Briefing

Should the UK confine hydrogen to industrial clusters or develop national pipelines?

January 2026

Summary

To establish an effective low carbon hydrogen economy in the UK it is important to understand whether it is better to co-locate hydrogen production close to end uses or develop national pipelines to transport it around the country.

The levelised cost of green hydrogen (made with renewable energy) production is similar for both co-location and pipeline networks. However, leaked hydrogen has a large global warming potential and leakage rates from pipelines are unknown, creating significant climate change risks. Therefore, co-location should be pursued over a major pipeline network, at least until risks are better understood.

The government should:

- **Improve leakage measurement** across the hydrogen supply chain, particularly in pipeline transportation, via a government funded independent study.
- **Encourage co-location**, as part of a new hydrogen demand strategy, with local transportation via pipelines, concentrated in areas with salt cavern storage.
- **Bring down the cost of electricity** to enable the affordable production of green hydrogen.

Introduction

Hydrogen can be used as a low carbon fuel or an ingredient for industrial processes where electrification is not possible, as well as in shipping and aviation. These sectors need to accelerate their decarbonisation in the next decade and, when it's made with renewable energy, hydrogen can have close to zero lifetime emissions.[1] This is explained further in our report '[What is the best use of hydrogen in the UK?]'.

Hydrogen production sites require either carbon capture and storage (CCS) infrastructure and access to CO_2 storage locations to produce 'blue hydrogen', or electrolysers and an electricity grid connection to produce 'green hydrogen' via renewable energy. Blue hydrogen production does emit carbon and therefore is not an ideal long term solution.

Co-location involves hydrogen production, storage and use being in the same place, such as an industrial cluster with multiple end users. It reduces the risk of leakage as there is no need for long distance transportation and limits the distance over which safety checks need to be made.

National pipeline infrastructure would mean the creation of a network of pipelines which transport hydrogen from a range of production sites to wherever the hydrogen is used. This can be achieved through a combination of new pipelines and adapting the existing gas pipeline network.

In assessing the comparative benefits of co-location vs national pipeline infrastructure, three factors should be considered: leakage and emissions; the costs of production and transportation; and storage requirements and what form the storage takes. These are covered in more depth below.

A national pipeline system could lead to greater climate risks

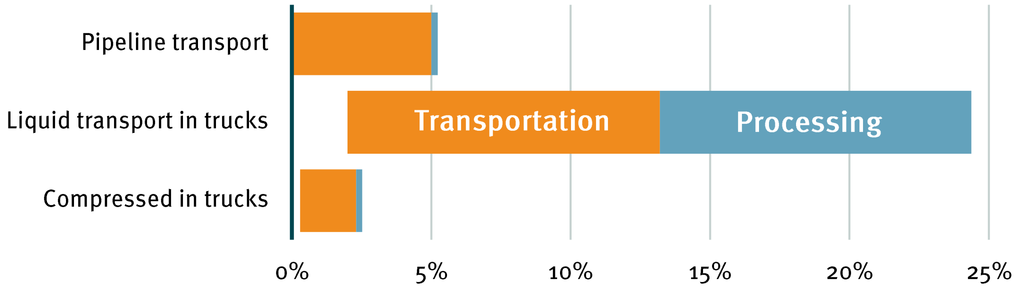
Hydrogen has a global warming potential 34 to 40 times that of CO_2 over 20 years, partly due to its effect in increasing the lifetime of methane, a potent greenhouse gas.[2] Hydrogen production that is geographically dispersed and connected to consumers via a regional or national transmission network, as the natural gas system is today, is likely to have a higher climate impact than co-location in industrial clusters or at individual sites. There are two main methods of transporting hydrogen, trucks and pipelines.

Trucks

Transporting hydrogen by road can be in the form of either liquid or compressed gas. Both have relatively high leakage rates and high levelised costs, at around £1 per kg to £3 per kg, depending on the distance covered per year.[3] This levelised cost is significantly higher than the equivalent for pipelines, and trucks cannot practically transport the same volume as a pipeline.

Liquid hydrogen transported via trucks leaks at two to 13 per cent and liquification (the process of turning gaseous hydrogen into liquid hydrogen) is estimated to lose an additional 0.15 to ten per cent. Compressed hydrogen has lower leakage in transportation, at rates of 0.3 to 2.3 per cent when carried in trucks, and 0.05 to 0.27 per cent during compression.[4]

Liquid hydrogen trucks' leakage rates are significantly higher than for pipelines or compressed gas trucks[5]



In terms of scale, liquid hydrogen trucks carry around 138kWh (assuming a container volume of 50m^3). Compressed hydrogen trailers carry significantly less, at 43kWh in the largest containers of 26m^3.[6, 7]

Pipelines

Hydrogen pipelines will initially transport hydrogen over short distances and may be expanded in the medium term if a national infrastructure approach is pursued. Early projections suggest the 2030 hydrogen pipeline requirement could be 100 to 1,000km, rising to 700 to 1,250km by 2035.[8]

The current operational cost of transporting hydrogen through a pipeline is £0.17 per kg, although there is a high degree of uncertainty around this figure.[9] It could cost £1.5 million per km to construct new pipelines, and £340,000 per km to redevelop gas pipelines, although these figures are also uncertain.[10] Pipelines are expensive to build but cheap to operate and are, therefore, better suited to transport larger quantities than trucks.

However, there are many obstacles to pipeline transportation, including leakage, pipe embrittlement (when hydrogen seeps into the metal structure, weakening it) and uncertainty on the feasibility of redeveloping pipelines.

While pipelines have a relatively low leakage rate of 0.1 to five per cent, if government demand projections are met the total volume leaked will be considerable.[11]

Electricity

Fundamentally, the question of which hydrogen transport option to choose is one of energy transmission. The third option is transporting electricity to where the hydrogen is needed and producing it with electrolysers. This is called co-location (if the hydrogen is used local to its production). While there are also losses from the electricity system, when produced via renewable generation the electricity has zero greenhouse impact.

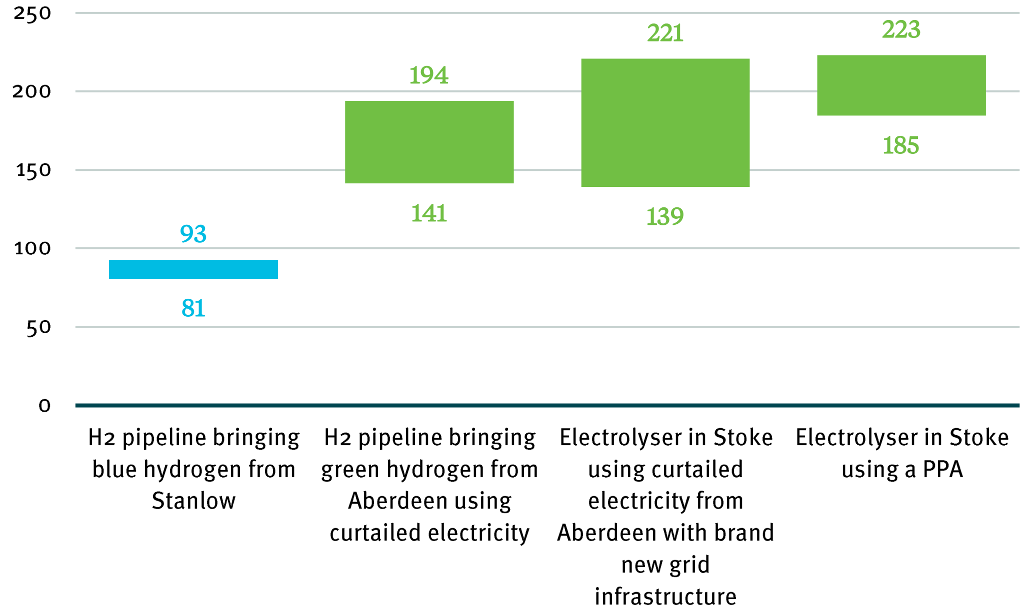
The costs of building hydrogen pipelines and transporting electricity are comparable

To examine the cost of co-location versus transporting hydrogen, we created a hypothetical case study where a ceramics company in Stoke-on-Trent switches to hydrogen as a heat source, replacing natural gas.

The four options we investigated were:

- **Hydrogen transportation:** building a pipeline connected to the HyNet cluster to deliver blue hydrogen to Stoke-on-Trent.
- **Hydrogen transportation:** building an electrolyser in Aberdeen using cheap, otherwise curtailed electricity (where companies are paid to turn off supply in periods of excess energy) and transporting green hydrogen by pipeline to Stoke-on-Trent.
- **Co-location:** building an electrolyser in Stoke-on-Trent and new electricity transmission lines to access cheap, otherwise curtailed electricity from Aberdeen.
- **Co-location:** building an electrolyser in Stoke-on-Trent and using existing grid infrastructure to power it, with electricity bought through a power purchase agreement (PPA) directly with a renewable energy generator to keep costs low.

Levelised cost of blue and green hydrogen, pounds per MWh under different transport and production scenarios[12]



The cheapest option is a new pipeline to connect with Stanlow (Hynet, see below). This is largely due to the lower cost of producing blue hydrogen (£74-85 per MWh, compared to £115-223 per MWh for green).[13] All three green hydrogen options are comparable in price with each other, although producing hydrogen at Stoke-on-Trent using a PPA is likely to be slightly more expensive than using curtailed electricity from Aberdeen and transporting either hydrogen or electricity.

The costs of new electricity transmission and hydrogen transport infrastructure are likely to be similar, though electricity transmission infrastructure cost has a larger cost uncertainty (£27- 36 per MWh for hydrogen pipelines and £24-63 per MWh for electricity transmission infrastructure).[14] Planned upgrades to the electricity grid mean that it should be easier to transport electricity, reducing the need for hydrogen transmission pipelines and their associated leakage impacts.

However, until electricity prices fall substantially, the cheapest option will continue to be to use pipelines to transport blue hydrogen. This should be kept to a minimum, at least until leaks are consistently measured and preventable. Where possible, new industrial uses of hydrogen should be co-located with its production.

Salt cavern storage will dictate where co-location occurs

Storage will be required to balance hydrogen supply and demand throughout the year. Although uses for industry, aviation and shipping are likely to be consistent in their demand, green hydrogen production and demand for hydrogen in electricity production will vary seasonally.[15] Therefore, hydrogen storage is required.

The most used form of storage by volume is likely to be salt caverns. The UK could need 200 to 3,100GWh of salt cavern hydrogen storage by 2030 and 600 to 13,200GWh by 2035.[16] However, the actual need is likely to be much lower, as these estimates include using hydrogen for home heating, which is now widely considered to be unlikely.

Salt caverns have been used to store hydrogen in the UK since 1971, although not on the scale that they will be needed in future. They are effective at storing gas as they can form a good seal to prevent leaks.[17]

Losses during storage are negligible, with cumulative losses over a 30 year period of use at 0.36 per cent of the total storage capacity.[18] This leakage does not necessarily make it into the atmosphere, but seeps into the surrounding geology.[19] The highest risk of leakage is during the flow of hydrogen into and out of the salt caverns, so care and maintenance at these stages is essential.

The need for salt cavern storage limits co-location opportunities to certain areas. Salt caverns exist in north west England, Humberside and the north east of England. These areas also have good access to renewables which can be used as the hydrogen industry transitions from blue to green production, and plans are already in place for production in these areas.[20]

Co-location should be pursued where possible

The future shape of the UK's hydrogen economy remains uncertain. Leakage is still poorly understood and, until this is improved, the full consequences of a large scale transition to hydrogen are not known. Given the costs of electricity transmission and hydrogen pipelines are comparable, to minimise the impact of leaks hydrogen production and use should be co-located where possible. Further research into pipeline leakage rates should be carried out.

The government should:

- **Improve leakage measurement** across the hydrogen supply chain, particularly in pipeline transportation, via a government funded independent study.
- **Encourage co-location**, as part of a new hydrogen demand strategy, with local transportation via pipelines, concentrated in areas with salt cavern storage.
- **Bring down the cost of electricity** to enable affordable production of green hydrogen.

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Endnotes

[1] S O'Connell, W Carr and L Hardy, December 2025, *Hydrogen's role in a clean power economy*, Green Alliance
[2] Green Alliance, May 2023, briefing, 'What is the best use of hydrogen in the UK?'
[3] UK Government, 2023, *Hydrogen transport and storage cost report,* p26
[4] D Trapani et al, 2025, 'Hydrogen leakages across the supply chain: current estimates and future scenarios', *International journal of hydrogen energy*
[5] Ibid
[6] Hydrogen Europe, 2021, 'Hydrogen transport & distribution'
[7] Higher heating value of 39.41 kWh/kg used: 3500 kg * 39.41 kWh/kg = 137,935 kWh, 1100 kg * 39.41 kWh/kg = 43,351 kWh. 3,500 kg and 1,100 kg come from the largest masses of hydrogen transportable by liquid and gas truck-trailers respectively. See: oge.net/en/hydrogen/hydrogen-calculator/application kg - kWh conversion
[8] Cornwall Insight and Frazer Nash, 2022, *Hydrogen infrastructure requirements up to 2035*, Department for Energy Security and Net Zero and Department for Business, Energy and Industrial Strategy, assets.publishing.service.gov.uk/media/63973bfde90e077c2e1ce834/Hydrogen_infrastructure_requirements_up_to_2035_-_report.pdf, p4
[9] Ibid, p47

[10] Ibid, p48

[11] D Trapani et al, 2025, op cit

[12] See associated methodology at https://green-alliance.org.uk/wp-content/uploads/2026/01/Methodology-Should-the-UK-confine-hydrogen-to-industrial-clusters-or-develop-national-pipelines.pdf

[13] Ibid

[14] Ibid

[15] Cornwall Insight and Frazer Nash, 2022, op cit, p5

[16] Ibid, p5

[17] Environment Agency, 2025, *The geomechanics of hydrogen storage in salt caverns: environmental considerations: summary*, www.gov.uk/government/publications/the-geomechanics-of-hydrogen-storage-in-salt-caverns-environmental-considerations/the-geomechanics-of-hydrogen-storage-in-salt-caverns-environmental-considerations-summary

[18] M Ghaedi and R Gholami, 2025, ‘Characterization and assessment of hydrogen leakage mechanisms in salt caverns’, *Nature,* www.nature.com/articles/s41598-024-84505-x

[19] Ibid

[20] S O’Connell, W Carr and L Hardy, December 2025, op cit