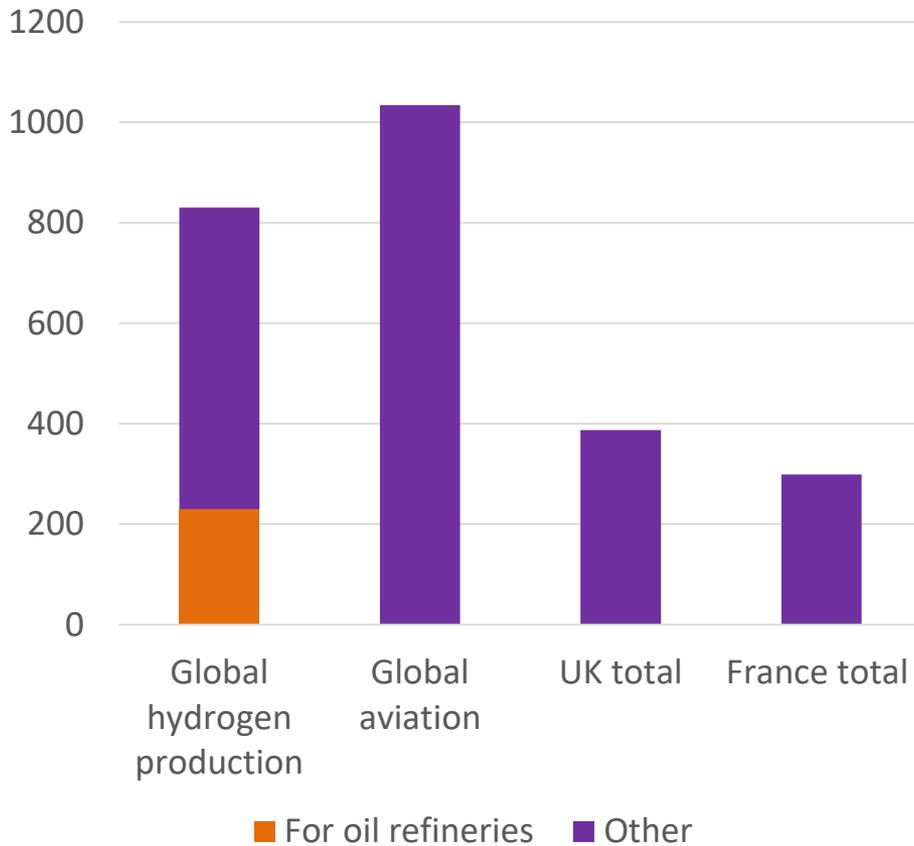


The hydrogen colour codes

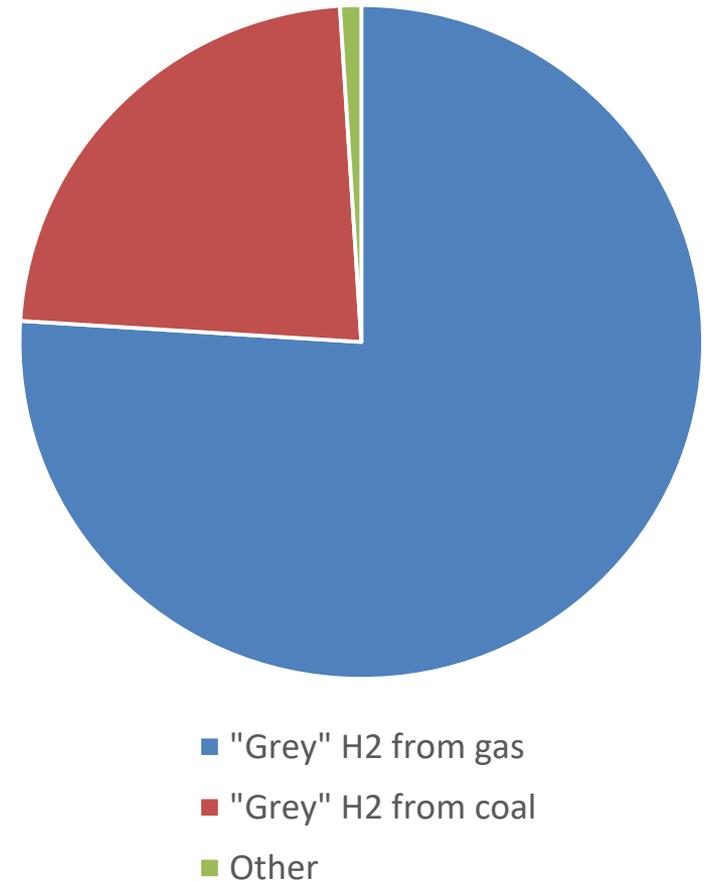
- “Grey” hydrogen. Take natural gas (CH_4). Separate the carbon from the hydrogen. Join the carbon to oxygen and put it in the atmosphere (CO_2). **Current production method. Can also be done from coal or coal seam gas**
- “Blue” hydrogen. Same as “grey”. Instead of putting the carbon in the atmosphere, capture it and store it (CCS). **Problems: (i) methane leaks, (ii) CCS has been in development for 30+ years and does not work at scale**
- “Green” hydrogen. Apply electricity to water (H_2O). Separate hydrogen and oxygen. Let the oxygen go. **It’s a greenhouse-gas-free method, but needs a HUGE amount of electricity (huge = with greater energy content than the hydrogen you end up with)**

"Grey" hydrogen is not "clean"

Carbon dioxide emissions, 2018, millions of tonnes



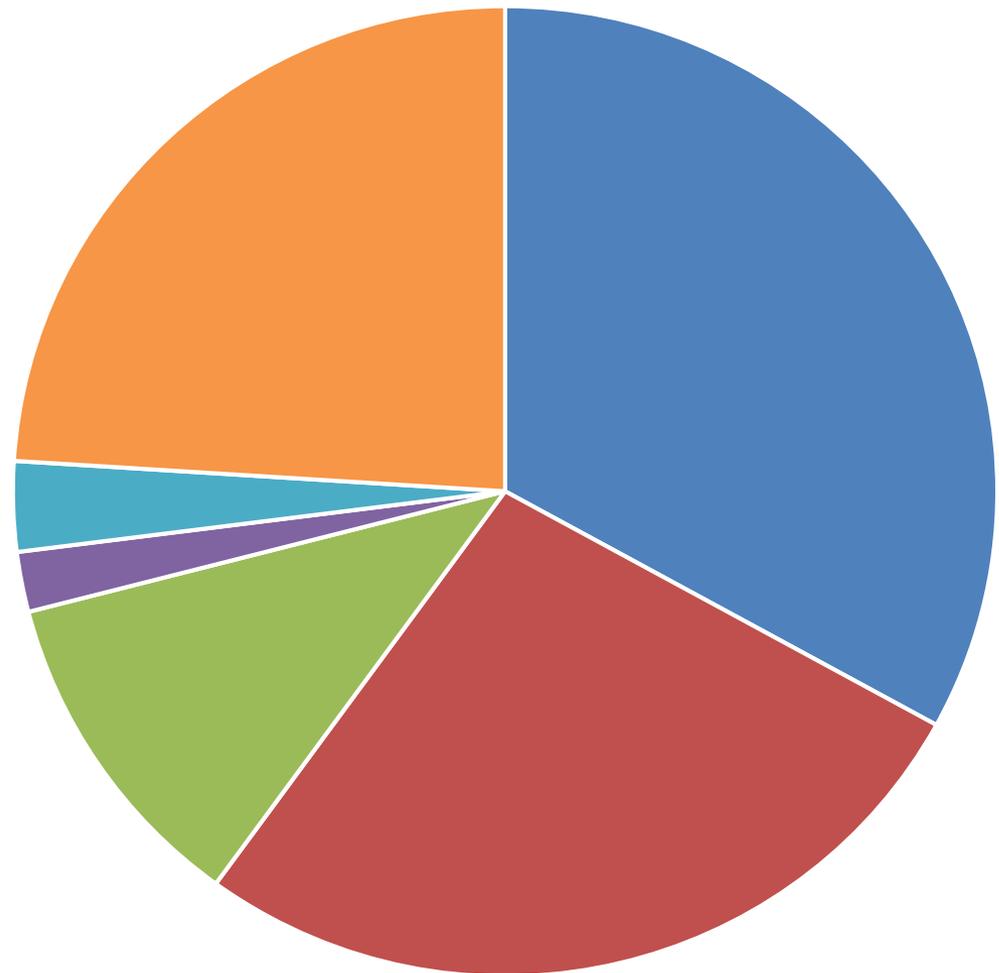
Global hydrogen production



Any rational decarbonisation policy would start by cleaning up this lot

**Consumption
of H₂ needs
to be
repurposed
and reduced**

Uses of hydrogen

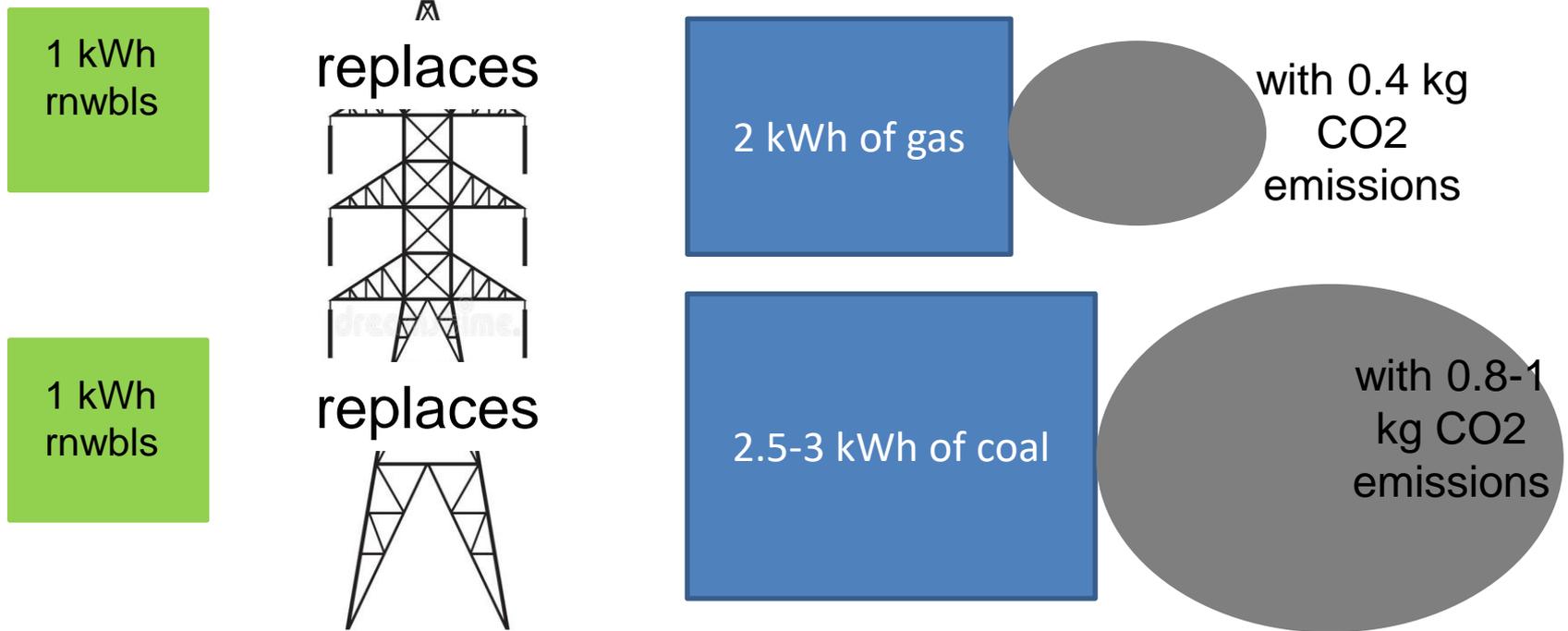


- Oil refineries
- Ammonia production
- Methanol production
- Other chemicals
- Steel production (DRI)
- Other

“Blue” H₂: does it save ANY carbon??!

- **“How green is blue hydrogen?” by R. Howarth and M. Jacobson (2021). Far from being low carbon, blue hydrogen produces plenty of greenhouse gas emissions, especially from methane leaks. Using their assumptions, the carbon footprint is 20% greater than that of natural gas.**
- **Howarth and Jacobson were quickly denounced by oil companies, and some other researchers, but even if you tweak their assumptions, you can not make blue hydrogen “low carbon”**
- **The government’s claim that hydrogen (or oil or gas) is the best way to protect jobs is a myth**

“Green” hydrogen: uses renewable electricity that should go to the grid first

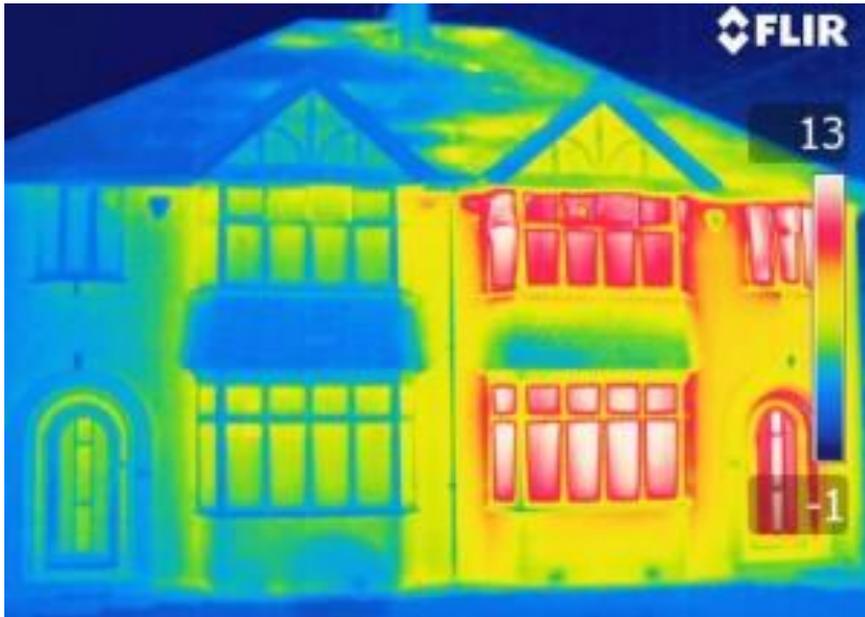


Until all fossil fuels are off the grid, renewables used for H2 have a carbon cost

UK government hydrogen strategy

- A “twin track” approach (“blue” and “green”) to produce 5 GW of hydrogen production capacity by 2030
- A £240m “net-zero hydrogen fund”, creation of a hydrogen-heated neighbourhood by 2023, hydrogen blending into natural gas (up to 20%). Much else is vague
- The strategy needs scanning for greenwash. Example: the BEIS press release claimed the strategy would produce enough hydrogen to replace natural gas in “powering 3 million UK homes each year”. But the text (page 62) talks about <1 TWh of energy for heat by 2030, i.e. enough for 70,000 homes
- The input of the fossil fuel industry, via the Hydrogen Advisory Council and lobbyists, is substantial

Leeds TUC retrofit +heat pumps proposal



Thermal imaging of heat escaping a house with insulation (left), and without. It's energy efficiency measure #1

- An alternative to the Northern Gas Networks H21 project to convert 15.7 million homes to hydrogen – which would need six times current UK wind capacity (for “green” H2) or 60 carbon capture plants as big as the world’s biggest (for “blue” H2)
- Super-insulation and heat pumps are established technologies
- They compare well with other pathways
- Deep retrofitting = opportunities for community involvement and democratic governance
- IPPR estimates heat networks, heat pumps and energy efficiency could need 300,000+ jobs in the UK by the mid 2030s

Recommended reading

- [R. Howarth and M. Jacobson \(2021\), “How Green is Blue Hydrogen?”](#)
- [C. Bauer et al \(2021\), “On the climate impacts of blue hydrogen production”](#)
- [Comments by Michael Barnard, CleanTechnica](#)
- [Carbon Brief: Does the world need hydrogen to solve climate change?](#)
- [“Blue hydrogen backlash ‘has ring of fracking row’”](#)
- [The hydrogen hoax \(S. Pirani\)](#)
- [Hydrogen for homes is a terrible idea. We should fight it \(S. Pirani\)](#)