

Following the publication of the Scottish Government's **Hydrogen Action Plan**, this briefing gives an overview of the different types of hydrogen production and considerations for their use in Scotland:

- **Blue hydrogen is not low carbon** and relies on speculative Carbon Capture Storage (CCS) technology which has historically been over-promised and undelivered. **Relying on CCS runs the risk of missing important emission reduction targets.** Blue hydrogen should not be developed in Scotland.
- Relying on large scale use of hydrogen risks locking us into a high-carbon, fossil fuel future, and missed climate targets, if it doesn't materialise.
- **Green hydrogen** might be appropriate for hard to decarbonise sectors such as heavy industry but not for heat or light transport.
- **The main focus for renewable electricity must be on directly meeting demand across homes, buildings, transport and heating where other more efficient options exist** such as heat pumps, direct electrification, energy efficiency and electric buses.

## Overview

Following the recent publication of the [UK Government Hydrogen Strategy](#), the Scottish Government is due to publish a corresponding Hydrogen Action Plan this autumn. The recent Programme for Government<sup>1</sup> sets out that there will be a “development of low-cost hydrogen capability” with an “initial ambition of generating 5GW of renewable and low-carbon hydrogen by 2030”. The recent Climate Change Plan update (CCPu)<sup>2</sup> also noted that hydrogen could be used to decarbonise heat, transport and industry.

## UK Hydrogen Strategy

The UK Government's [10 point plan](#) aims to produce 5GW of annual “low-carbon” hydrogen in the UK by 2030. Currently, this capacity stands at nearly zero. The Committee on Climate Change has previously [noted](#) that the UK government should “set out [a] vision for contributions of hydrogen production from different routes to 2035” in its hydrogen strategy. The Hydrogen Strategy does not do that, instead stating it will provide “further detail on our production strategy and twin track approach by early 2022”. The UK hydrogen strategy has been criticised for this twin track approach which runs the risk of favouring fossil hydrogen and locking the UK into continued fossil fuel use.

The hydrogen strategy also stated that the Government expects less than 1 KWh of energy for heating to be produced from hydrogen by 2030. Current energy demand in the entirety of the UK for hot water and space heating is approximately 435 TWh making 1TWh 0.2% of demand and equating to only approximately 67,000 households. This demonstrates that **hydrogen for heating cannot play a notable role for decarbonising heat before 2030.**

<sup>1</sup> <https://www.gov.scot/programme-for-government/>

<sup>2</sup> <https://www.gov.scot/publications/securing-green-recovery-path-net-zero-update-climate-change-plan-20182032/>

## ***Fossil Hydrogen***

Blue Hydrogen is made from fossil gas, a process which still releases carbon dioxide and methane emissions. Proposals for fossil hydrogen rely on Carbon Capture and Storage (CCS) technology to capture emissions, however the scale of **CCS necessary to reduce emissions at the level required has not been demonstrated anywhere in the world.**<sup>3</sup> CCS projects have, for decades, received billions in investment with little success. Recent studies have also shown that in the past 50 years the cost of CCS has still not decreased.

The Scottish Government is supporting the development of fossil hydrogen at the Acorn project at St Fergus. Whilst the UK hydrogen strategy claims to support more individual renewable hydrogen projects than fossil hydrogen projects, overall the strategy would actually see greater generation of fossil hydrogen (approx 900 MW) than renewable (less than 200 MW). This shows that **fossil hydrogen is being relied upon for decarbonisation in the UK much more than renewables.** Recent research<sup>4</sup> also shows that while carbon dioxide emissions are lower from blue hydrogen than grey (fossil hydrogen without CCS), **methane emissions are higher (and are 86 times more impactful than carbon dioxide)** because of an increased use of fossil gas to power the carbon capture.

Further, the **greenhouse gas (GHG) footprint of blue hydrogen is more than 20% greater than burning natural gas or coal for heat.** Due to the increased GHG emissions from fossil hydrogen and its reliance on expensive and unproven CCS technologies it is our view that fossil hydrogen projects should not be pursued in Scotland.

## ***Green hydrogen***

Green hydrogen is made from the process of electrolysis, using an electric current to split water into its component elements of oxygen and hydrogen. There is significant efficiency loss in the process of converting electricity to hydrogen, with as much as 40-60% of energy lost, meaning that in most cases it is vastly more efficient, and cost-effective, to use electricity directly.<sup>5</sup> Furthermore, the creation of green hydrogen relies on there being an abundance of low-cost renewable electricity.<sup>6</sup> In 2019, **only 51.7% of electricity generated in Scotland was renewable.** Green hydrogen will not be ready on any significant scale to help meet our climate target of 75% emissions reduction by 2030.

## ***Hydrogen is not the solution for heating***

To date, no country in the world has managed to decarbonise their heat supply with pure hydrogen. As outlined above, hydrogen is an inefficient use of electricity; **research shows that producing and burning hydrogen-based fuels in home gas boilers requires 6 to 14 times more electricity than heat pumps providing the same warmth.**<sup>7</sup>

The Scottish Government has proposed blending hydrogen into the gas grid, a process where a proportion of hydrogen would be mixed with gas. The maximum level of hydrogen that can be safely blended with gas is approximately 20% due to hydrogen's propensity to corrode steel pipes. However, a **20% hydrogen blend** has been estimated to **reduce the UK's carbon emissions by just 6 million tonnes**<sup>8</sup> which is **less than 2% of total**

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<sup>3</sup><https://foe.scot/resource/report-carbon-capture-storage-energy-role/>

<sup>4</sup> <https://onlinelibrary.wiley.com/doi/full/10.1002/ese3.956>

<sup>5</sup> <https://www.sciencedirect.com/science/article/abs/pii/S1364032116305366?via%3Dihub>

<sup>6</sup><https://www.iea.org/commentaries/the-clean-hydrogen-future-has-already-begun>

<sup>7</sup> [Potential and risks of hydrogen-based e-fuels in climate change mitigation](#)

<sup>8</sup><https://hydeploy.co.uk/faqs/much-difference-20-hydrogen-make-uk-carbon-emissions/>

**emissions emitted in 2019.**<sup>9</sup> This is clearly insufficient. To meet climate targets, Scotland's heating system must be completely decarbonised. Rather than backing hydrogen in heating, priority should instead be on investing in the **electrification of heat**, widespread adoption of **heat pumps, heat networks** and ensuring that homes are built or retrofitted to the **highest efficiency standards**, making them easier to heat and supporting the eradication of fuel poverty.

### ***Hydrogen vehicles are inefficient and unnecessary to decarbonise transport***

Transport is Scotland's largest emitting sector, accounting for approximately 37% of total emissions. However, **using renewable electricity to create hydrogen rather than to directly power vehicles is extremely inefficient.** Electric bus fleets produce lower levels of cumulative emissions compared to hydrogen,<sup>10</sup> and electric cars and small trucks are cheaper to run than hydrogen fuel cell vehicles.<sup>11</sup> Our **priority should be expanding electric bus fleets and, with manufacturing companies like Alexander Dennis in Scotland, protecting and expanding these jobs.**<sup>12</sup>

### ***Limited potential for green hydrogen and rules for its use***

While the top priority for renewables should be to create electricity for direct use, there will be circumstances, for instance in remote areas or to supply hard-to-decarbonise industries like heavy industry or heavy transport, where using renewable power to make green hydrogen might make sense. However, **the upscaling of green hydrogen nationwide represents a real risk of diverting efforts away from cheaper and more readily available options.**

In these areas where green hydrogen might be the only option for reducing emissions, **there must be rules put in place to ensure that green hydrogen producers fund or build the development of new renewable installations needed to make hydrogen.** This should be additional to existing renewable capacity. Without this **there is a serious risk of diverting precious renewable electricity from existing sources which are needed to decarbonise other important sectors.** If renewable electricity is diverted for hydrogen production the grid could compensate for this loss by using fossil fuel power to replace the electricity lost causing an increase in net emissions rather than decreasing them.

Scotland's Hydrogen Action Plan must not rely on hydrogen both renewable or fossil to decarbonise heating or transport as stated above, must include a definition of what "low-carbon" hydrogen is given that fossil hydrogen is still a carbon emitting process and as noted in the recent SNP-Green policy programme "**Any strategy for deployment of these technologies must enable decarbonisation at pace and cannot be used to justify unsustainable levels of fossil fuel extraction or impede Scotland's just transition to net zero**"

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<sup>9</sup>[https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/875485/2019\\_UK\\_greenhouse\\_gas\\_emissions\\_provisional\\_figures\\_statistical\\_release.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/875485/2019_UK_greenhouse_gas_emissions_provisional_figures_statistical_release.pdf)

<sup>10</sup> <https://www.sciencedirect.com/science/article/pii/S136192092030537X>

<sup>11</sup> <https://data.bloomberglp.com/professional/sites/24/BNEF->

<sup>12</sup> [Hydrogen-Economy-Outlook-Key-Messages-30-Mar-2020.pdf](https://foe.scot/good-green-jobs-at-alexander-dennis-under-threat/)  
<https://foe.scot/good-green-jobs-at-alexander-dennis-under-threat/>