

ANNEX 1a

SSAC Hydrogen Briefing Note - Opportunities and challenges associated with hydrogen's role in the delivery of future energy systems in the context of a Just Transition

Links provided to various documents:

[North of Scotland Future Energy Scenarios \(NoSFES\) \(ssen-transmission.co.uk\)](https://ssen-transmission.co.uk)

SSEN Distribution, has published future local energy scenarios for the north of Scotland [here](#)

[Publication - The Future Cost of Electricity-Based Synthetic Fuels \(agora-energiewende.de\)](https://agora-energiewende.de)

[A review of independent research](#) indicates that hydrogen is unlikely to be a feasible option for heating due to high costs and inefficiencies. 18 independent studies produced since 2019 have ruled out hydrogen playing a major role in the heating of buildings.

An EU [study from Fraunhofer IEE](#) found that blending 20% hydrogen into the natural gas grid could lead to price increases of up to 16% for household consumers, and 43% for industrial consumers (media coverage [here](#)).

Powering boilers with green hydrogen uses [six times more renewable energy](#) than the renewable energy used for heat pumps.

The high costs suggest hydrogen is more likely to play a role in decarbonising industries where there is no alternative. In its 2022 [Mitigation of Climate Change](#) report, the IPCC identified that hydrogen would play a vital role in reaching net zero emissions, but was sceptical about the extent to which it would be used for heating.

The [Scottish Hydrogen Assessment](#) forecast that the hydrogen economy could contribute between £5b and £25b in GVA in Scotland by 2045. Likewise, it could either protect or create between 70,000 and 300,000 jobs.

<https://www.imperial.ac.uk/news/233420/heat-pump-roll-out-must-urgent-home/>
<https://www.raponline.org/blog/pipe-dream-alleviating-energy-poverty-hydrogen/>

suggests that energy efficiency, heat pumps (including hybrid systems) and heat networks will be the least-cost pathway to decarbonising heat (with direct electric heating in space-constrained properties and some use of biomass in hard-to-insulate, off-grid properties)

Our analysis [here](#) of pathways to net zero based on the Sixth Carbon Budget shows that shows that renewable energy produced in the north of Scotland has the potential to contribute 10% of the emissions abatement required for net zero.

The Energy Systems Catapult [net-zero report](#) states that while “speculative innovation measures” that result in carbon capture of up to 99% would make blue hydrogen “highly appealing”, anything less effective should not be considered: “Without speculative innovation measures, methane reforming at a 95% capture rate is too high carbon to meet net-zero.”. Even at 100% CCUS

effectiveness emissions from blue hydrogen would still occur through upstream leakage as illustrated in [a report](#) which accounts for these leakages, by the [Pembina Institute thinktank](#)
www.carbonbrief.org/in-depth-qa-does-the-world-need-hydrogen-to-solve-climate-change

Climate Change Committee in their most recent advice to both the UK and Welsh Governments:

[2022 Progress Report to Parliament - Climate Change Committee \(theccc.org.uk\)](#)

[CCC responds to UK Government's Energy Security Strategy - Climate Change Committee \(theccc.org.uk\)](#)

[Innovating to Net Zero - Energy Systems Catapult](#)

National Grid ESOs 2020 Future Energy Scenarios: [ESO: Future Energy Scenarios for the next 30 years](#)
[| National Grid Group](#)

www.carbonbrief.org/in-depth-qa-does-the-world-need-hydrogen-to-solve-climate-change

[The Local Heat and Energy Efficiency Strategies \(Scotland\) Order 2022 \(legislation.gov.uk\)](#)

[7th Annual Global Conference on Energy Efficiency \(windows.net\)](#)

[A review of independent research](#) indicates that hydrogen is unlikely to be a feasible option for heating due to high costs and inefficiencies.

The International Energy Agency (IEA) found in its [Net Zero by 2050](#) report that its least-cost pathway to net zero would include less than 2% hydrogen in decarbonising buildings.

Hydrogen Economy Pathways

https://www.youtube.com/watch?v=2tNNKABq_k0

Options for Energy Transition in Colombia (30 minutes)

<https://we.tl/t-KPMrC3FCXr>

Thomas Lowe Grey Lecture: Alternative Energy Futures (60 minutes)

<https://we.tl/t-nkWVlvm0bb>

The Ocean Route: Development of the North Coast of South Africa

<https://we.tl/t-foQ0P8t53E>

<https://www.hy4heat.info/>

[Heat in Buildings Strategy - achieving net zero emissions in Scotland's buildings - gov.scot \(www.gov.scot\)](#)

[Jacobs-Strategy-for-Long-Term-Energy-Storage-in-UK-August-2020.pdf](#)

[Scottish Hydrogen Assessment Project - Arup](#)

[Offshore wind to green hydrogen: opportunity assessment - gov.scot \(www.gov.scot\)](#)

[Hydrogen action plan: draft - gov.scot \(www.gov.scot\)](#)

Growing the supply chain for net zero:

<https://www.beama.org.uk/industry-support/net-zero/growing-the-supply-chain-for-net-zero.html>

Citations:

<https://www.energynetworks.org/creating-tomorrows-networks/>

<https://www.sgn.co.uk/sites/default/files/media-entities/documents/2021-11/North East Network and Industrial Cluster Development Summary Report November 2021.pdf>

<https://www.gov.uk/government/publications/uk-hydrogen-strategy>