FutureGrid
Hydrogen Transmission in Action

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The National Transmission System (NTS)

The role of gas:

- **23m** Gas customers across the UK
- **85%** of UK households use gas for heat
- **881 TWh** of energy is supplied by the NTS each year

UK gas demand:

- **39%** Power Generation
- **38%** Domestic Use
- **23%** Industrial & Commercial

- **7,660km** high-pressure pipe
- **94 bar** maximum pressure on the network
- **23** compressor stations
- **504** above-ground installations
- **8** connected distribution networks

The National Gas Transmission System delivers gas to 23 million customers across the UK, with 85% of UK households using gas for heat. The network delivers 881 TWh of energy each year. The UK gas demand is divided as follows: 39% for power generation, 38% for domestic use, and 23% for industrial and commercial use. The network consists of 7,660 km of high-pressure pipe, with a maximum pressure of 94 bar on the network. The system includes 23 compressor stations, 504 above-ground installations, and 8 connected distribution networks.
Dual Pathway to a hydrogen NTS: hydrogen blending and rollout of 100% hydrogen pipelines

Rollout of blending across the NTS

Strategic rollout of 100% pipeline connections

Delivering a Dual Pathway to transitioning the NTS to hydrogen:

- In 2024/5 low level hydrogen blending on will be facilitated on the transmission network
- From 2025 onwards blending could extend and increase up to 20% - more if deblending technology can be proven.
- In 2028/9 Project Union will deliver the first phases of 100% hydrogen transmission pipeline between the northern clusters
- By 2033 Project Union will have delivered a circa 2000km hydrogen backbone joining key production and use clusters
- Asset conversion continues to 2045 to deliver a complete 100% hydrogen network.

Net Zero 2050

Levelling up, Job Creation

Global Leader in Green Innovation

Providing flexibility and optionality

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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 ~2,000 km 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
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
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.

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

Our goal is to deliver a World-Class Hydrogen Test & Demonstration facility for Compression systems providing the key evidence to transition the UK network in 2026.
## FutureGrid Compression Team

### National Gas Transmission
- **Owner and operator of National Transmission System, end user of the project outcomes and evidence**

### Siemens Energy
- **OEM for turbine and compressor systems on the NTS and worldwide, demonstrating future capability**

### DNV
- **DNV Spadeadam site owners and expert consultants across the gas industry and delivering the test facility**

### Cullum
- **Compressor cab design and engineering specialists delivering the ancillary equipment to site**

### SGN
- **Gas distribution network owner and operator, developing LTS futures at DNV Spadeadam and sharing data across FutureGrid and LTS programmes**

### Northern Gas Networks
- **Gas distribution network owner and operator, H21 facility demonstrating the distribution network alongside FutureGrid at DNV Spadeadam**

### Premtech
- **Digital modelling and simulation experts, whom will produce the detailed site design and associated data**

### Cardiff University
- **Academic institute to peer review activities with a focus on the rotating machinery and digital aspects of the project**

### HSE Science & Research Centre
- **HSE Science & Research Centre to independently peer review safety data relating to compressors on the project.**

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**National Gas Transmission |**
1km High pressure 36” pipeline

A20 Gas Turbine
Upgraded combustion can to utilise H2 <100%

Gas Compressor
Repurposed from NTS and replaced for 100% H2

Aftercooler to prevent test loop overheating

H2 & CH4 Storage
48” 450m x2

Buried Pipework to enable operational maintenance testing

PIG Traps to enable access to the test loop & for future testing

FutureGrid & HyNTS control room
What are the benefits?

<table>
<thead>
<tr>
<th>OPTION</th>
<th>Total forecast expenditure</th>
<th>Saving vs. Baseline</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Change</td>
<td>Cost of not transitioning to hydrogen</td>
<td>(£6.5b)</td>
</tr>
<tr>
<td>Baseline</td>
<td>Replacement of all units</td>
<td>(£4.5b)</td>
</tr>
<tr>
<td>Option 1</td>
<td>Repurposing to 100% Hydrogen</td>
<td>(£3.1b)</td>
</tr>
<tr>
<td>Option 2a</td>
<td>Repurposing to 25% and then repurposing 100% Hydrogen</td>
<td>(£3.3b)</td>
</tr>
<tr>
<td>Option 2b</td>
<td>Repurposing to 25% and then replacement</td>
<td>(£4.7b)</td>
</tr>
<tr>
<td>Option 3a</td>
<td>Repurposing to 50% and then repurposing 100% Hydrogen</td>
<td>(£3.4b)</td>
</tr>
<tr>
<td>Option 3b</td>
<td>Repurposing to 50% and then replacement</td>
<td>(£4.8b)</td>
</tr>
</tbody>
</table>

**End Consumer**
Minimisation of new build disruption & cost
Minimise cost for the transition through reuse of assets and maintained lifetime
Access to Net Zero gases instead of costly domestic heat upgrades

**Energy Supply Resilience & Government Priorities**
NTS provides resilience vs localised/transient supply & access to remote production sources
Storage and flexibility through linepack supporting access to green & blue hydrogen
Enabling Hydrogen for Industry, Transport, Power and Domestic Heating

**Environment**
Minimisation of new build impact, utilisation of existing sites to prevent green field requirement
Reduction in reliance on natural gas
Reduced compressor CO₂ emissions
Thanks for listening
Opportunity for questions