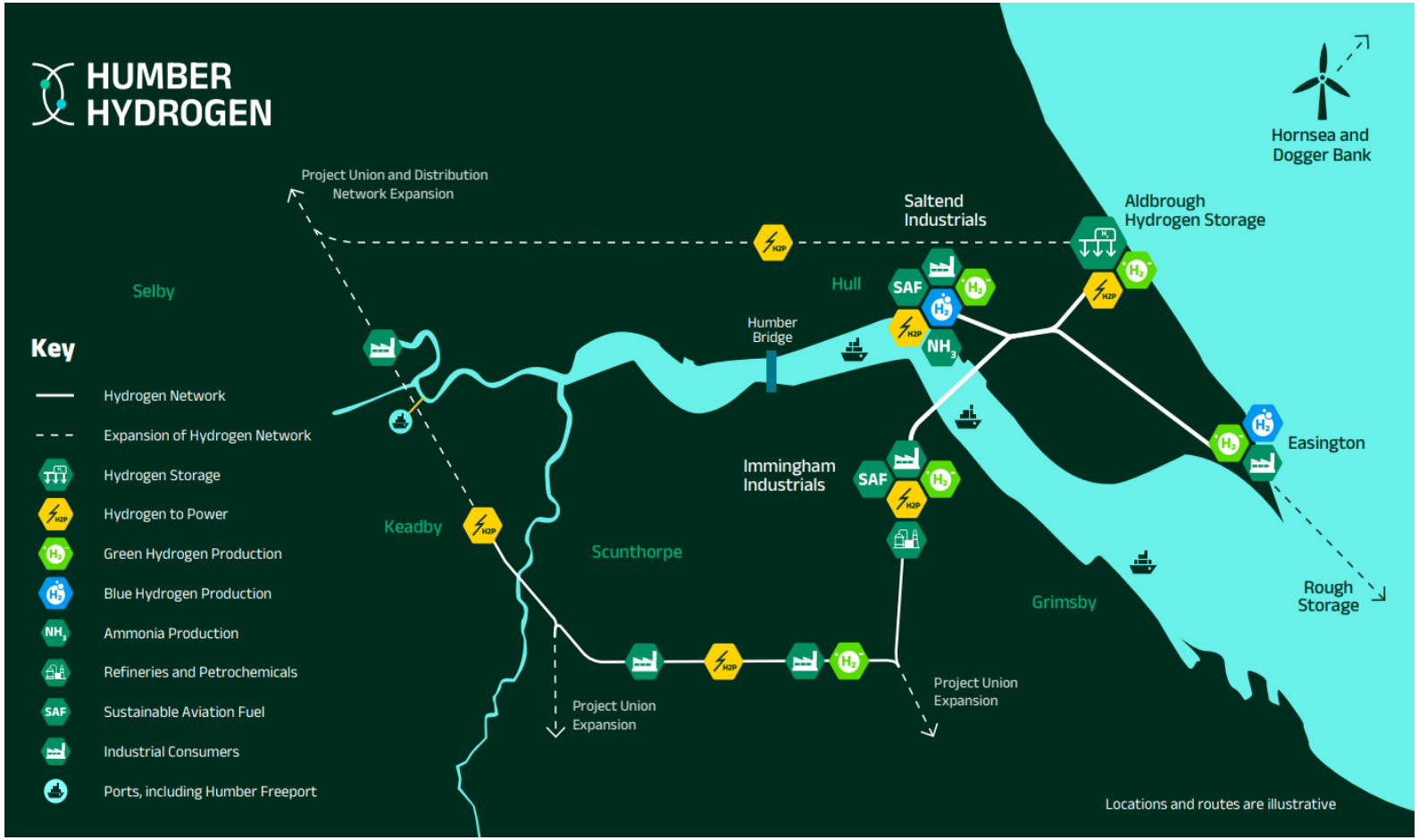
Our plan is to now implement the transition towards a hydrogen economy by establishing a first regional hydrogen system in the Humber



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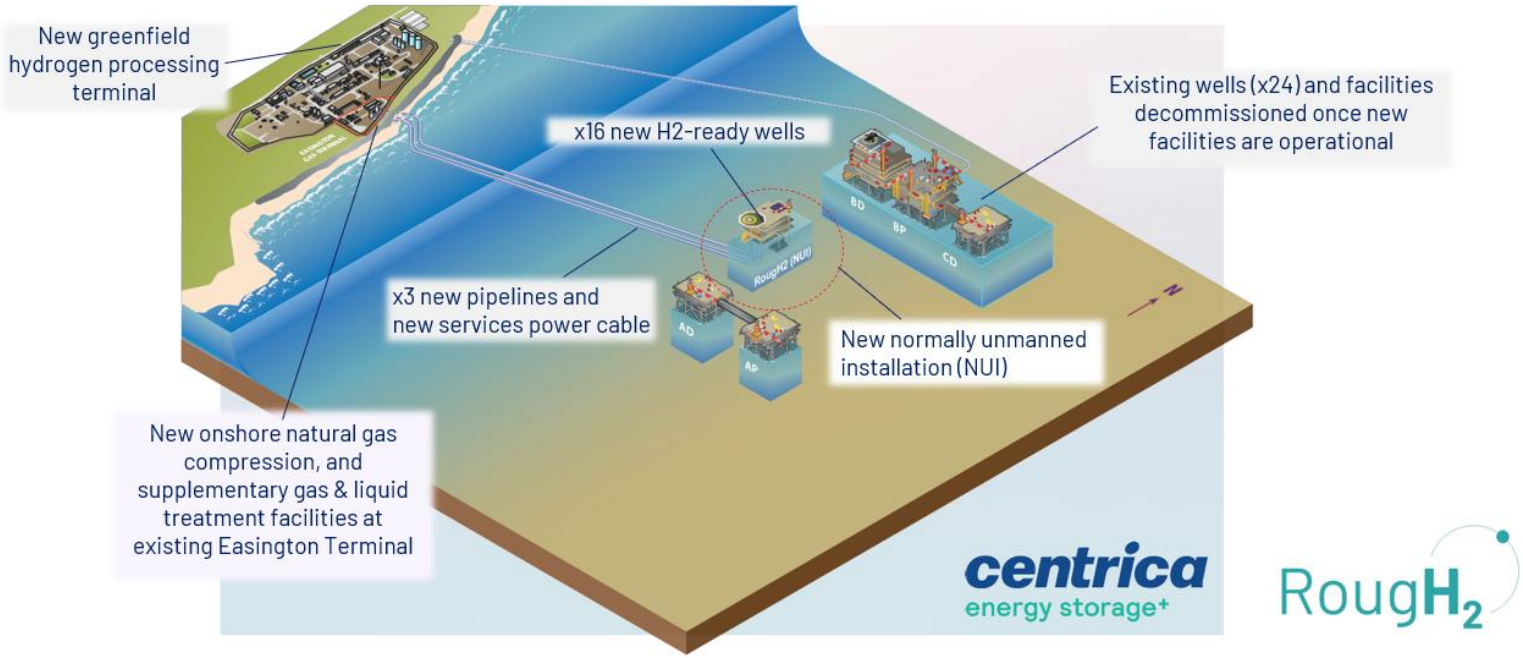
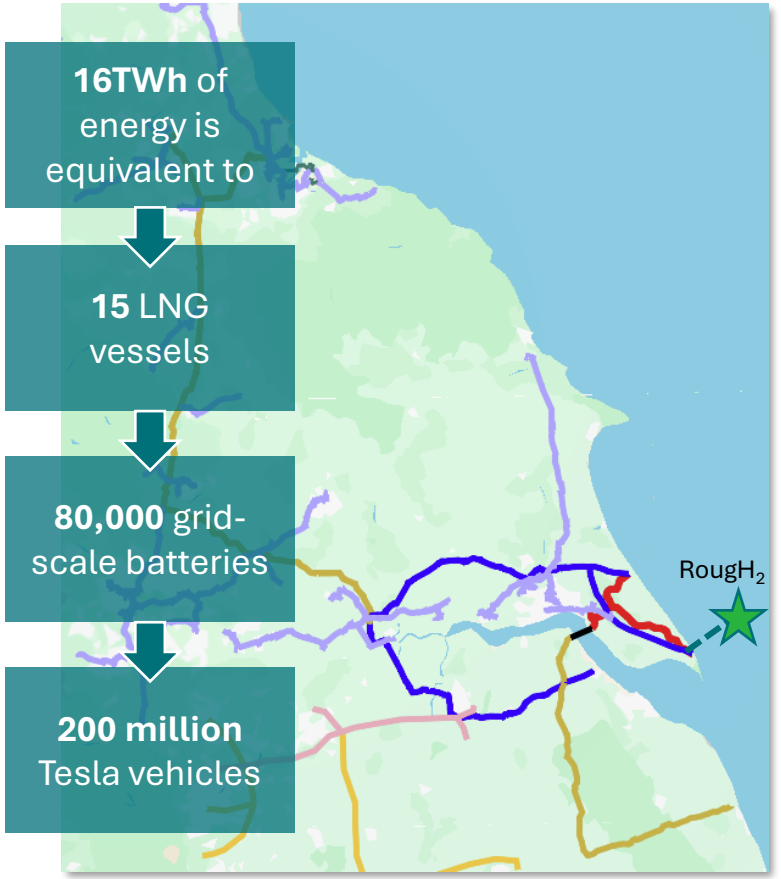
RoughH_2 presents unrivalled large-scale energy storage enabling GB whole system flexibility via hydrogen network development and integration

- **Phase 1** **120bcf natural gas storage re-development** with H_2-ready offshore infrastructure
- **Phase 2** **hydrogen storage up to 200bcf/16TWh** with additional new onshore hydrogen processing development (as H_2 economy needs)
- **FEED for Phase 1 complete**, Phase 2 pre-FEED completed





Notes: Based on LNG vessel size of 170k cubic metres, 50MW grid batteries with 4h duration, electric vehicle with 75kWh battery

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Please use the QR code to access the full report

Taking A Whole Systems Approach to Net Zero