GREEN RECOVERY REPORT:
CAN HYDROGEN CARRY US TO NET ZERO BY 2050?

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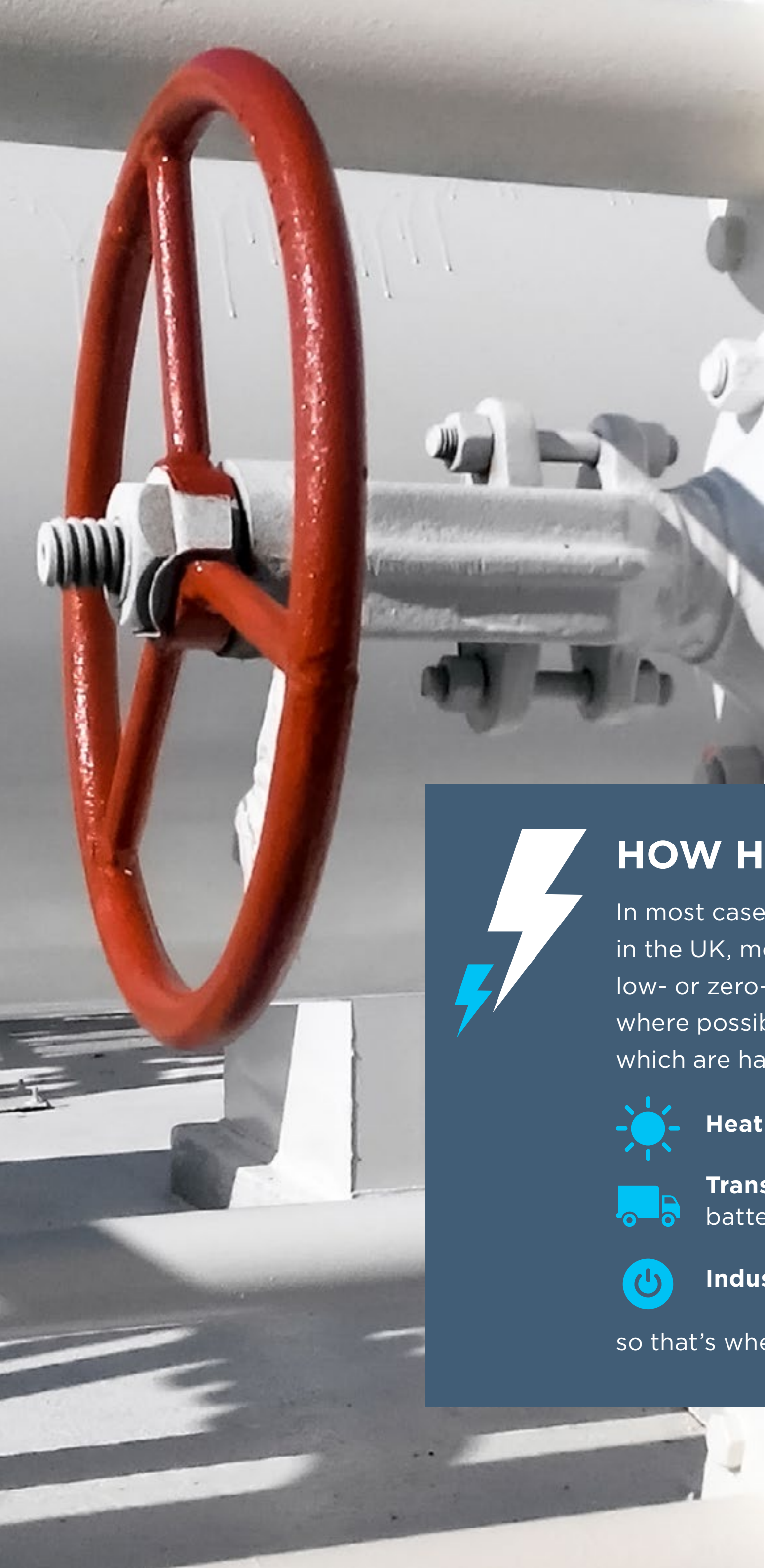
A WAY FOR THE OIL AND GAS INDUSTRY TO AVOID STRANDED ASSETS,

OR

THE SOLUTION TO ALL OUR EMISSIONS PROBLEMS?

Hydrogen has a lot of hype at the moment. We take a look behind the numbers to work out how it fits in to the 2050 decarbonisation pathway.



2050 DEADLINE

The UK was the first country to enact a legally binding target to reduce carbon emissions to net zero by 2050, but other countries are following. The EU is aiming to be climate-neutral by 2050; Scotland has set a 2045 target; New Zealand, Japan and South Korea have all pledged 2050 net zero targets. We can expect more to follow at the COP26 conference in Glasgow later this year.

HYDROGEN PRODUCTION

There are three main ways of producing hydrogen:

Grey hydrogen	made using fossil fuel gas with no emissions captured
Blue hydrogen	made using fossil fuel gas but with CO_2 emissions captured and stored
Green hydrogen	made using electrolysis: if renewable electricity is used in the process, then there are no carbon emissions

Most of the world's hydrogen is currently produced from natural gas (76%) or coal (23%); only 2% is produced from electrolysis[1].

HOW HYDROGEN HELPS

In most cases, electrification is the best way to decarbonise: in the UK, more and more of our electricity is generated from low- or zero-carbon sources and using this green electricity where possible will reduce emissions. But there are sectors which are hard to electrify fully:

- **Heat** – hydrogen could replace natural gas
- **Transport** – especially heavy goods vehicles where batteries are not powerful enough
- **Industry** – powering industrial heat processes

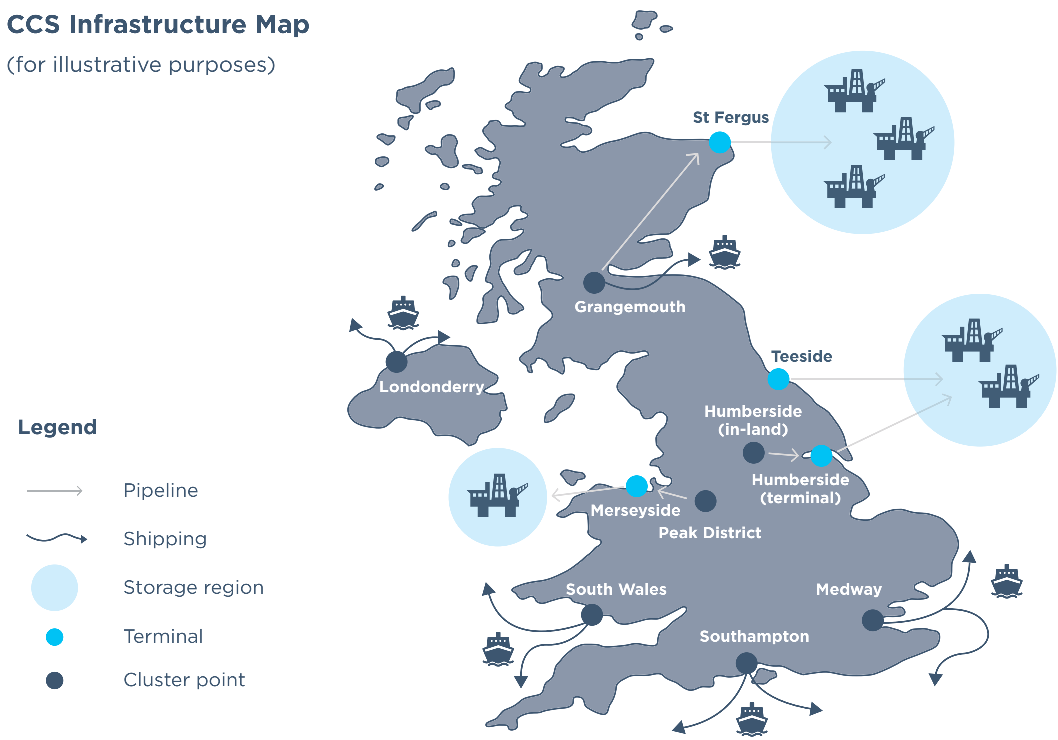
so that's where hydrogen can help.

[1] IEA report, The Future of Hydrogen, June 2019

HYDROGEN TRANSPORTATION AND STORAGE

The UK Government is looking at “industrial clusters” where hydrogen can be produced and stored close to the industries that will use it. This will open up new opportunities in building this new infrastructure. This map from the CCC’s Sixth Carbon Budget shows the main potential locations. There is talk of Centrica’s disused gas storage site at Rough off the North East coast of England being used to store hydrogen, which would benefit the proposed Zero Carbon Humber industrial cluster.

POTENTIAL LOCATIONS FOR CLUSTER POINTS AND TERMINALS FOR CO_2 TRANSPORT AND STORAGE INFRASTRUCTURE



Source: Element Energy (2020) Deep-de carbonation pathways for UK industry, report for the Climate Change Committee

THE PROBLEM WITH HYDROGEN

Although we’ve been able to make hydrogen from electricity for 200 years, it’s not easy or cheap to do, so that’s why most hydrogen produced today is grey hydrogen. If we are to use it as a fuel in future, we need to produce it in a greener way and bring the costs down.

One potential use for hydrogen is as a way of storing excess green electricity and helping to balance the grid. The snag here is that the conversion process from electricity to hydrogen is inefficient; in converting electricity to hydrogen, storing it then later converting it back to electricity, you are left with around 35% of what you started with. So it’s not the best storage option.

Other drawbacks to hydrogen is that it is less dense than natural gas so can escape through metal gas pipes; and it has three times less energy by volume than natural gas, so ideally needs to be stored as a liquid – all of which adds to the cost.

A ROADMAP TO A HYDROGEN FUTURE

Despite these difficulties, with the 2050 net zero imperative, we will need to harness hydrogen as a low-carbon fuel, which means kick-starting the "hydrogen economy". In the UK, we are waiting for the Government's Hydrogen Strategy which is due very shortly, but in the meantime the Prime Minister's Ten Point Plan and the Energy White Paper have set out a roadmap:

LOW-CARBON HYDROGEN COULD BREAK EVEN WITH GREY HYDROGEN BETWEEN 2028-34 AT A COST OF \$35-50 PER TON OF CO_2 EQUIVALENT

2021 TO 2030: THE PREPARATIONS

2021 – 2022 – 2023 – 2024 – 2025 – 2026 – 2027 – 2028 – 2029 – 2030

2021 – publish Hydrogen Strategy and consult on preferred business models for hydrogen

2022 – finalise hydrogen business models

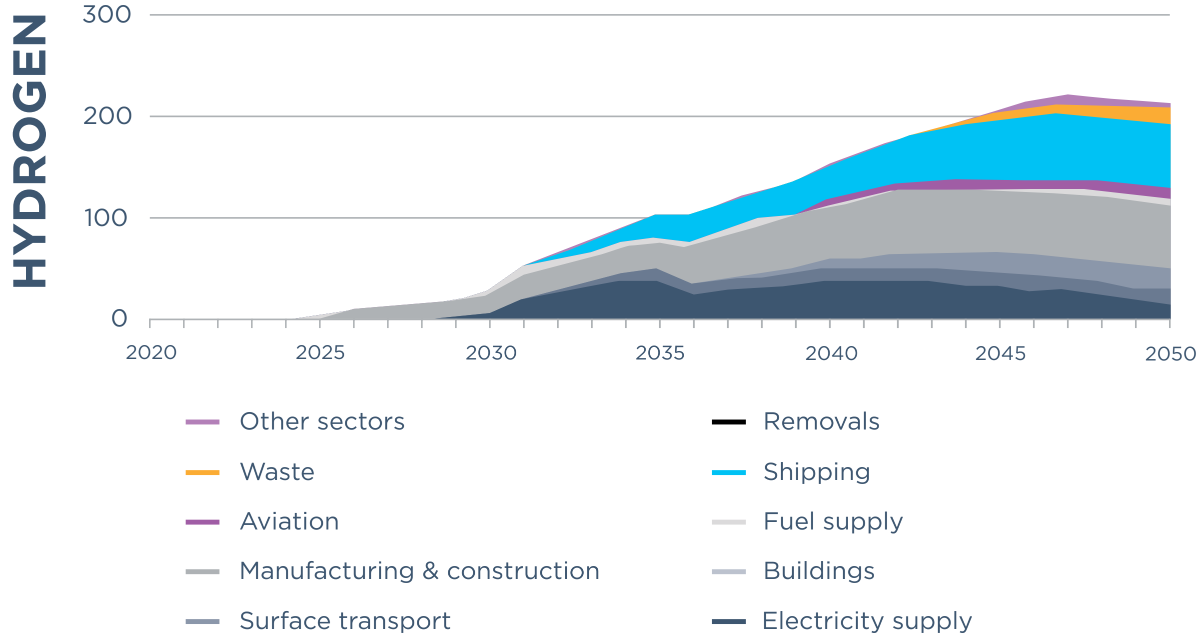
2023 – work with industry to complete necessary tests to allow blending of up to 20% hydrogen into gas grid

2025 – 1GW of hydrogen production capacity

2030 – 5GW of hydrogen production capacity

2030 – 2050: scaling up

The Committee on Climate Change's Sixth Carbon Budget Report of December 2020 projects that from the 2030s onwards a hydrogen economy will develop from virtually zero use in the energy system today, to a scale that is comparable to existing electricity use by 2050 as this chart from the CCC report showing energy demand in TWh demonstrates:



OVER 30 COUNTRIES HAVE HYDROGEN ROADMAPS AND 228 LARGE-SCALE HYDROGEN PROJECTS ANNOUNCED ACROSS THE VALUE CHAIN

SO HOW DO WE GET THERE?

In 2019 the International Energy Agency (IEA) published The Future of Hydrogen report with 7 key recommendations to scale up hydrogen:

1.

Establish a role for hydrogen in long-term energy strategies. National, regional and city governments can guide future expectations. Companies should also have clear long-term goals. Key sectors include refining, chemicals, iron and steel, freight and long-distance transport, buildings, and power generation and storage.

2.

Stimulate commercial demand for clean hydrogen. Clean hydrogen technologies are available but costs remain challenging. Policies that create sustainable markets for clean hydrogen, especially to reduce emissions from fossil fuel-based hydrogen, are needed to underpin investments by suppliers, distributors and users. By scaling up supply chains, these investments can drive cost reductions, whether from low-carbon electricity or fossil fuels with carbon capture, utilisation and storage.

3.

Address investment risks of first-movers. New applications for hydrogen, as well as clean hydrogen supply and infrastructure projects, stand at the riskiest point of the deployment curve. Targeted and time-limited loans, guarantees and other tools can help the private sector to invest, learn and share risks and rewards.

4.

Support R&D to bring down costs. Alongside cost reductions from economies of scale, R&D is crucial to lower costs and improve performance, including for fuel cells, hydrogen-based fuels and electrolysers (the technology that produces hydrogen from water). Government actions, including use of public funds, are critical in setting the research agenda, taking risks and attracting private capital for innovation.

BY 2050, HYDROGEN COULD MEET 18% OF THE WORLD'S FINAL ENERGY DEMANDS

5.

Eliminate unnecessary regulatory barriers and harmonise standards. Project developers face hurdles where regulations and permit requirements are unclear, unfit for new purposes, or inconsistent across sectors and countries. Sharing knowledge and harmonising standards is key, including for equipment, safety and certifying emissions from different sources. Hydrogen's complex supply chains mean governments, companies, communities and civil society need to consult regularly.

6.

Engage internationally and track progress. Enhanced international co-operation is needed across the board but especially on standards, sharing of good practices and cross-border infrastructure. Hydrogen production and use need to be monitored and reported on a regular basis to keep track of progress towards long-term goals.

7.

Focus on four key opportunities to further increase momentum over the next decade.

By building on current policies, infrastructure and skills, these mutually supportive opportunities can help to scale up infrastructure development, enhance investor confidence and lower costs:

- Make the most of existing industrial ports to turn them into hubs for lower-cost, lower-carbon hydrogen.
- Use existing gas infrastructure to spur new clean hydrogen supplies.
- Support transport fleets, freight and corridors to make fuel-cell vehicles more competitive.
- Establish the first shipping routes to kick-start the international hydrogen trade.

AT LEAST $300 BILLION WILL BE INVESTED GLOBALLY IN HYDROGEN OVER THE NEXT 10 YEARS BY THE PUBLIC AND PRIVATE SECTORS

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LOOK OUT FOR...

In our next offshoot we look at how green finance is helping to underpin the **Green Recovery** and shaping boardroom discussions around future strategies.

PROBLEMS. POSSIBILITIES.
COMPLEXITY. CLARITY.
OBSTACLES. OPPORTUNITIES.
THE DIFFERENCE IS IMAGINATION.

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