The Feasibility of H_2 at Ports

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Is H_2 in ports feasible?

Yes

[end of presentation]

Important bits

- Is H_2 safe?
- Will it go bang?
- Is it too risky for a port?
- Where will it be used?
- What skills/people do we need?
- Is H_2 going to be used at scale or is it just a hype?
- Is there a market for H_2 beyond ports?
- What does it mean for me and what do I need to be aware of?
- When is all this going to happen?

Essentially the who, what, why, where, when, how of H_2 at ports.

Ten Point Plan for a Green Industrial Revolution

Boris “The Liar” Johnson: “*Now is the time to plan our green recovery*”

1. Offshore wind: Producing enough offshore wind to power every home, quadrupling how much we produce to 40GW by 2030, supporting up to 60,000 jobs.
2. **Hydrogen: Working with industry aiming to generate 5GW of low carbon hydrogen production capacity by 2030 for industry, transport, power and homes, and aiming to develop the first town heated entirely by hydrogen by the end of the decade.**
3. Nuclear: Advancing nuclear as a clean energy source, across large scale nuclear and developing the next generation of small and advanced reactors, which could support 10,000 jobs.
4. Electric vehicles: Backing our world-leading car manufacturing bases including in the West Midlands, North East and North Wales to accelerate the transition to electric vehicles, and transforming our national infrastructure to better support electric vehicles.
5. Public transport, cycling and walking: Making cycling and walking more attractive ways to travel and investing in zero-emission public transport of the future.
6. **Jet Zero and greener maritime: Supporting difficult-to-decarbonise industries to become greener through research projects for zero-emission planes and ships.**
7. Homes and public buildings: Making our homes, schools and hospitals greener, warmer and more energy efficient, whilst creating 50,000 jobs by 2030, and a target to install 600,000 heat pumps every year by 2028.
8. Carbon capture: Becoming a world-leader in technology to capture and store harmful emissions away from the atmosphere, with a target to remove 10MT of carbon dioxide by 2030, equivalent to all emissions of the industrial Humber today.
9. Nature: Protecting and restoring our natural environment, planting 30,000 hectares of trees every year, whilst creating and retaining thousands of jobs.
10. Innovation and finance: Developing the cutting-edge technologies needed to reach these new energy ambitions and make the City of London the global centre of green finance.

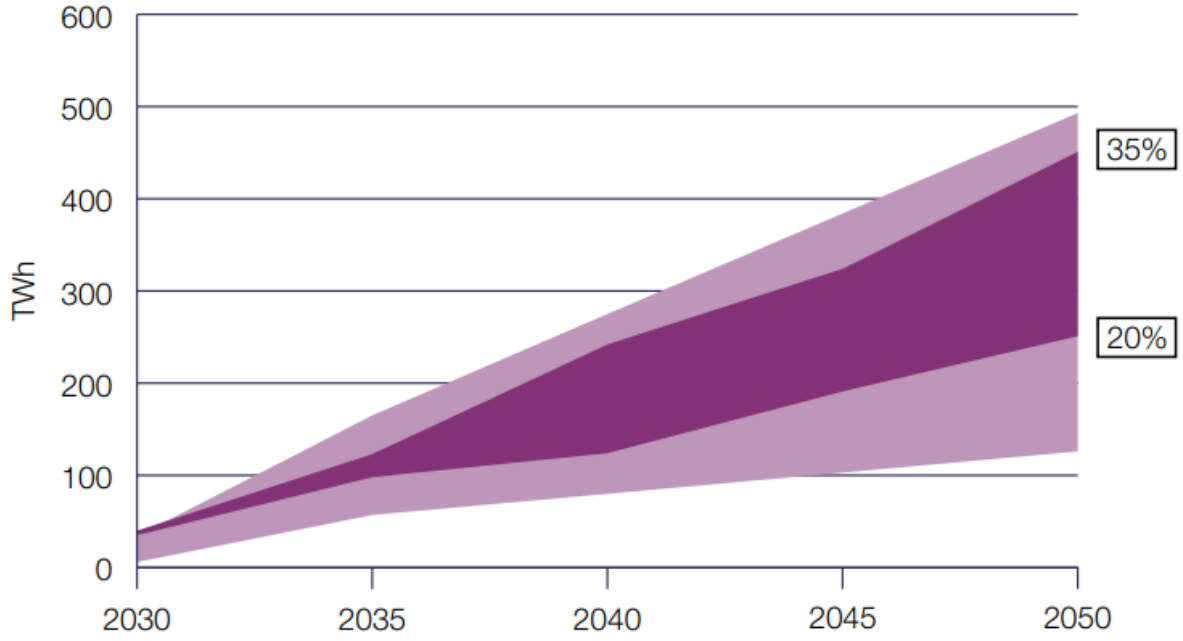
https://www.ft.com/content/6c112691-fa2f-491a-85b2-b03fc2e38a30

https://www.gov.uk/government/news/pm-outlines-his-ten-point-plan-for-a-green-industrial-revolution-for-250000-jobs

H_2 - National Strategy

- Currently ~95 MT produced annually
- 10 GW of H_2 by 2030 at least 50% green
- First cluster projects operational by 2030
- This 10 GW only represents ~1/3 of the H_2 needed by 2050
- H_2 will be used in sectors including:
  - Aerospace + Maritime
  - Heavy transportation
  - Industry / hard to decarbonise activities
  - Peak load power supply

Figure 1.2: Hydrogen demand and proportion of final energy consumption in 2050



% = hydrogen as proportion of total energy consumption in 2050

H_2 Production - Options

H_2 Cost = £
Age = 😷
Scale = 10
CO_2 = 😟

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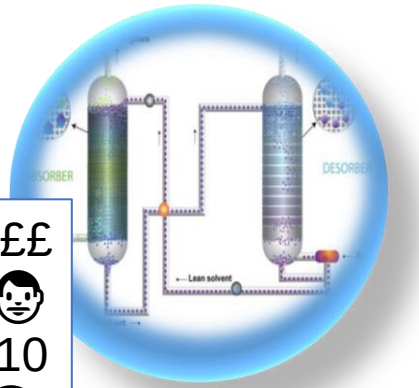
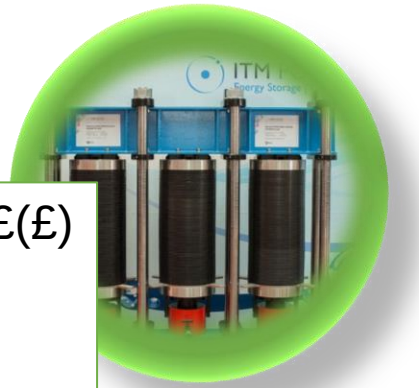
Age = 😷
Scale = 10
CO_2 = 😟

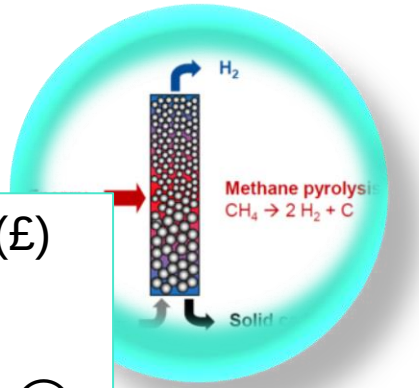


H_2 Cost = ££
Age = 👦
Scale = 10
CO_2 = 🙂



H_2 Cost = £££(£)
Age = 🧔
Scale = 10
CO_2 = 😁

H_2 Cost = £££
Age = 🧒
Scale = 7
CO_2 = 😁



H_2 Cost = ££(£)
Age = 👶
Scale = 4
CO_2 = 🙂/😁

H_2 value chain

Production

Networks & Storage

Industry

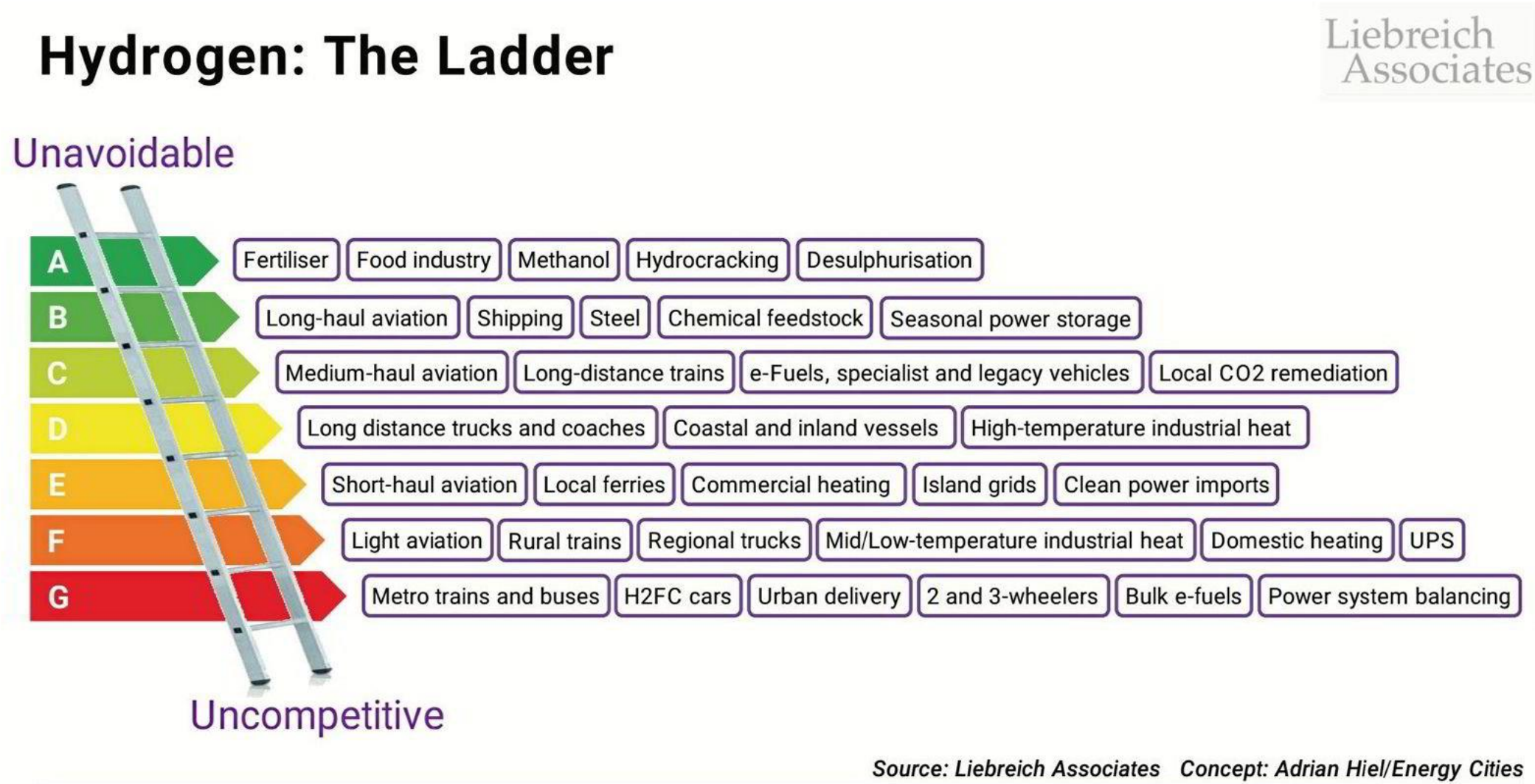
Transport

Heat

Power

Jobs & Skills

Hydrogen uses



H_2 safety experience

- An excellent safety record for over ~100 years
- Mega-tonne scale production in UK and globally
- Not a new thing, just different applications and users – therefore safety awareness changes

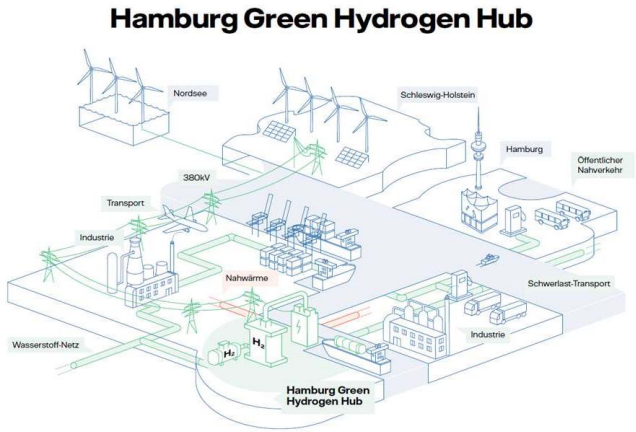
Same as natural gas	Different to natural gas
Colourless	Low ignition energy
Odourless	Wider range of flammability
Tasteless	Near colourless flame
Flammable	Interacts with metals differently
	More buoyant
	Higher diffusivity

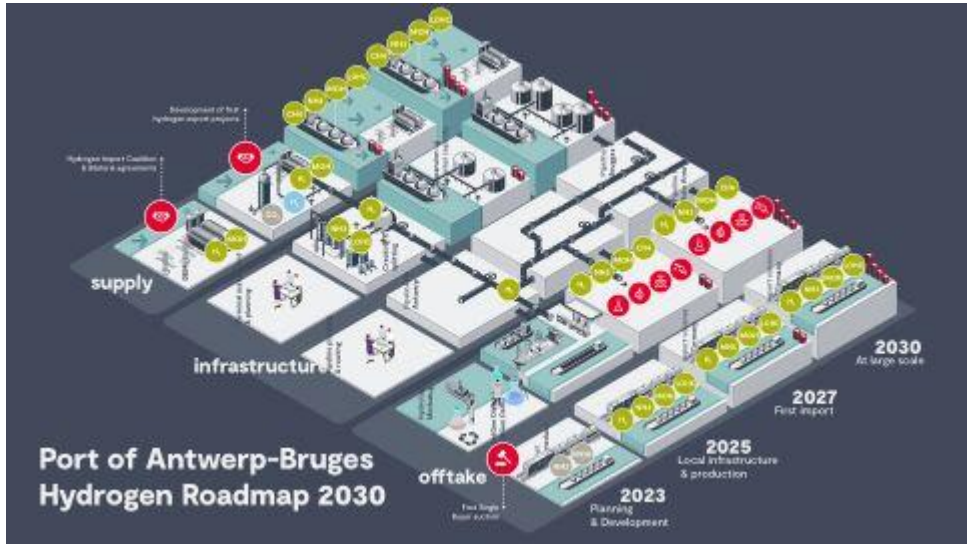
No more dangerous than other fuels but needs different considerations

Note: Liquid H_2 is very different though

Examples of H_2 use at ports

- H_2 for port operations
- H_2 for port users (HGV's)
- H_2 as NH_3 for storage and ship refuelling





Where will it be used in my port?

It depends… very port is different and is set up for different things

Do you currently refuel vessels?

Do you move containers in and out?

24h operations?

How many reach stackers and fork lifts do you have?

How often are your NRMM replaced?

Proximity to population

Bunkering capacity and local area considerations – Hazardous area consent radius

Sell to end users in local area? Industry close by?

Production/conversion/import/export of H_2?

What do I need to be aware of?

Risks and regulations for H_2

- Hydrogen policies written initially for petrochemicals and ammonia plants based on their experience
- Standards for hydrogen use and storage in industrial settings are already well-established
  - Control of Major Accidents and Hazards (COMAH)
  - Dangerous Substances and Explosive Atmospheres Regulations (DSEAR)
  - International Carriage of Dangerous Goods by Road (ADR)
- HSE/ISO for codes and standards
- Local Authority for land use and hazardous substances related to storage
- UK VCA for H2 vehicles
- Oil and gas authority and Ofgem for pipelines and gas networks
- EA oversees emissions of H_2
- All of this is changing on a regular basis

Skills and people required

"*Hydrogen Champion*"

- Knowledge retention
- Extension to safety team with specialist H_2 knowledge
- Awareness of regulations, modelling needs, planning, inspections
- Emergency preparedness

Get advice and input from someone who's done it before and the HSE

Port of London's MarRI-UK project – Work Package 6

https://www.pla.co.uk/Sea-Land-and-Port-Smart-Integration-of-a-Hydrogen-Highway

Is this all just hype?

- Can't reach net zero without H_2
- Maritime sector will see more H_2 than others because
  - Characteristics of port operations
  - Vehicle types, loads and activities
  - Import/export location for H_2 and distribution

"Up to 42% (22 Mt, or 730 TWh) of total hydrogen demand in the EU in 2050 could be located in port areas"

https://www.clean-hydrogen.europa.eu/system/files/2023-04/Study%20on%20hydrogen%20in%20ports%20and%20industrial%20coastal%20areas.pdf

https://www.clean-hydrogen.europa.eu/media/news/press-release-study-hydrogen-ports-and-industrial-coastal-areas-2023-03-30_en

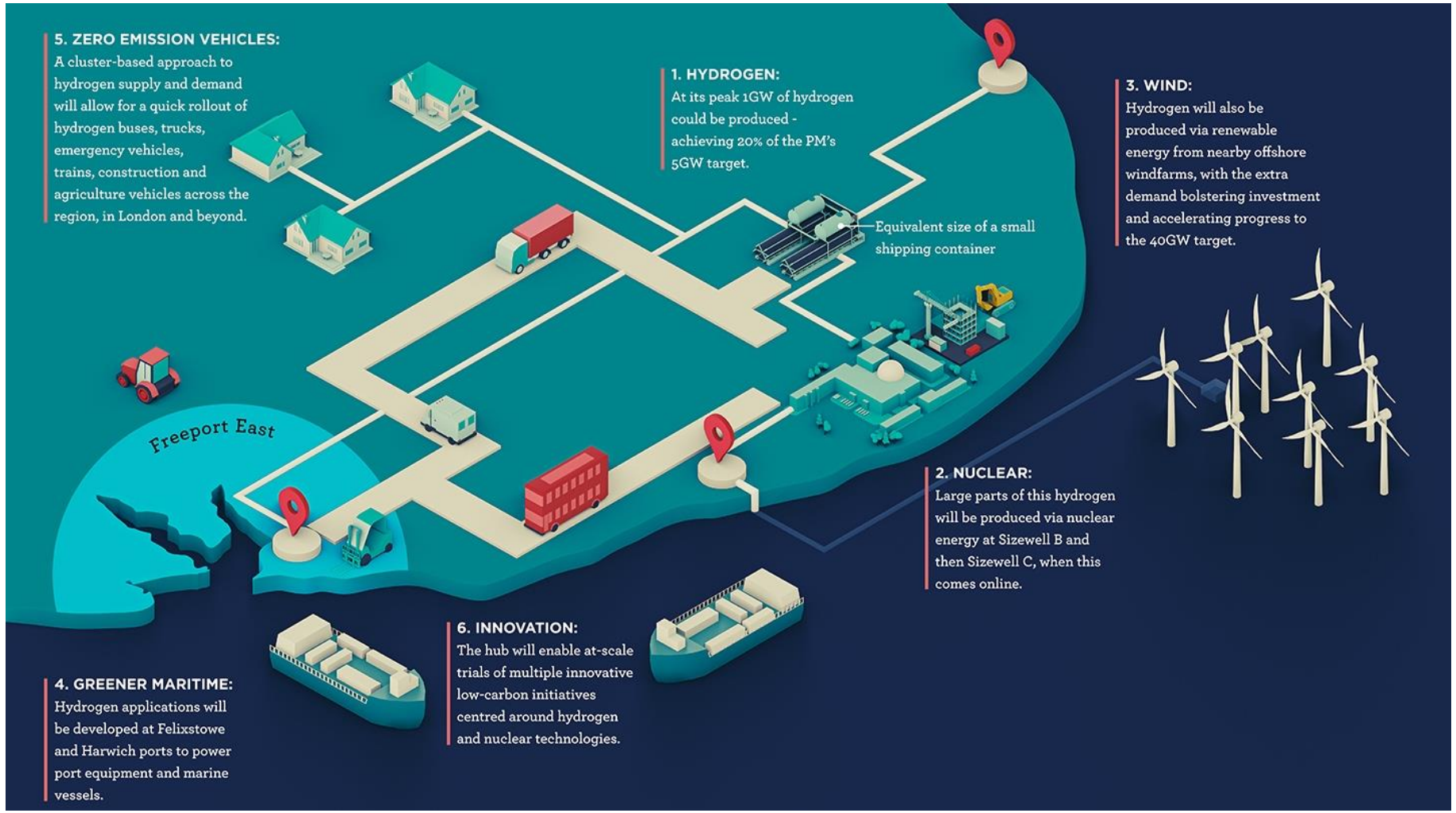
Clean Maritime Demonstration Competition

Freeport East Energy Hub Feasibility Study

Department for Transport

Innovate UK

Freeport East Hydrogen Hub



Study was broken up into:

1. Background analysis of energy and emissions
2. Zoned assessment
   - Decarbonisation of port operations
   - Regional impact through port users

Aim: Quantify the role and impact that H_2 could have in different scenarios.

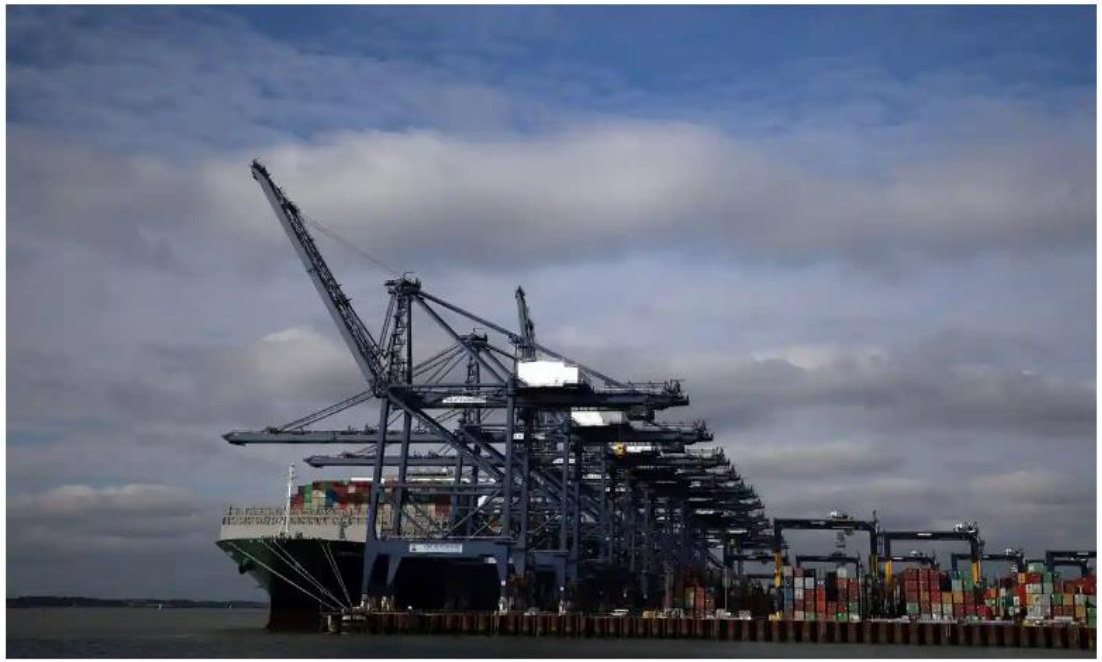
Hydrogen power

ScottishPower to build £150m green hydrogen plant at Port of Felixstowe

Exclusive: plant at Suffolk port is slated to produce 100megawatts of power from 2026

Alex Lawson *Energy correspondent*

Mon 8 Aug 2022 14.10 BST



The port of Felixstowe. ScottishPower plans to build the facility on brownfield land within the port. Photograph: Hannah McKay/Reuters

Clean Maritime Demonstration Competition

Freeport East Energy Hub

Feasibility Study

Key Learnings:

- Engage with local users / off takers
- Start planning early
- Go big or go home (H_2 scale and users)
- Team up and share knowledge
- Collaborative decarbonisation

HUTCHISONPORTS · Cranfield University · EDF · SizewellC · Department for Transport · UKRI Innovate UK

Welcome to the…

…decade of H_2

1 Dollar | 1 Kilogram | 1 Decade

TIME TO MATURITY ASSESSMENT

FreeportsHub

	Short term (pre-2025)	Medium term (2025 – 2030)	Long term (post 2030)
MARITIME – Port/offshore operations	Some potential for isolated low number early adoption of specialist vessels (e.g. Crew Transfer Vessels[7]). Isolated examples of shore-side demonstration activities.[8]	Potential for trialling or early adoption of equipment and vessels (e.g. similar initiatives to SHAPE UK project[9] or announced plans by Shoreham Port[10]).	Potential for ongoing commercial fleet replacement of specialist vessels (e.g. CTVs) and adoption of shore-side equipment subject to competitiveness.
MARITIME – Ferries	Low number of small vessel showcase projects.	Potential for isolated demonstration projects or early adoption (e.g. HYSEAS III project[11]).	Adoption on commercial basis as part of fleet replacement may be possible in longer term.
MARITIME – Shipping	Current research and demonstration activities are predominantly based internationally[12], with a few isolated initiatives supported by recent DfT funding[13].	Potential for pilot and trial programmes.	Prominent industry analyses suggest uptake of hydrogen-based fuels in the maritime sector expected from 2030[14][15]

https://energycentral.com/system/files/ece/nodes/597641/freeport-east-hydrogen-offtake-assessment.pdf

Back to the initial question: Is H_2 in ports feasible?

Yes…

but lots to learn and do
and not much time to do it

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