# Climate-(Mis)aligned Hydrogen

## *Four Stranding Risks of Supply-Driven $H_2$ Buildout*

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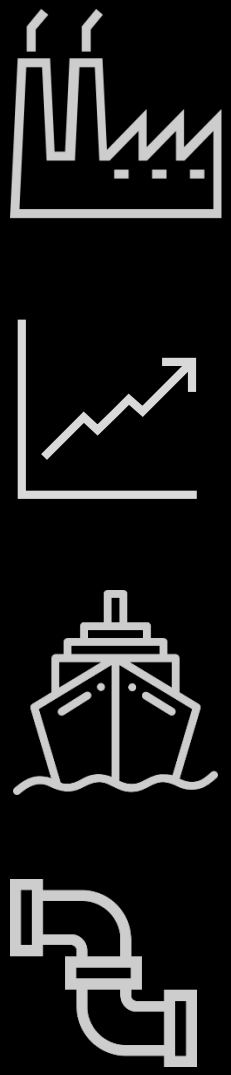
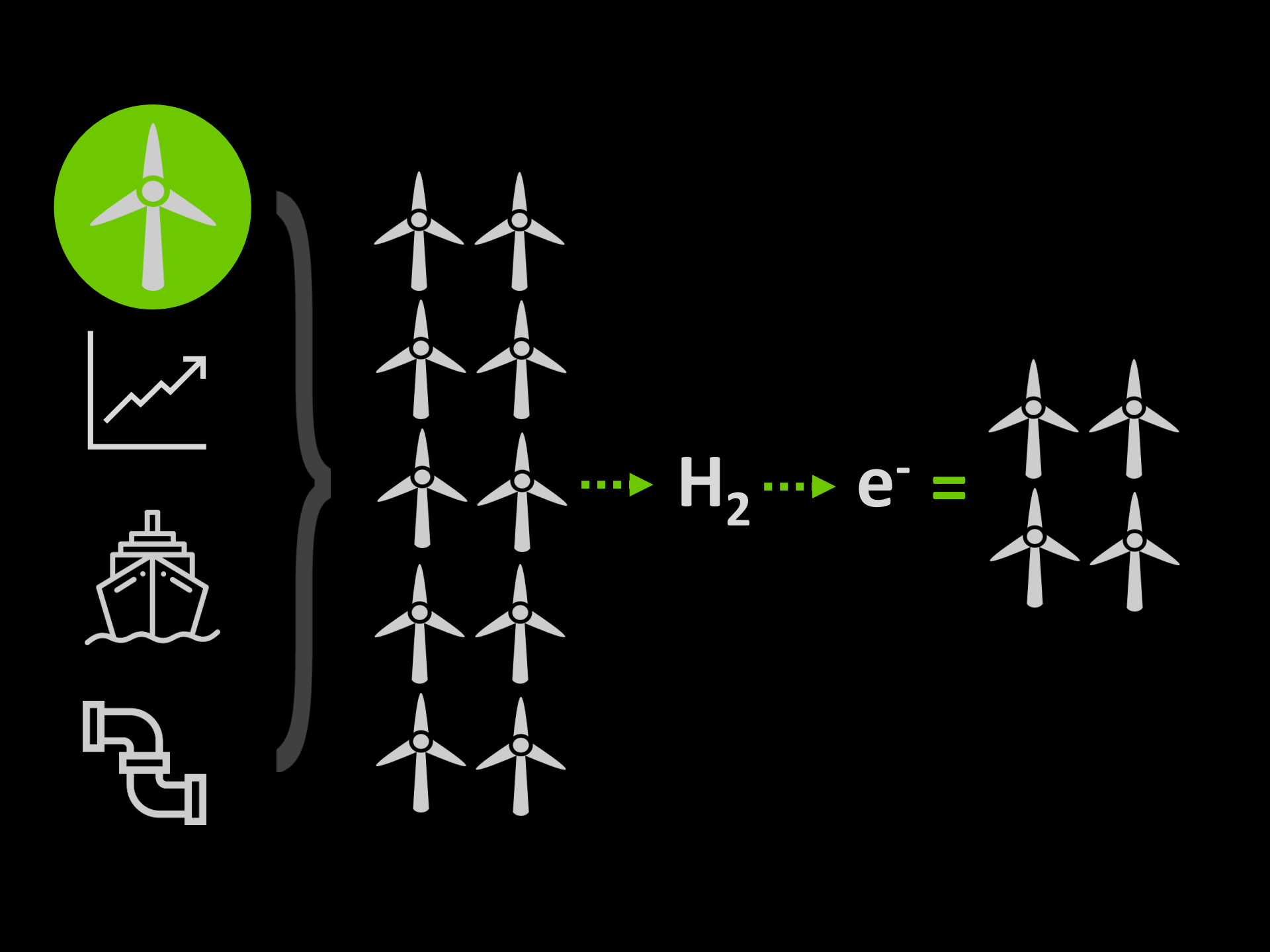
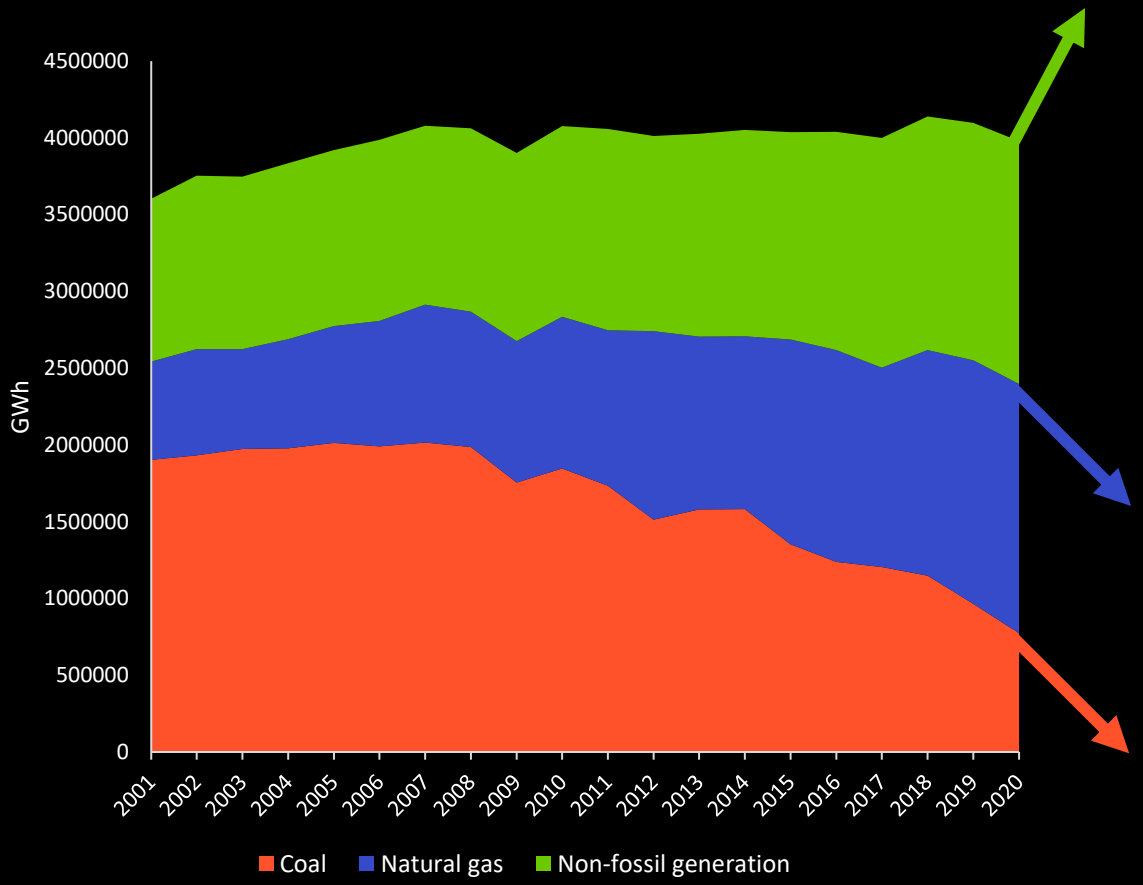
Union of Concerned Scientists

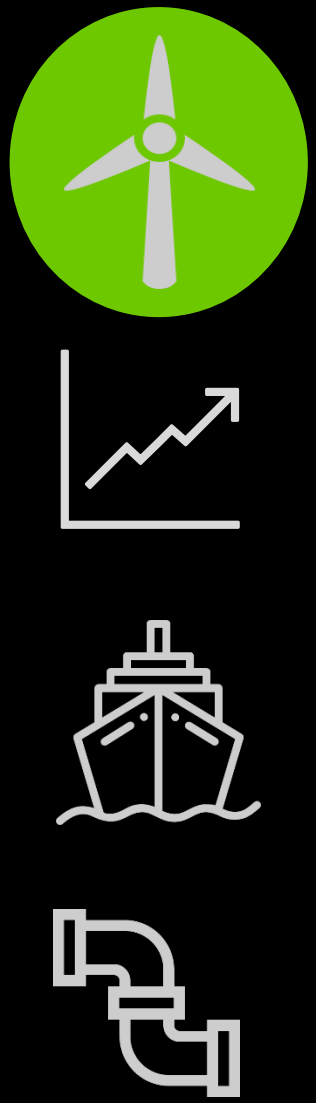


1. Carbon emissions
2. Cost competitiveness
3. End-use alternatives
4. Proximity to need

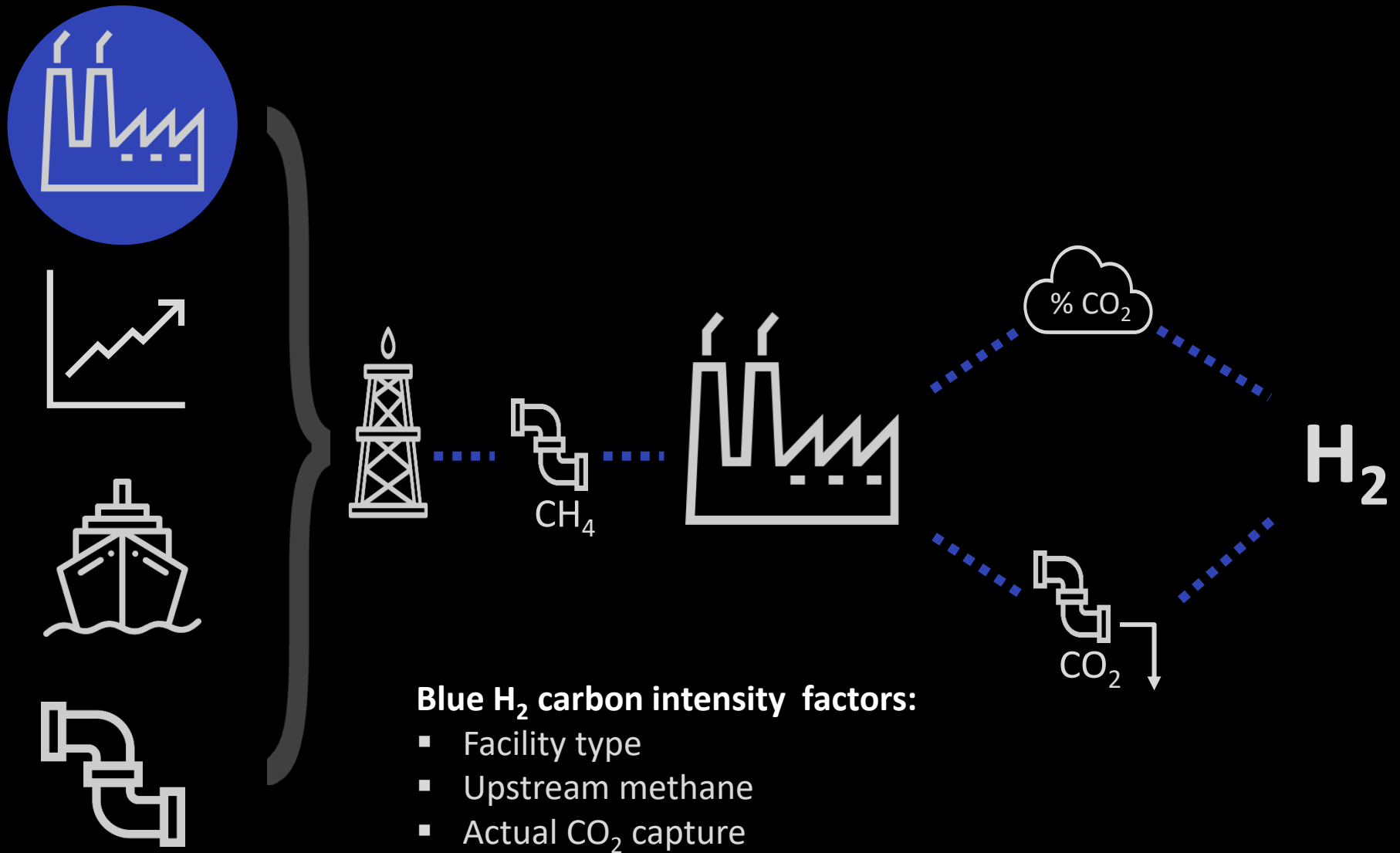

$H_2$
$e^-$

For clean energy transition to succeed, the power grid needs clean energy displacing fossil fuels—and fast.



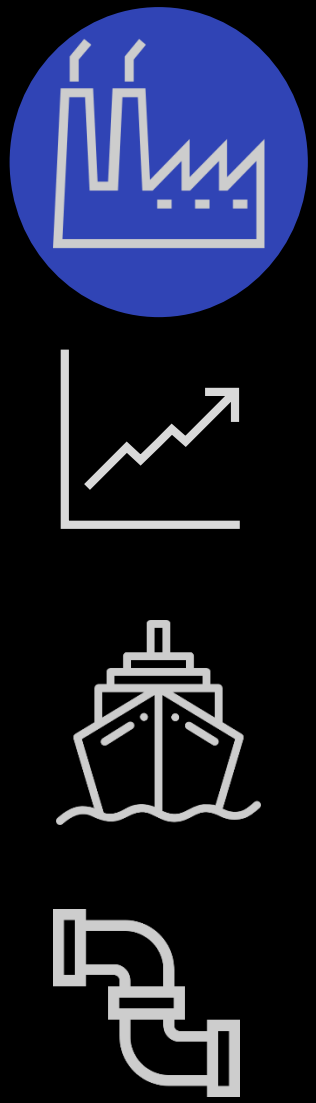


Inefficiencies mean direct electrification best; required power sector transition limits near-term green $H_2$ buildout.




**Blue $H_2$ carbon intensity factors:**

- Facility type
- Upstream methane
- Actual $CO_2$ capture
- $CO_2$ storage



Multiple upward pressures on blue $H_2$ emissions risk undermining low-carbon profile.

Electrolyzer capex on **steep downward** trajectory.

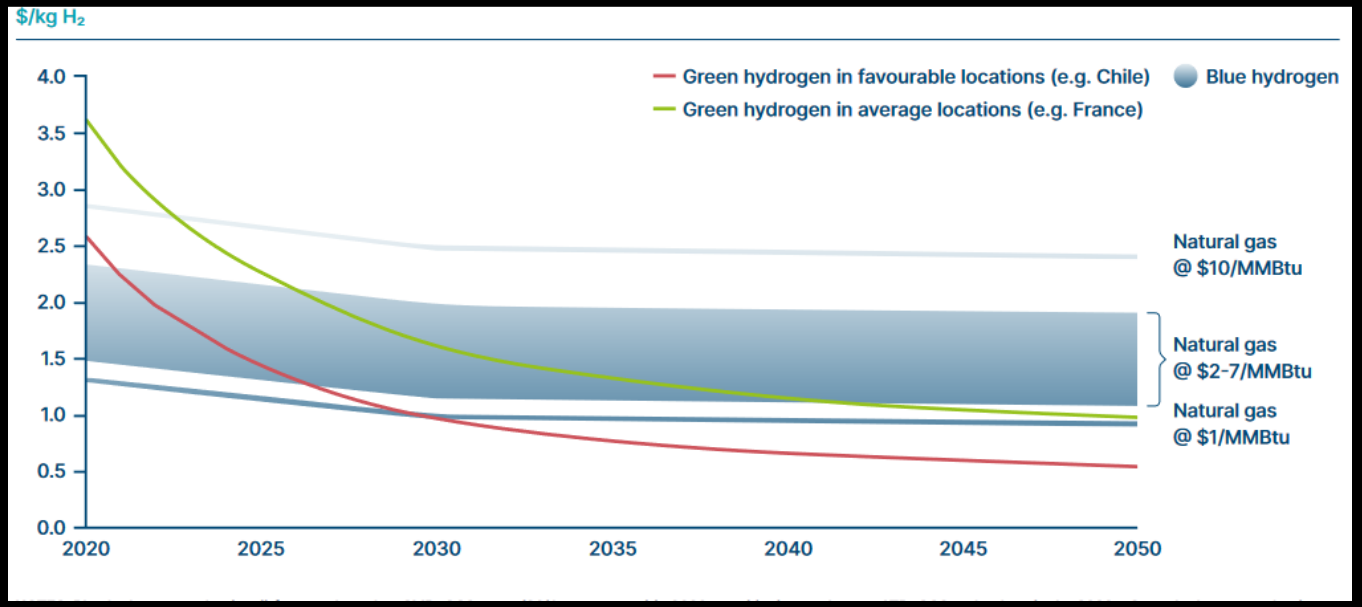
Renewable electricity prices on **continuing downward** trajectory.

Natural gas **price volatility** anticipated to continue.

Cost of uncaptured carbon emissions **expected to rise**.

# Cost of hydrogen production from different production routes

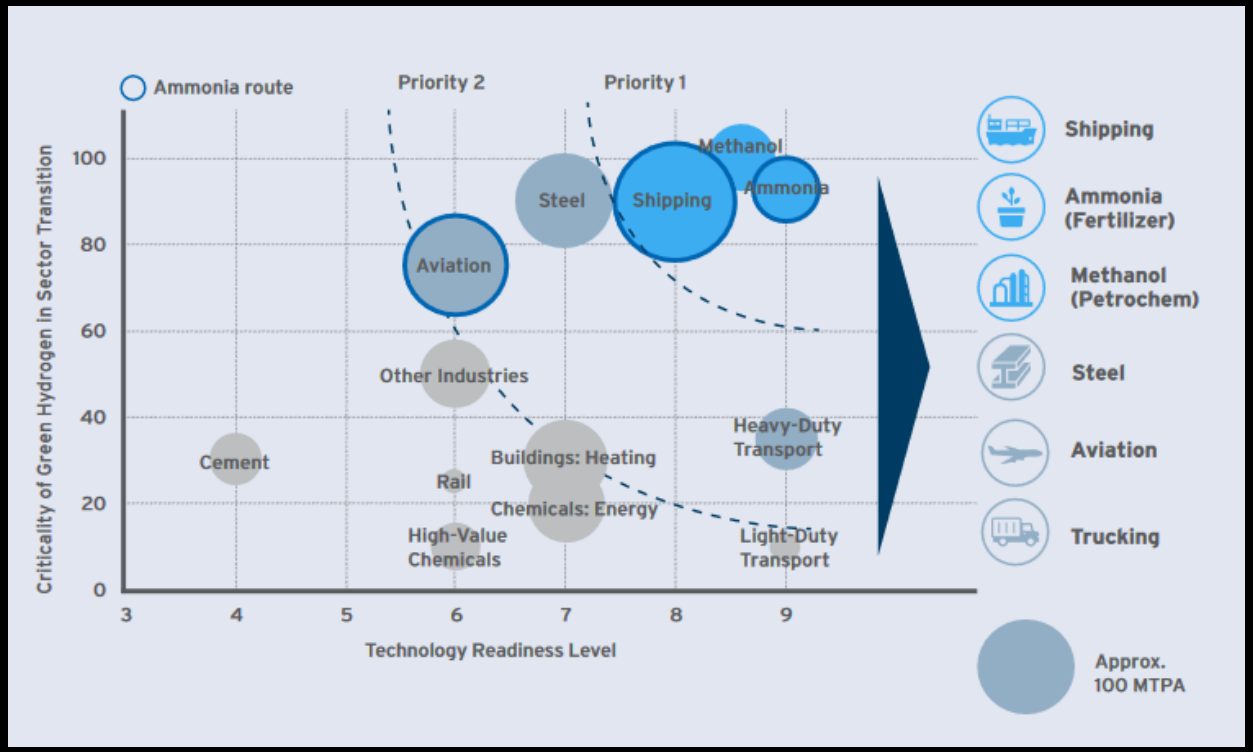
(excluding transport & storage costs)




*Credit: Energy Transitions Commission (2021)*

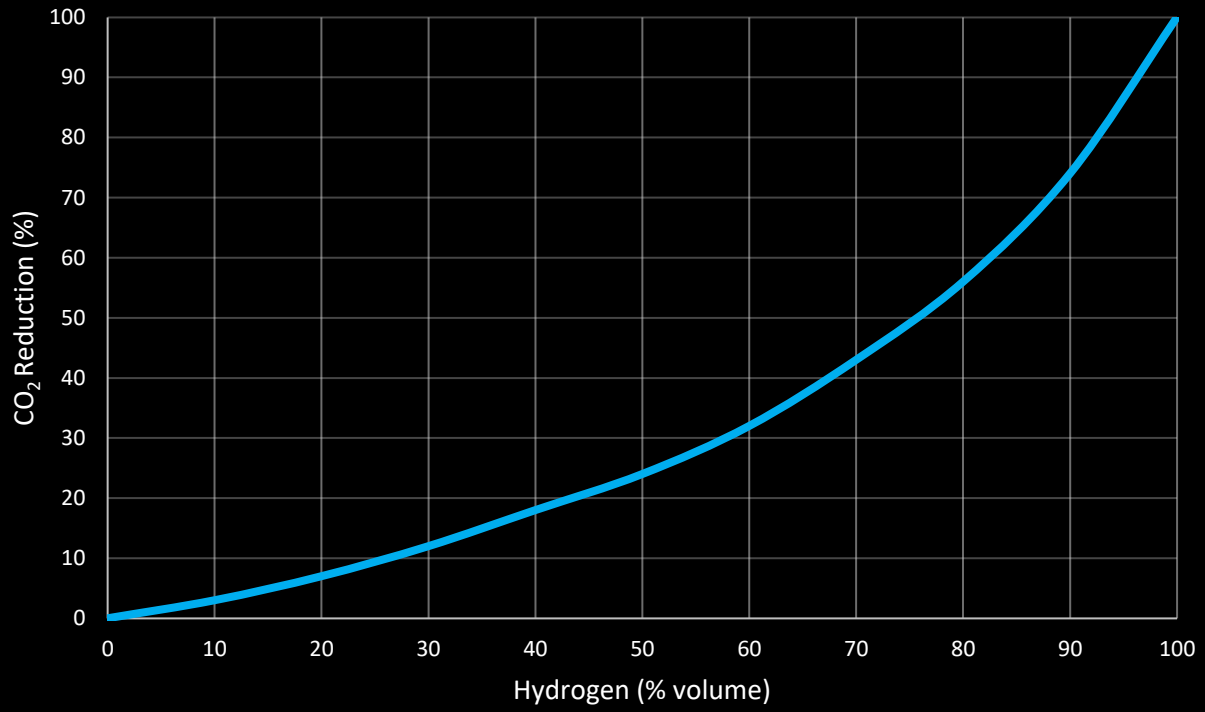
Cost advantage for $H_2$ production expected to shift from fossil fuels to renewables within decade.

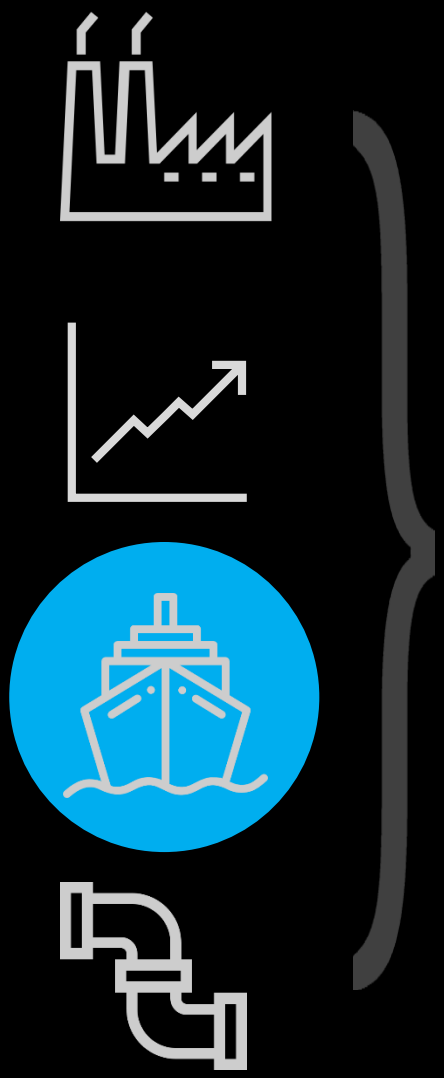
# Evaluating technology readiness, need, and potential size of market



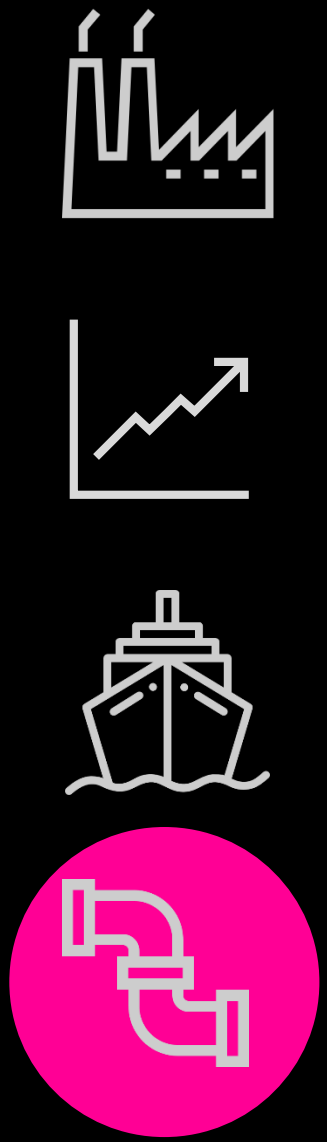

*Credit: RMI (2021)*

# Blending hydrogen in gas does not result in linear carbon emission reductions.





Multiple hydrogen end uses face competition from more efficient, more affordable alternatives.



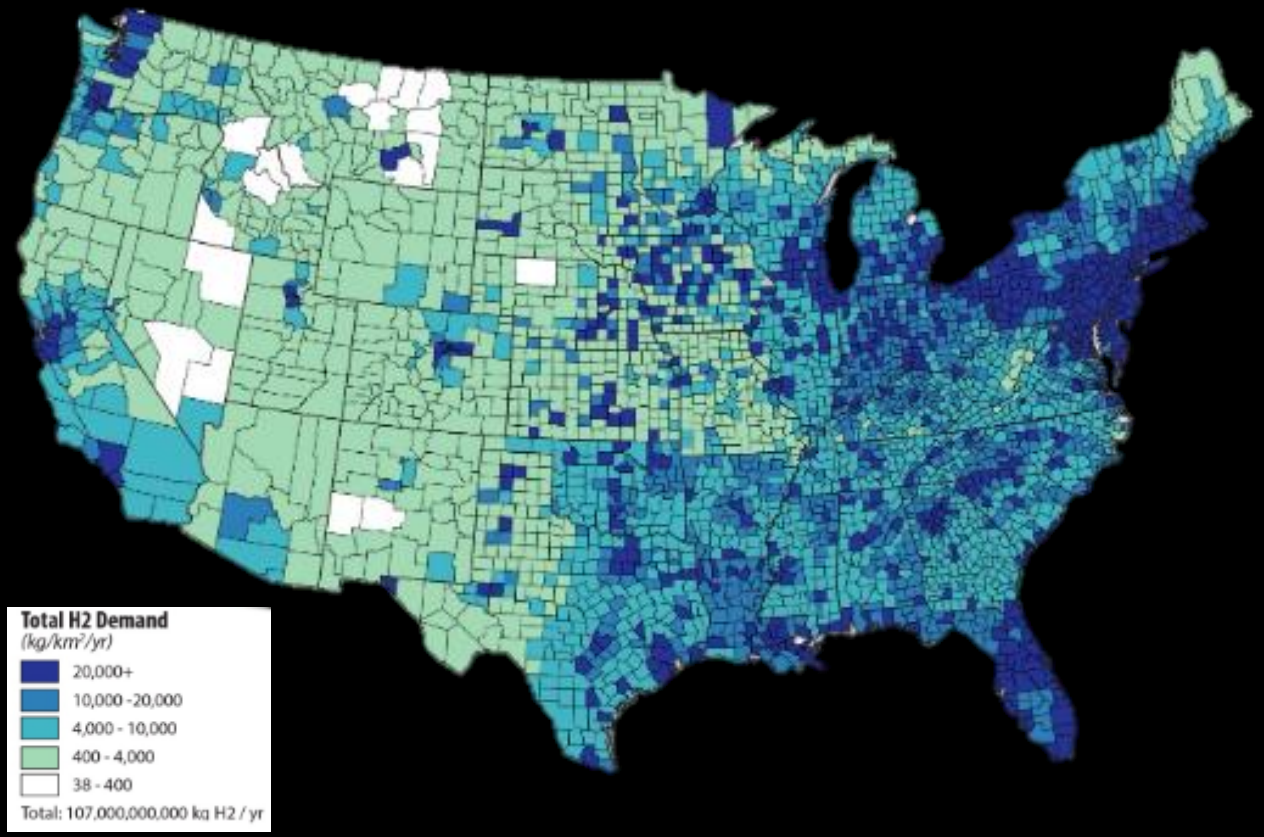
## Feasibility of transport

- Transport & storage feasible – but can present significant cost adders
- Driven early attention to industrial hubs with multiple users in close proximity

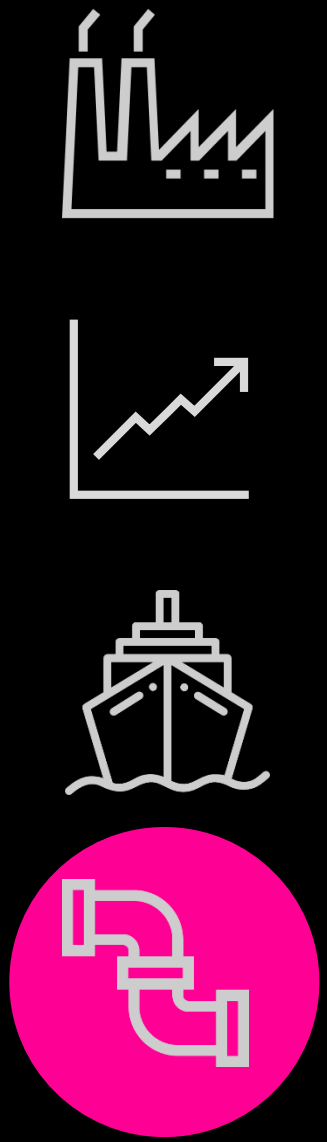
## Safety and standards

- Lack of uniform pipeline safety standards
- Need to limit hydrogen leakage will require new technologies

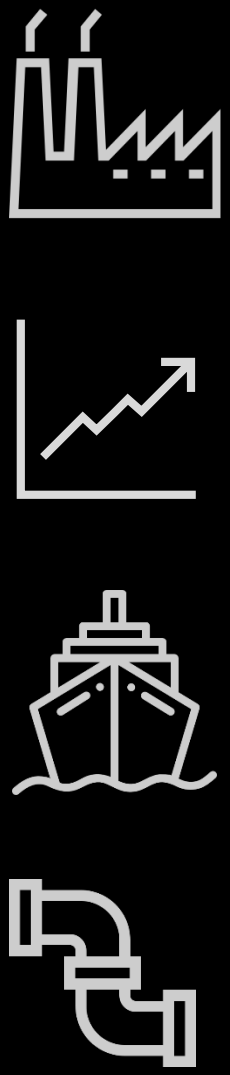
# Serviceable Consumption Potential for Industrial & Transport Sectors, Natural Gas, and Storage




*Credit: NREL (2020)*

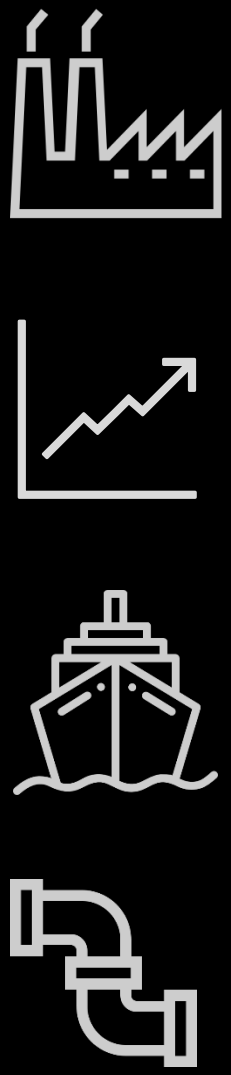


Safety, environmental impact, and cost of transport and storage means proximity to demand matters.



1. If not low carbon,
2. If too expensive,
3. If better alternatives exist, or
4. If proximity/transport unresolved:

*=> Hydrogen Will Not Be Used.*



Match near-term planning with long-term climate goals to ensure climate-aligned hydrogen buildout.