Future of Gas

Webinar – 3 July 2023 at 10.00am

We will start at 10.02 to allow participants to finish previous meetings and join the call

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Welcome and Opening

Thank you for joining us today

- Hope you'll enjoy this interactive webinar
- This session will give you an update on our key projects as we transition toward net zero. We are taking into consideration a whole systems thinking approach and would like your thoughts.
- We want you to participate throughout the session and give us your questions, thoughts and ideas on the information you'll be hearing. You can do this by using slido.com and using the code #NGT3

Danielle Stewart
Project Director – Project Union

Logistics

- Should last around 60 minutes
- Questions and Polls via slido.com using #NGT3
- All attendees on mute and cameras off
- Slides and recording will be circulated

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Who will be speaking?

Tom Neal
FutureGrid Manager

Emily Ly
Hydrogen Strategy Manager

Ian Bennett
Innovation Delivery Manager

Michelle Hocknull
Customer & Stakeholder Lead Hydrogen/Facilitator

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Agenda

1. FutureGrid
2. Project Union
3. Gas and Electricity Transmission Infrastructure Outlook (GETIO)
4. Question and Answer Session

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Question to the audience

What are the opportunities of doing more work around whole system thinking / planning?

We'll come back to look at this after our last session today.

General Q&A will be open throughout the session.

FutureGrid

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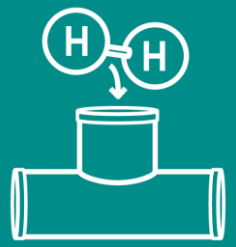
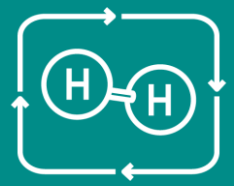
FutureGrid

A high-pressure **hydrogen test facility** using **decommissioned transmission assets,** to **demonstrate** the National Transmission System (NTS) can **transport hydrogen safely and reliably.**



Standalone hydrogen Tests
Standalone hydrogen test modules are operating alongside the main test facility, to provide key data required to feed into the main facility.



Offline hydrogen test facility
A representative range of NTS assets of different types, sizes, and material grades have been supplied from decommissioned assets to build the test facility.

Four key hydrogen concentrations are being tested:

- 2% hydrogen gas
- 5% hydrogen gas
- 20% hydrogen gas
- 100% hydrogen gas

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Offline hydrogen test facility

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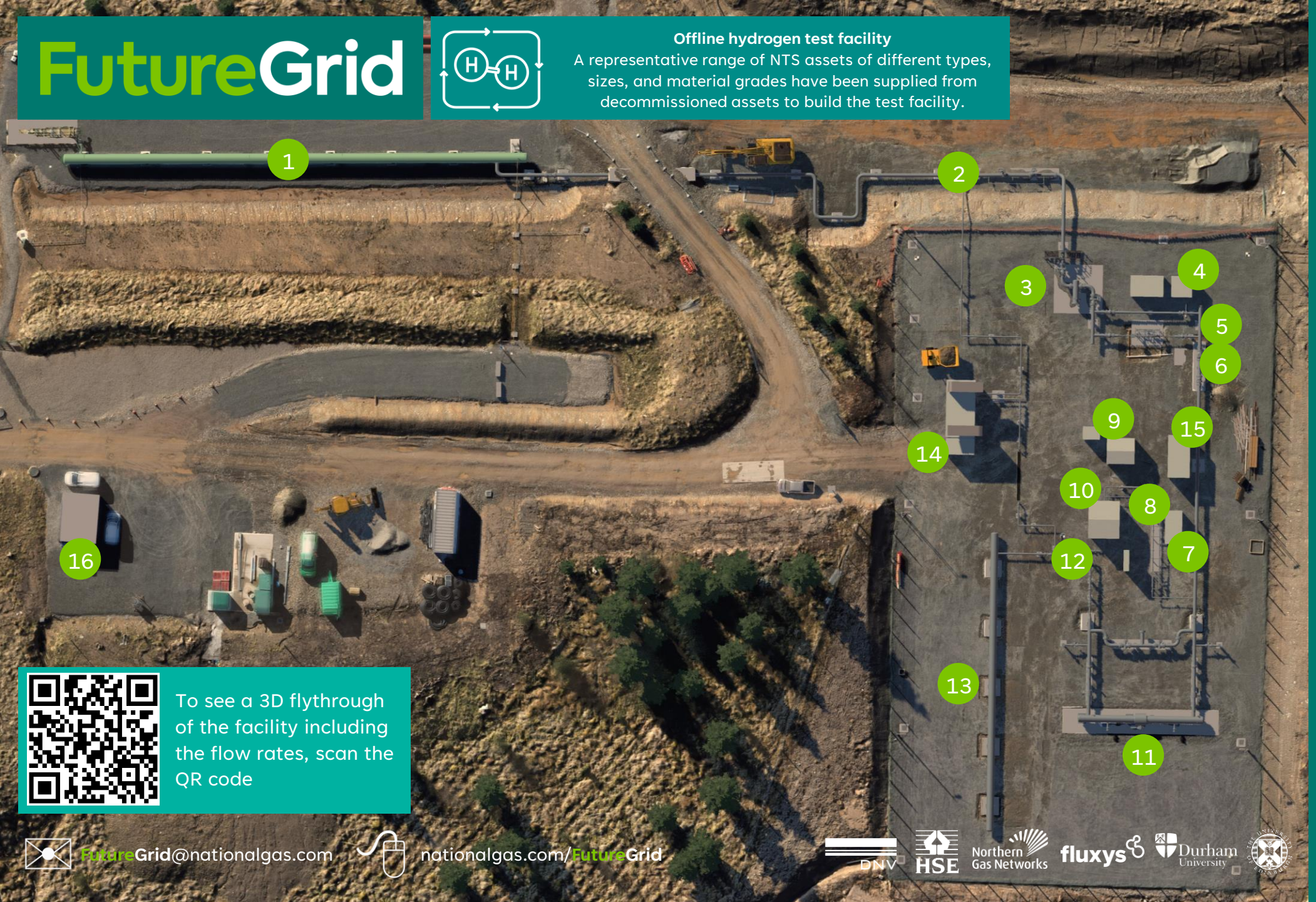

1. High pressure storage
2. Ball valve arrangement
3. Filter
4. Ultrasonic meter
5. Flow control valve
6. Non-return valve
7. Filter skid
8. Orifice plate meter
9. Boiler house & heat exchanger
10. Regulator skid
11. Pipeline isolation valve
12. Flow control valve
13. Low pressure storage
14. Recompression unit
15. Data centre
16. Control room

To see a 3D flythrough of the facility including the flow rates, scan the QR code

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Standalone hydrogen Tests

Standalone hydrogen test modules will operate alongside the main test facility, to provide key data required to feed into the main facility.

Material permeation testing

These tests are seeking to determine the rate at which hydrogen permeates through the pipe wall in a pressurised hydrogen environment.

Pipe coating and CP testing

This is the assessment of hydrogen impact on external pipe coatings as well as the cathodic protection system to identify any issues.

Flange testing

These tests will assess the effect of hydrogen on RF and RTJ flanged joints.

Asset leak testing

Hydrogen is more prone to leaking than natural gas. These tests will help determine the leakage rates and mitigations required.

Rupture testing

Investigating overpressures caused by delayed ignition of ruptures on a buried line containing 100% hydrogen.

Fatigue testing

Hydrogen asset fatigue testing 36” X60 pipe with 9 different weld types used twice. Running 75k cycles ~ 200 years service

19,000

pressure cycles completed

as of June 2023

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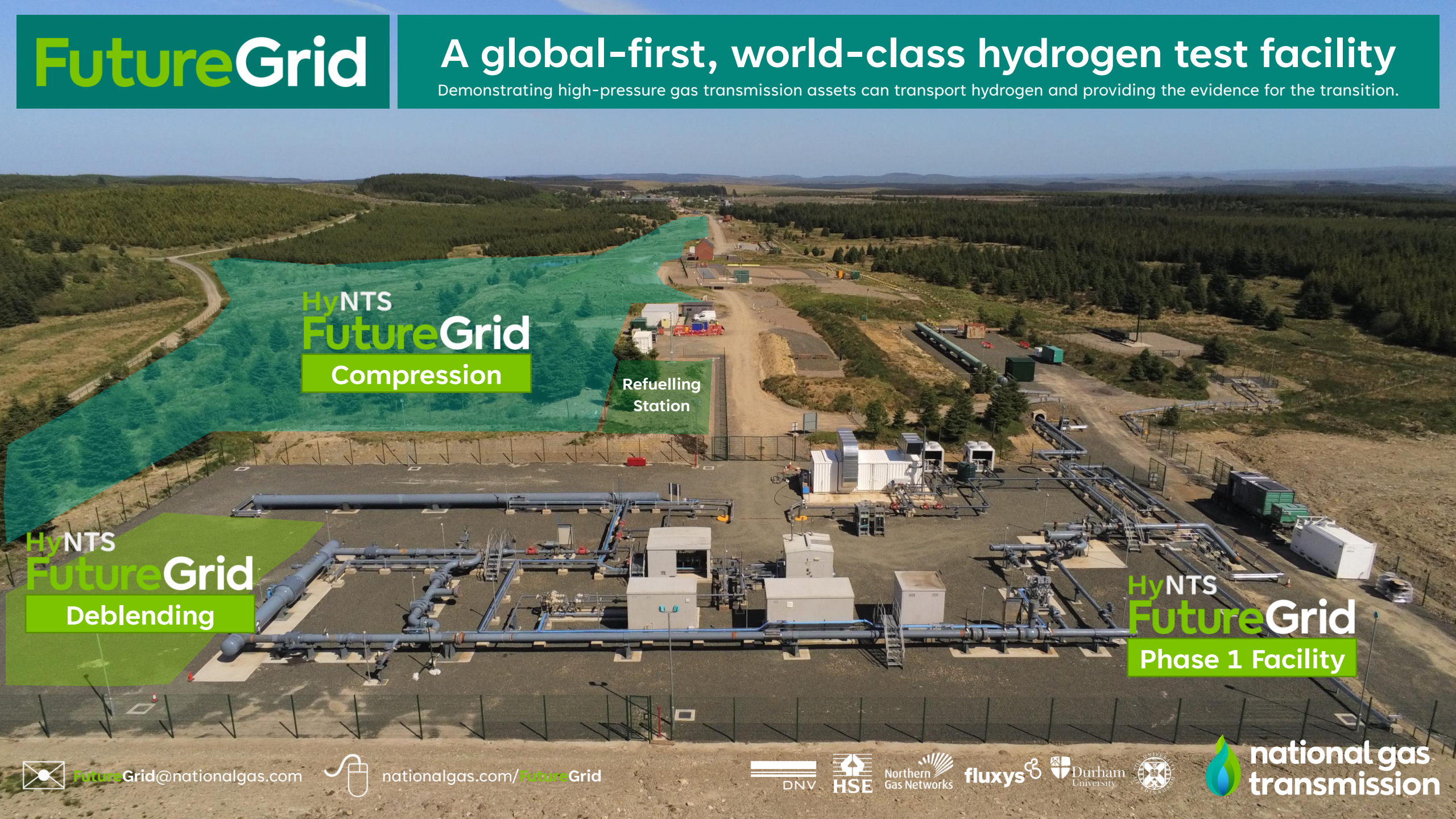
A global-first, world-class hydrogen test facility

Demonstrating high-pressure gas transmission assets can transport hydrogen and providing the evidence for the transition.



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ProjectUnion

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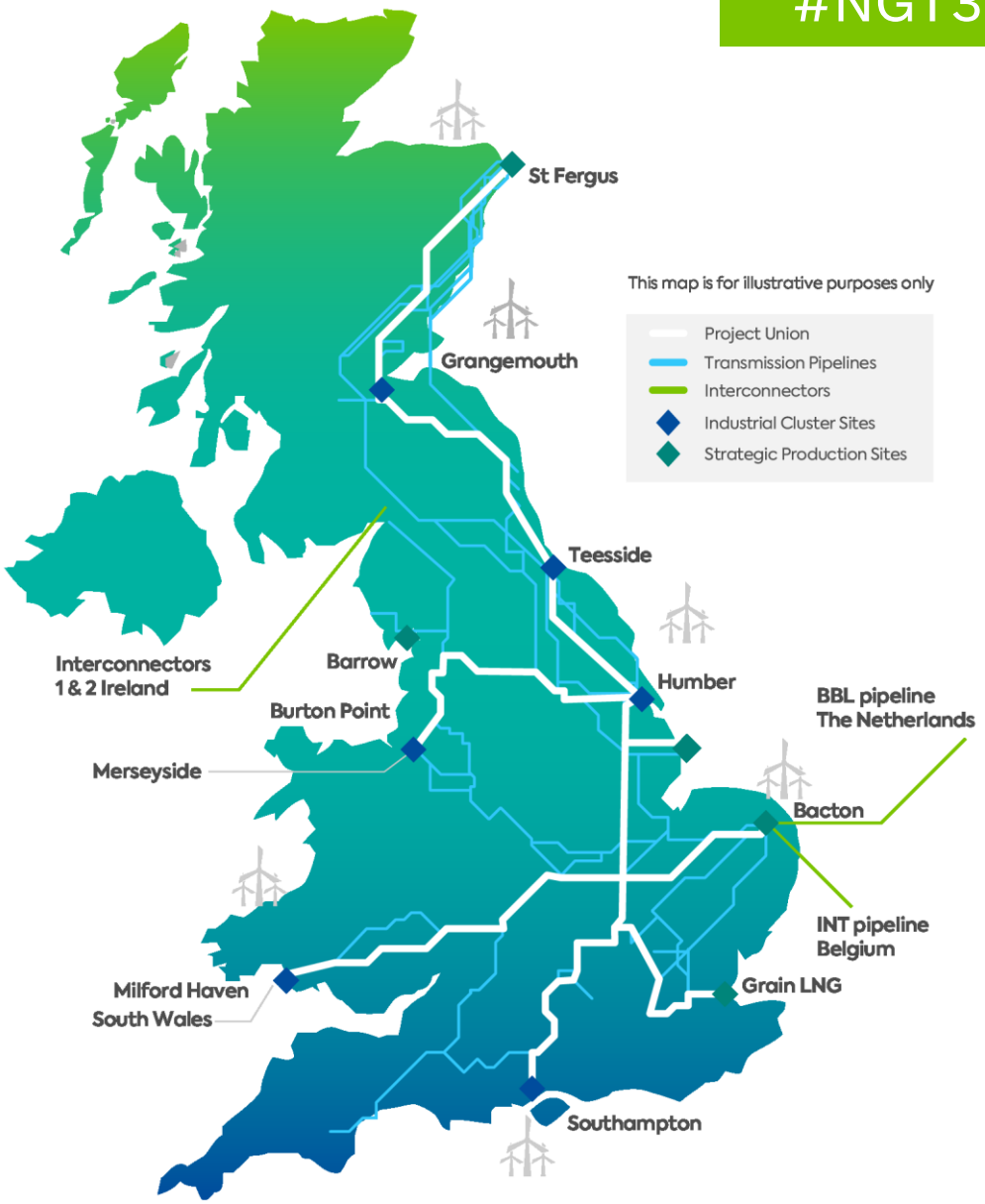
ProjectUnion

Project Union will connect, enable net zero and empower a UK hydrogen economy, repurposing existing transmission pipelines to create a hydrogen ‘backbone’ for the UK by the early 2030s.

- Repurpose ~2,000km of the NTS through a phased approach in line with Government’s cluster prioritisation and green hydrogen development
- Connect cross GB supply, demand and strategic storage sites, enabling growth of a UK hydrogen economy
- Use existing infrastructure to deliver a low carbon future, reducing environmental impact of new construction
- Enable early and affordable market growth of a low carbon hydrogen economy to achieve net zero



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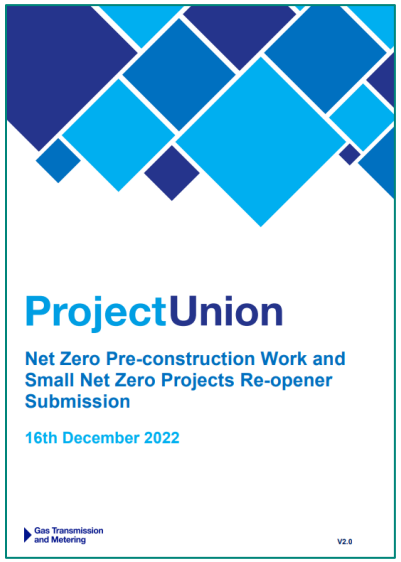
Timeline

DEC 16

PROJECT UNION FEASIBILITY PHASE REOPENER SUBMISSION



JAN 13

SQS RECEIVED

FEB 17

CONSULTATION OPEN

MAR 17

CONSULTATION CLOSED

APR 25

DECISION

£5.626M*

FUNDING UNDER NZASP REOPENER MECHANISM

£0.625M

ADDITIONAL CONTRIBUTION REQUIRED

*18/19 price base

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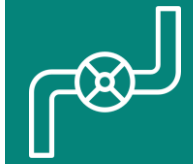
ProjectUnion: Feasibility Phase key deliverables and Funding outcome



Pre-Front End Engineering and Design (pre-FEED)

Phasing Strategy and Priority

Hydrogen market enabling activities

Technical Delivery
(£1.270)

Construction Plan
(£1.039)

Implementation Strategy
(£0.859)

Supply Chain
(£0.462)

Network Modelling
(£1.051)

Asset Management Plan
(£0.178)

Market Needs Analysis
(£0.413)

Engineering Policy Review
(£0.559)

Data
(£0.678)

Hydrogen Policy
(£0.042)

Programme Management
(£0.207)

Regulation*
(£0)

Commercial Frameworks*
(£0)

System Operator*
(Use It Or Lose It)

* Outside of NZASP re-opener scope

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Hydrogen Acceptability Study

Hydrogen / Blend Acceptability

- Focus on industrials / large consumers
- Implications for sites
- Implications for transmission network

We have commissioned Progressive Energy to carry out a hydrogen acceptability study on our direct connect customers. The final report is due in the Summer.

For more information on this project contact michelle.hocknull@nationalgas.com

Gas and Electricity Transmission Infrastructure Outlook 2050 (GETIO)

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Gas and Electricity Infrastructure Outlook 2050

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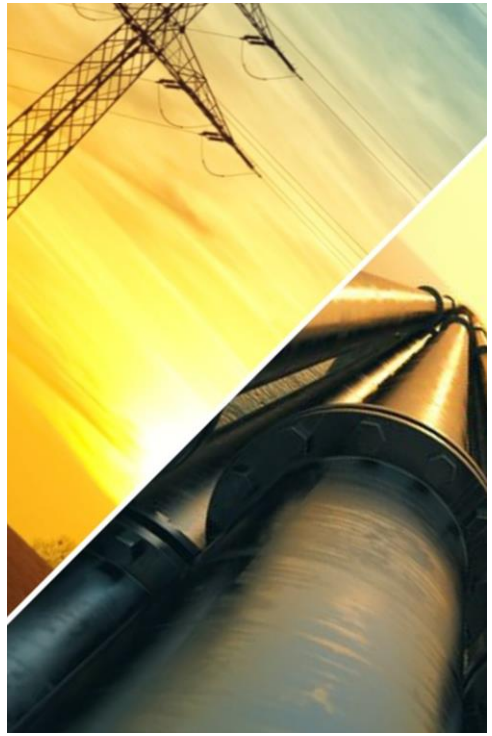
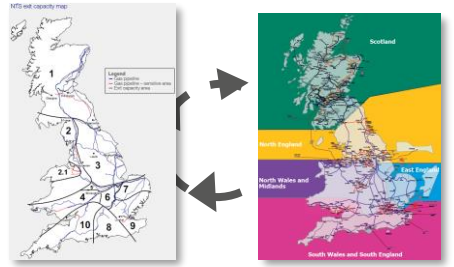
An integrated energy system study for Great Britain in 2050



Aim and Vision

Whole system planning is key to achieving Net-Zero in the most cost-effective way, whilst maintaining security of supply throughout.

This project will help guide the development of an effective GB market, regulatory and policy framework to realize the benefits of a more integrated and optimised system for future gas and electricity transmission, delivering Net-Zero energy to all sectors.



Model Configuration

23x Regions:
- 11 GB regions
- 9 offshore nodes
- 3 neighboring regions

4x Model Years
2025, 2030, 2040,2050

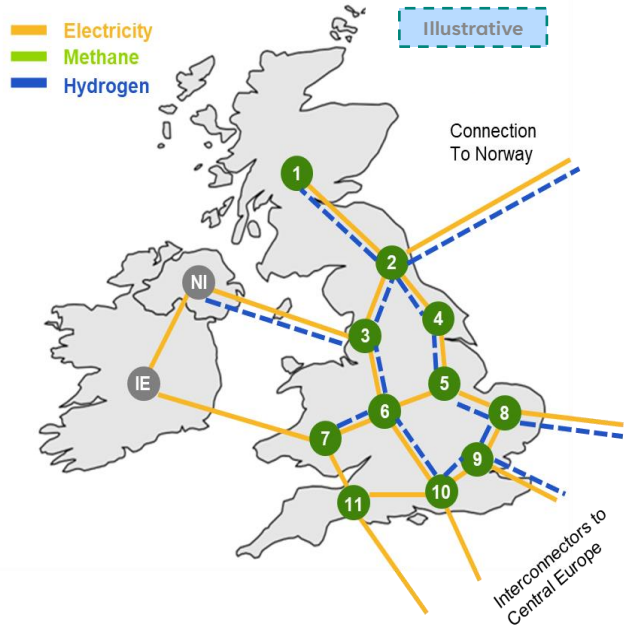
3x Scenarios

6x Rep. day:

3x Energy Carriers:
- Electricity
- Hydrogen
- Methane

Output

- **Transmission expansion** for hydrogen, methane & electricity
- **Investments** in generation, storage & conversion
- Use of **methane & hydrogen in power sector**
- **CO_2 emissions** over study time-frame
- **Total system costs** over study time-frame



*Modelling output combined with stakeholder engagement will support policy and regulatory dialogue and an innovation project pipeline **involving and benefiting all Great Britain's Energy Sector Stakeholders while delivering the optimal energy system for consumers***

Executive messages

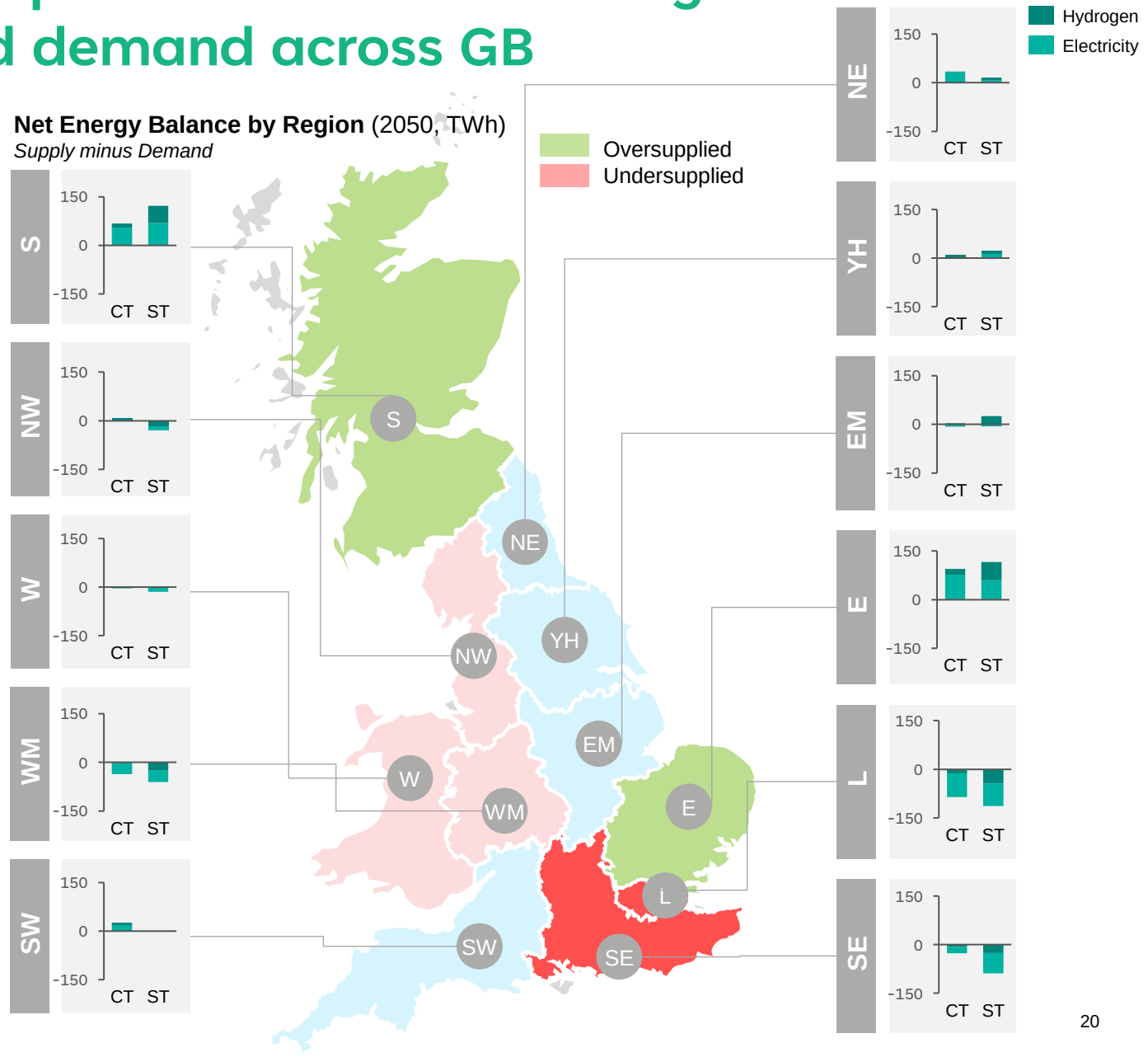
Across **all the modelled scenarios integrated electricity and hydrogen transmission infrastructure planning can realise savings,** especially in **System Transformation** where energy system **savings** of **£38 billion by 2050** are possible. Early investments common across the transmission networks are needed to realise these savings.

Transmission infrastructure development is needed to bridge regional differences in supply and demand across GB

Key Messages

- In 2050, there would be **significant differences in the electricity and hydrogen supply-demand balance** across GB.
  - Our analysis shows a significant **North-South imbalance** in energy supply and demand, as well as an **East-West imbalance**.
  - Regions in the North and East benefit from **abundant renewable energy potential**, while other regions may require electricity and hydrogen imports to meet their demand.
- These **regional energy supply-demand differences are consistent** to a great extent **across different visions of the future** (CT and ST scenarios).

Transmission infrastructure is needed to connect electricity and hydrogen supply and demand across GB



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Electricity key takeaways

The modelling shows that the increasing regional supply-demand imbalances will require increased GB-wide coordinated approach to transmission network development to minimise system costs, over and above that is currently undertaken.

A geographically coordinated approach to transmission network development is needed to optimise and accommodate the transport of the unprecedented increase in electricity supply capacity in some regions such as Scotland with more than 100 GW of renewables installed capacity by 2050.

Curtailment could be greatly reduced in an integrated scenario with the introduction of electrolysis and storage with renewable generation, unlocking their full potential by providing optionality to the power produced.

In a limited integration scenario, introducing electrolysis, as well as other technologies into the energy mix has the potential to greatly reduce renewable generation curtailment. This can lead to reduced energy costs and greater investment incentives with more stable revenues for developers.

Harnessing the opportunities of weather-dependent renewable energy sources requires you to increase the role of demand side flexibility and dispatchable peak generation

The scale-up of weather-dependent renewable resources increases the importance of supply-side flexibility and demand-side flexibility resources.

Early strategic investments in electricity transmission infrastructure are needed today to accommodate for the increase in renewable generation and reduce it cost

Strategic, whole system investments in new transmission infrastructure will be needed in across the modelled project scenarios to support the development of renewables and meet demand across the country. Taking investment decisions promptly will allow for better network integration which will result in reduced power generation costs and attract investments to build the required supply capacity. This need resonates with other studies conducted in the past year, such as the Offshore Transmission Network Review, Network Planning Review and others.

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Hydrogen key takeaways

From the project modelling the hydrogen imbalance shows a need for a GB-wide hydrogen network, the scale and design of which differs with each scenario.

The scale and design of the backbone differs depending on purpose and need for hydrogen. In a high hydrogen demand scenario, the backbone delivers low-cost hydrogen from regions with excess supply to regions with high demand. However, in a high electrification scenario, the backbone plays a key role in delivering hydrogen to H_2 Gas Turbines across the country

In a high hydrogen demand scenario, a GB-wide backbone delivers low-cost hydrogen from regions with excess supply to regions with high demand. In a high electrification scenario, the network is more limited playing a key role in delivering hydrogen to H2 Gas Turbines across the country

In System Transformation, a scenario with significant hydrogen demand, blue hydrogen plays a key role in 2030 and 2040 to meet a rapidly increasing demand. In 2050, while green hydrogen plays a dominant role, delivering low-cost supply and reducing electricity curtailment, blue hydrogen is still needed to provide weather-independent supply to meet the scenario's important residential heating demand.

In all modelled scenarios, hydrogen storage is critical in supporting whole energy system demand during peak demand periods and low wind days

Hydrogen storage plays a critical role during high demand, low wind days, delivering up to 95 GW of firm, dispatchable supply and supporting both the gas and electricity systems. If Great Britain were to keep current gas storage volumes of 10TWh, hydrogen reserve would not last more than 5 days.

Strategically located investments in hydrogen transmission infrastructure are needed in the next decade to deliver the benefits of integrated system planning

Strategic, whole system investments in hydrogen transmission infrastructure are needed to support the development of renewable generation and meet demand across the country. Taking investment decisions promptly will allow for better network integration which will result in optimised energy generation and attract investments to build the required supply capacity.

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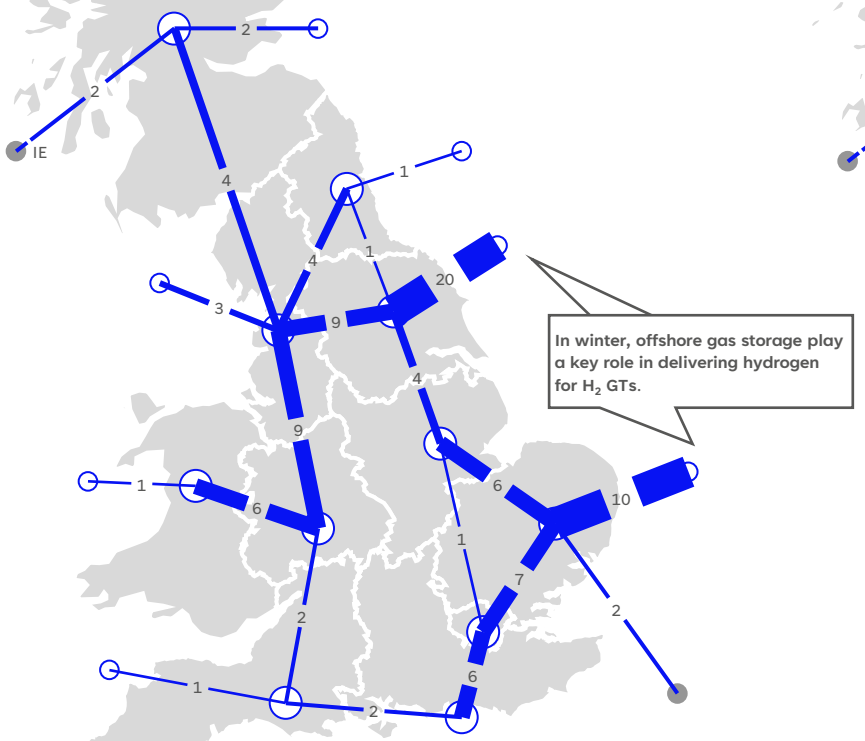
In both System Transformation and Consumer Transformation scenarios, a hydrogen network develops by 2050; however, serving different purposes

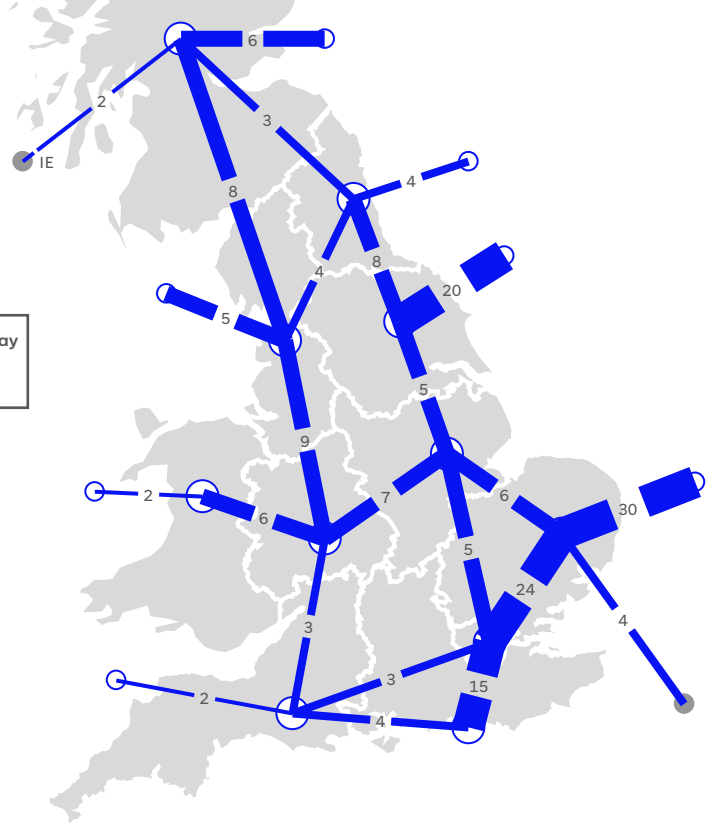
2050 – Consumer Transformation

A hydrogen network primarily **delivers hydrogen to H_2 GTs for electricity supply**



2050 – System Transformation

Hydrogen backbone **connects hydrogen supply and demand.**



Key Messages

- **Both scenarios show a need for a GB-wide hydrogen network in 2050.** The scale and design of that, however, differs depending on purpose and need for hydrogen.
- **In Consumer Transformation (CT)**, despite limited demand from end-users, a network still develops. This transmission network plays a **key role in delivering hydrogen to H_2 GTs across the country**, roughly 32 GW.
- **In System Transformation (ST)**, the backbone **delivers low-cost hydrogen from regions with excess supply** (Scotland, East of England) **to regions with high demand** (London, South-East).

Note: (1) These maps presents a simplified representation of GB's future hydrogen transmission network defined by the nodal configuration used in this study and does not accurately reflect the real-world configuration of the existing natural gas network. (2) Transmission capacities reported in the map represent minimum operational capacity needs, and not rated nameplate capacities. (3) Analysis results may not align with planned hydrogen transmission investments, nor targets.

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Results - Question to the audience

What are the opportunities of doing more work around whole system thinking / planning?

Responses


Q&A
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What next?

You will receive the recording and materials from today's session

If you have any further questions or would like to discuss anything specific please get in touch:
engage@nationalgas.com

Feedback is important to us, therefore if you have not already taken part, we would like to put you forward for a survey

Further Webinars

Event Name		Date/Time	Hosts
Keynote Speech	Catch Up	28th June | 10:00	Martin Cook, Jake Tudge
Commercial Frameworks	Catch Up	29th June | 13:30	Ian Radley
Future of Gas	Current	03rd July | 10:00	Danielle Stewart
Regulation	Sign Up	05th July | 10:30	Tony Nixon
Operating the Network	Sign Up	06th July | 10:00	Ian Radley & Craig James

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Thank you

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