Hydrogen's Role in the Clean Energy Economy

Hydrogen Webinar, The Climate Center

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University of Cambridge and Hydrogen Science Coalition

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Hydrogen science coalition

*A voluntary group of **independent academics, scientists and engineers** who aim to bring **an evidence-based viewpoint** to the hydrogen debate*

Members

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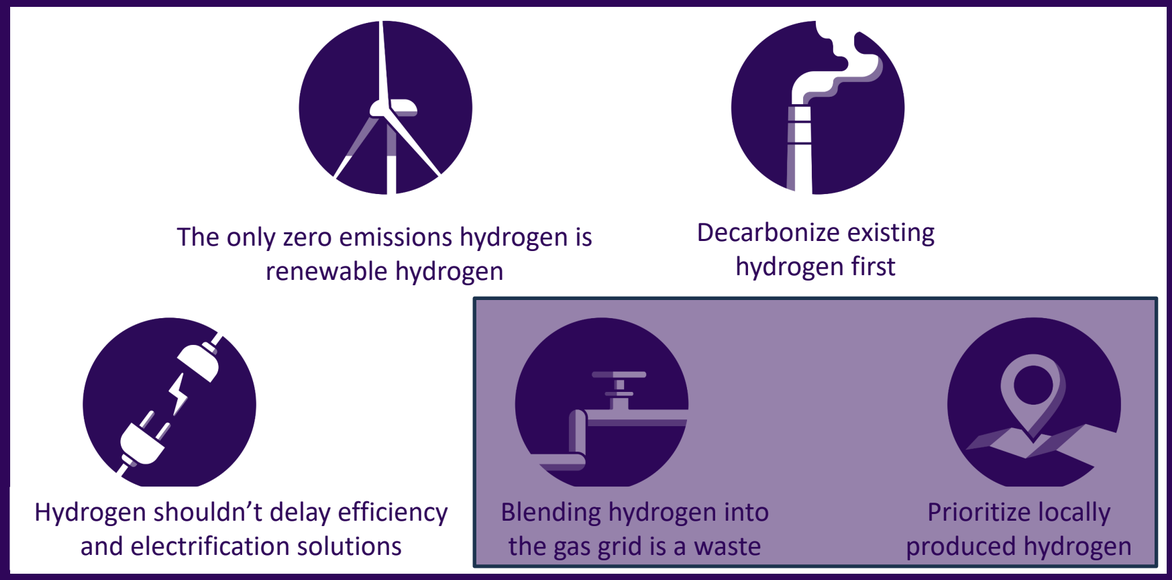
Principles



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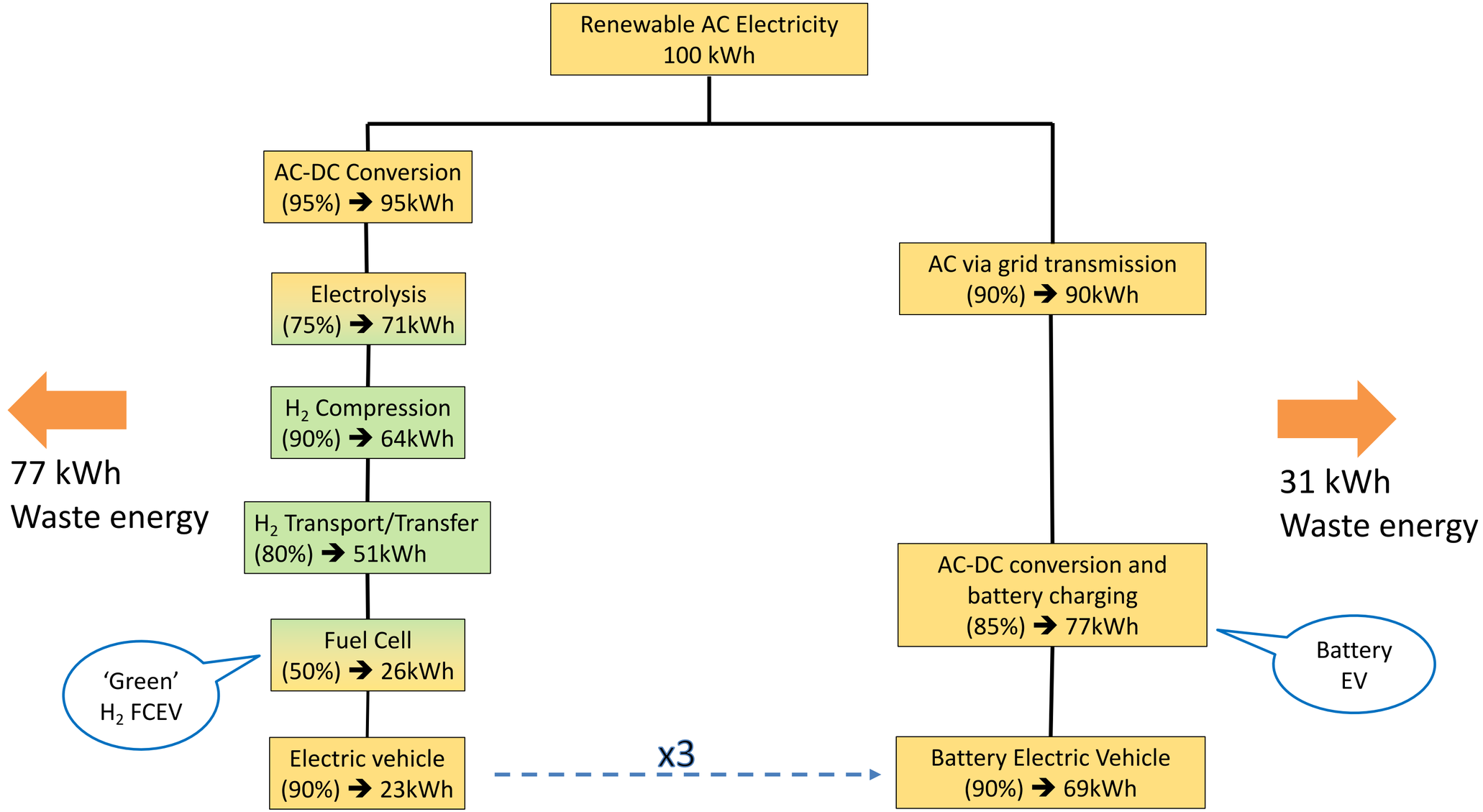
Decarbonise grey hydrogen first…

1. Grey hydrogen is 2% of world CO_2 emissions… same as aviation.
2. Start where grey hydrogen is used today as a chemical feedstock:
    - Fertilizer
    - Petrochemical processing
    - Plate glass
    - Maybe steel
    - ….

Hydrogen should not be used to delay electrification

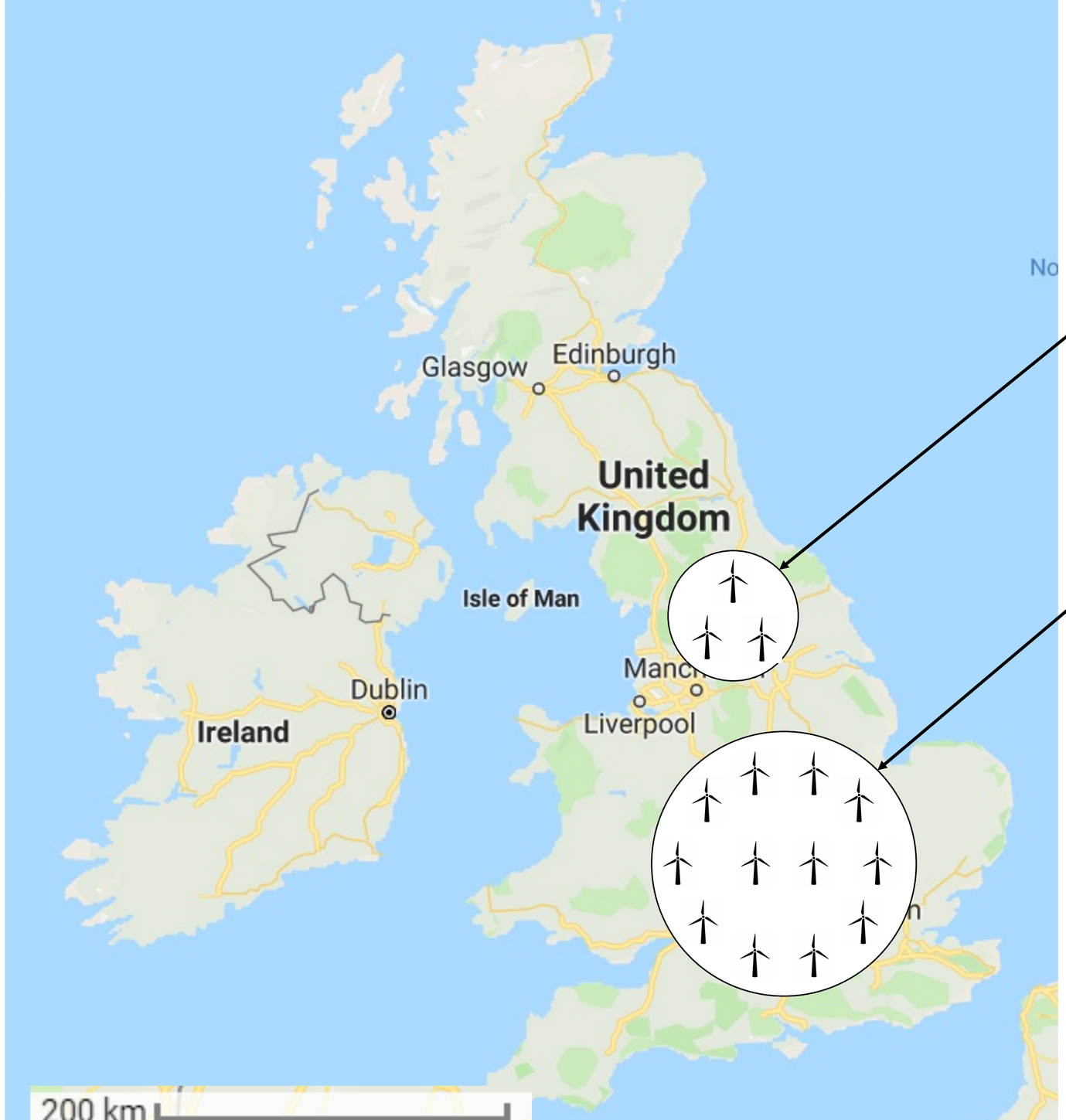
1. When electricity can be used instead of hydrogen, it is:
   - More efficient
   - Lower cost
   - Lower CO_2
   - A more mature solution: quicker to deploy
2. Green hydrogen solutions need massive renewable energy generation.
3. Blue hydrogen solutions are not clean.

Electrify everything we can: Vehicles…



- 3x more renewable electricity to power a hydrogen FCEV than a Battery EV: 3x cost!
- The killer is the conversion from heat to work in the fuel cell
- Electrify everything you can!

Land Areas for Electrification of UK Road Freight



Battery Electric Vehicles:

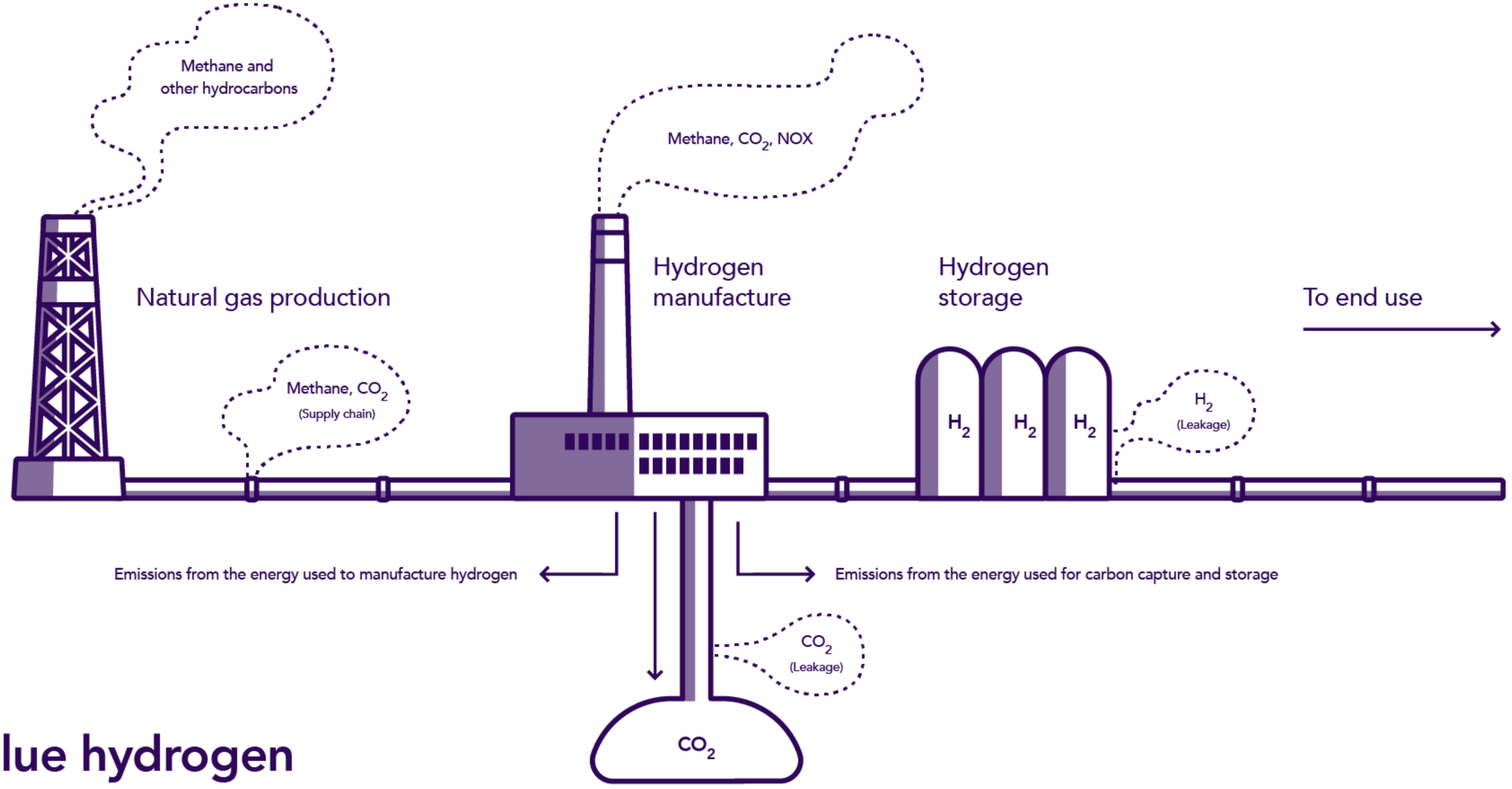
- 11.9 GW
- 4,000 wind turbines
- Land Area=6,000 km^2

'Green' Hydrogen:

- 35.6 GW
  (31 GW = UK average)
- 12,000 wind turbines
- Land Area=18,000 km^2

Assumptions:

1. UK freight: 189b t.km per year
2. 0.19 kWh/t.km (44t), LF=0.75
3. Efficiencies:
   - 0.77 ERS
   - 0.23 H_2
4. Turbine power: 3MW
5. Wind power density: 2 W/m^2



Blue hydrogen production emissions

The only low emission hydrogen is green hydrogen…

1. Blue hydrogen:
   - Increases gas consumption by 45%
   - releases 10%-50% CO_2 of grey hydrogen
   - generates high fugitive methane emissions
   - requires large-scale, non-existent CCS
   - See HSC's definition* of clean H_2
2. Using grey hydrogen generates significantly higher CO_2 emissions than burning fossil fuels.
3. Green hydrogen is much cleaner, but requires a lot of renewable electricity.

* https://h2sciencecoalition.com/briefings/clean-hydrogen-definition/

Why is this important?

1. Hydrogen for heating and road transport is inefficient and will increase costs and fuel poverty and damage economies
2. Blue hydrogen will increase gas imports, create high emissions and damage energy security;
3. Generating green hydrogen will require massive renewable electricity and will prevent decarbonisation of electricity grid;
4. Hydrogen must only be used where there are no other alternatives…
   - Fertilizer, plastics, glass, maybe steel
   - Not heating, Not heavy vehicles, Not electricity storage …
5. Confusion and uncertainty around hydrogen will delay international decarbonization.