



WHEN TRUST MATTERS

DNV – Future Grid

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A global assurance and risk management company

160
years

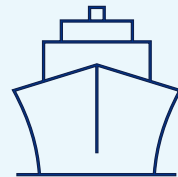
~15,000
employees

~100,000
customers

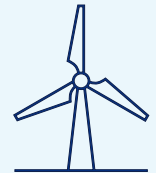
100+
countries

5%+
of revenue in R&D

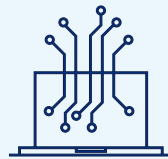
Ship and offshore
classification and advisory



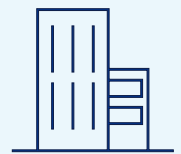
Energy advisory, certification,
verification, inspection and
monitoring



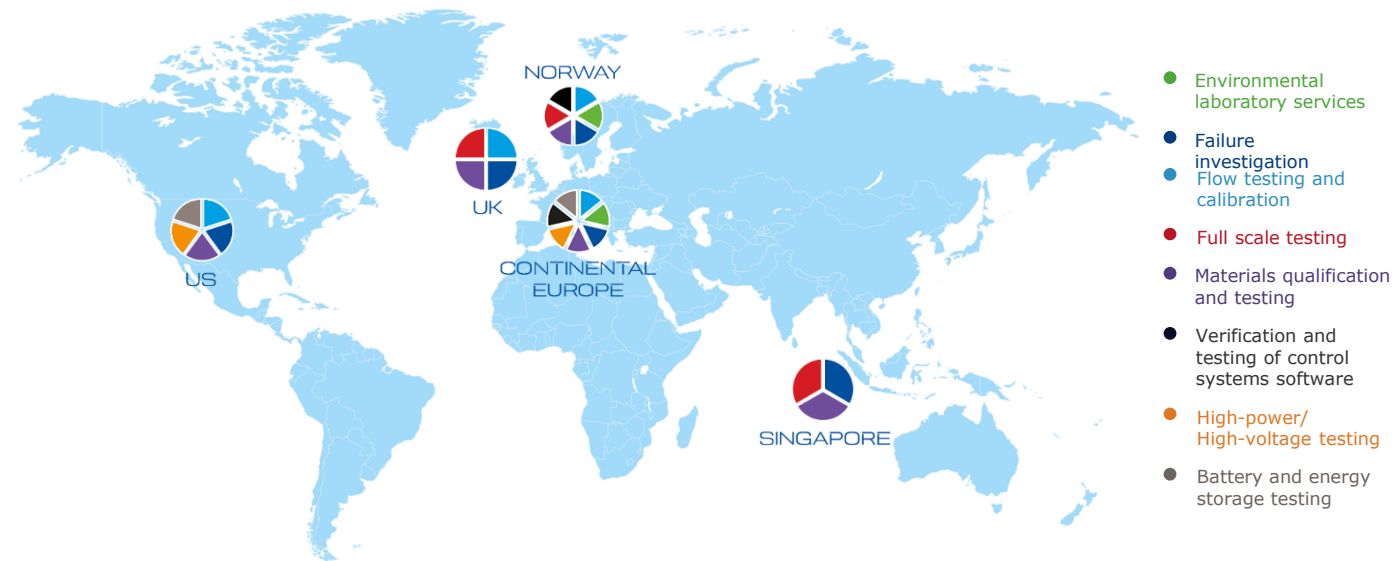
Software, cyber security,
platforms and
digital solutions



Management system
certification, supply chain and
product assurance

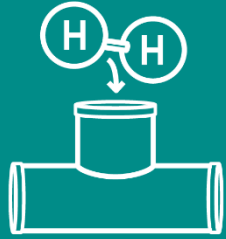


Putting our expertise to the test: 14 laboratories across 3 continents

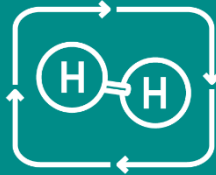


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FutureGrid phase 1

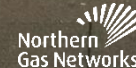


Standalone hydrogen Tests
Standalone hydrogen test modules are operating alongside the main test facility, to provide key data required to feed into the main facility.



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:



Future Grid Material Testing

- Fracture toughness testing of NTS pipeline materials
 - Vintage, semi-modern and modern
 - X42 through to X80 grade
- Fatigue crack growth rate testing
- Fracture mechanics assessment to derive maximum allowable operating pressure and fatigue life
- Pipe stress analysis of Above Ground Installations (AGIs) and Compressor Stations to identify fatigue hotspots and requirements for inspection or modification
- Analysis of historical pressure and temperature monitoring data to reduce design conservatism and extend future fatigue life



Why



National Infrastructure Commission - *New networks to transport carbon and hydrogen are vital to support decarbonisation across the economy.*



The EU are targeting a blend of hydrogen up to 3% in transmission pipelines by 2025



Developing evidence for Project Union (Hydrogen Transmission Network in UK)

Progress

Testing complete on FG loop complete.
Findings to be published

Weld cycling continues. 30,000+ cycles
carried out so far. No impact on welds
have been witnessed

Several rupture tests carried out with the
results feeding into the QRA

Numerous stakeholder events held with
international visitors



HyNTS FutureGrid Phase 2 – Deblending

HyNTS
FutureGrid
Compression

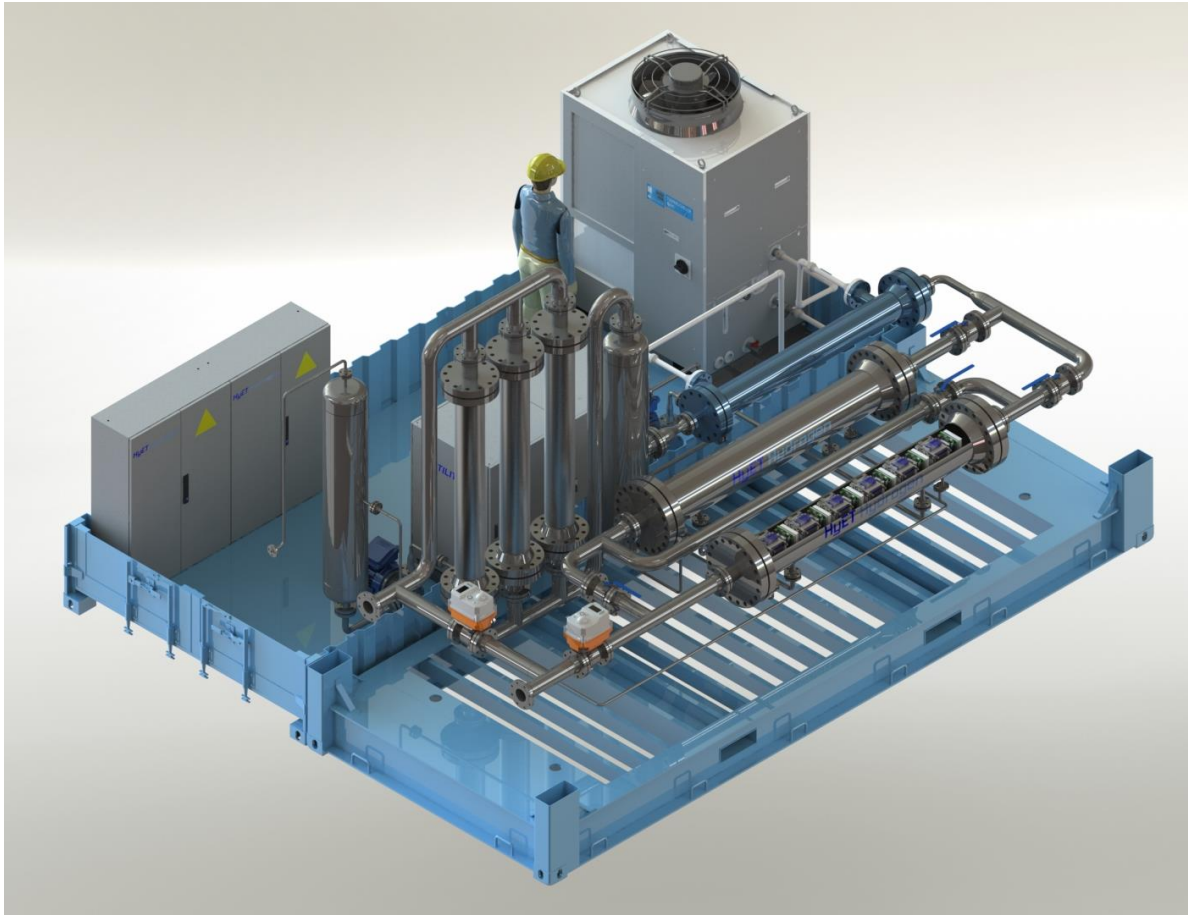
Refuelling
Station

HyNTS
FutureGrid
Deblending

HyNTS
FutureGrid
Phase 1 Facility



What - Bulk separation & Purification and compression systems



Isometric view of the artist's impression of the Bulk Separation system for 200 kg H₂/day



Isometric view of the artist's impression of the compression and purification system of 40 kg H₂/day

Why?

Potential to unlock hydrogen for transport

NGT aim to commence blending into NTS from 2028

3% hydrogen blends from Europe in 2025

Benefit	Deblending	Deblending + Tube Trailer	Tube Trailer	Onsite Production
Levelised cost of hydrogen (£/kg H2)	£6.70 - £7.70	£7.30 - £8.23	£8.34	£8.40
Accessing low-cost hydrogen production from centralised facilities	✓	✓	✗	✗
Competitive distribution costs over long distances	✓	✓	✗	n/a
Highly reliable hydrogen supply	~	~	✗	✗
Small onsite storage requirements	~	~	✗	✗
Small onsite footprint at compared to refuelling hub scale (c. 4,500 m2)	✓	✓	✓	✓
Reduced delivery logistics and local traffic	✓	✗	✗	✓

HyNTS FutureGrid phase 2 Compression

What

Installation of a 1km 36" repurposed pipeline loop

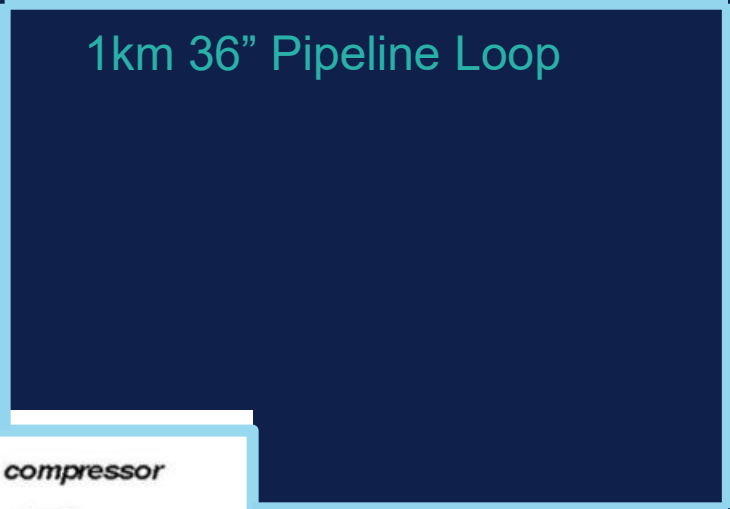
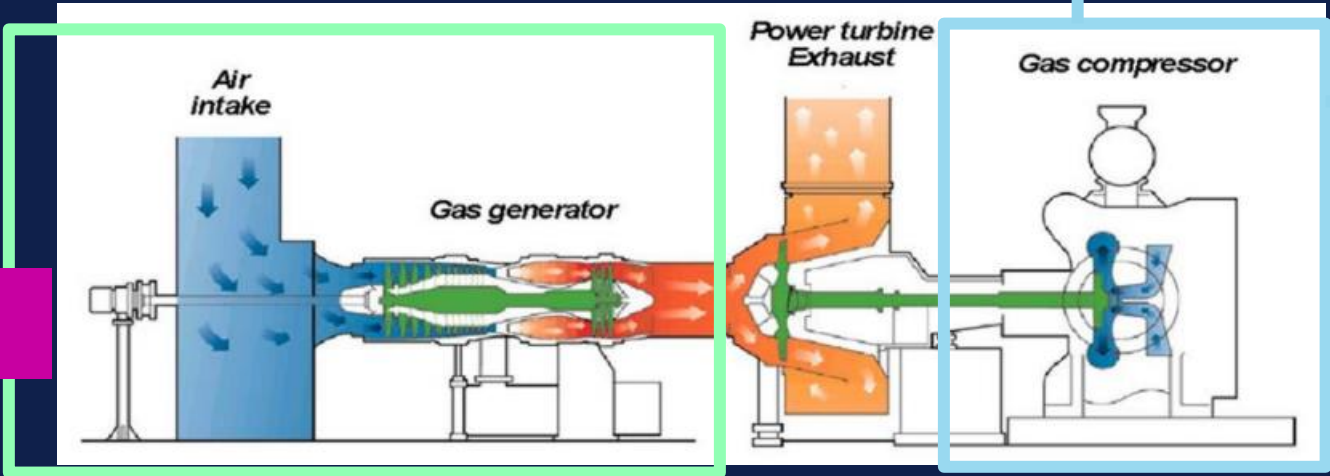
Overseeing the removal, transportation and installation of one compressor station (Huntingdon)

Compressor storage array

Testing of existing compressor up to 50% H₂

New Siemens compressor to be tested on 100% H₂





The gas compressor is capable up to 50% hydrogen but then needs a redesign to suitably compress 100% hydrogen

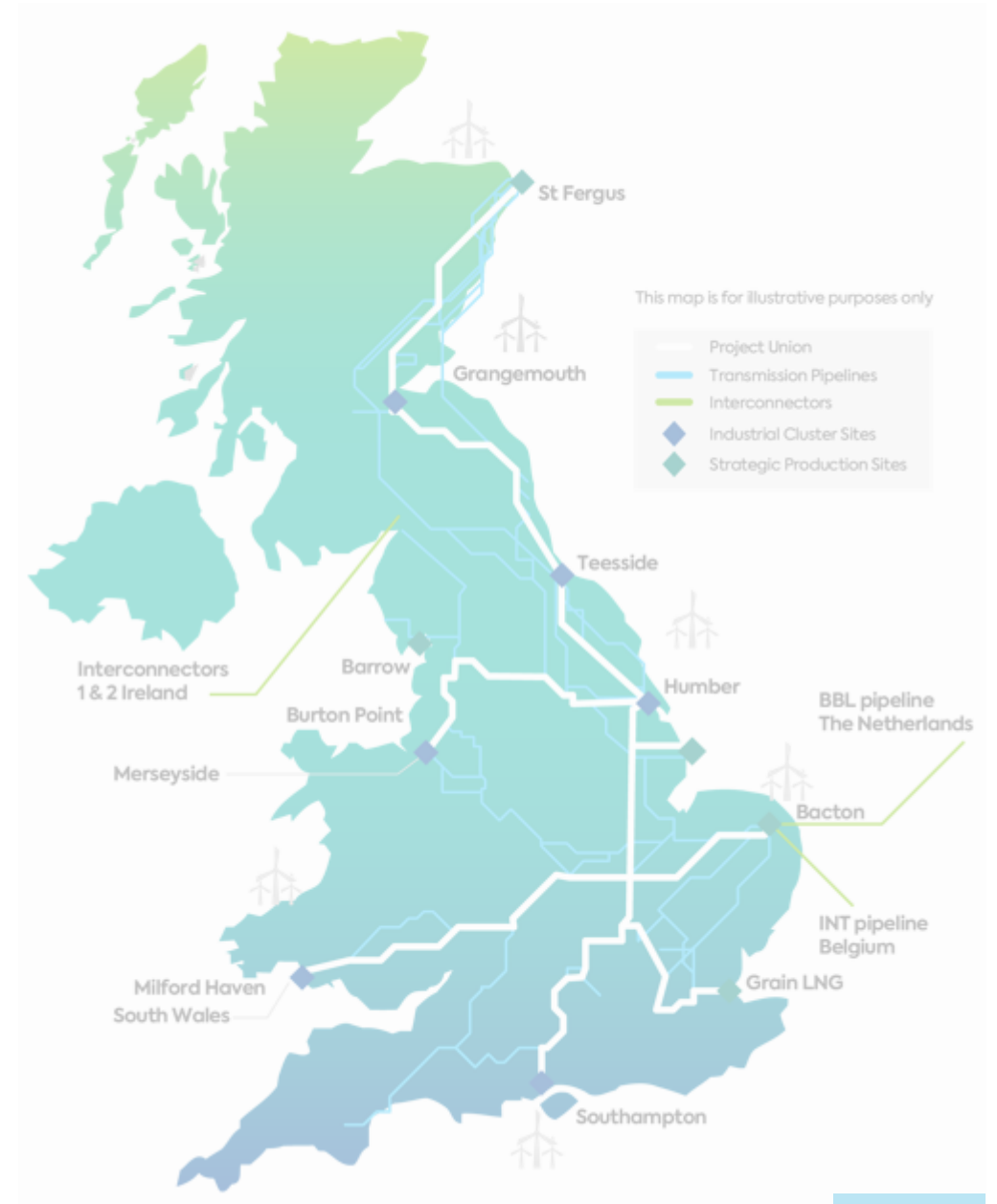
The gas turbine has shown to be capable of running on hydrogen and being repurposed

Why?

Properties of hydrogen mean that the required pressure ratio cannot be achieved with existing compressors

There are 24 compressor stations in the UK and approximately 70 compression units. Each compression unit would cost approximately £60m to replace

Critical to UK hydrogen backbone



Thanks

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