



# The Future of Hydrogen

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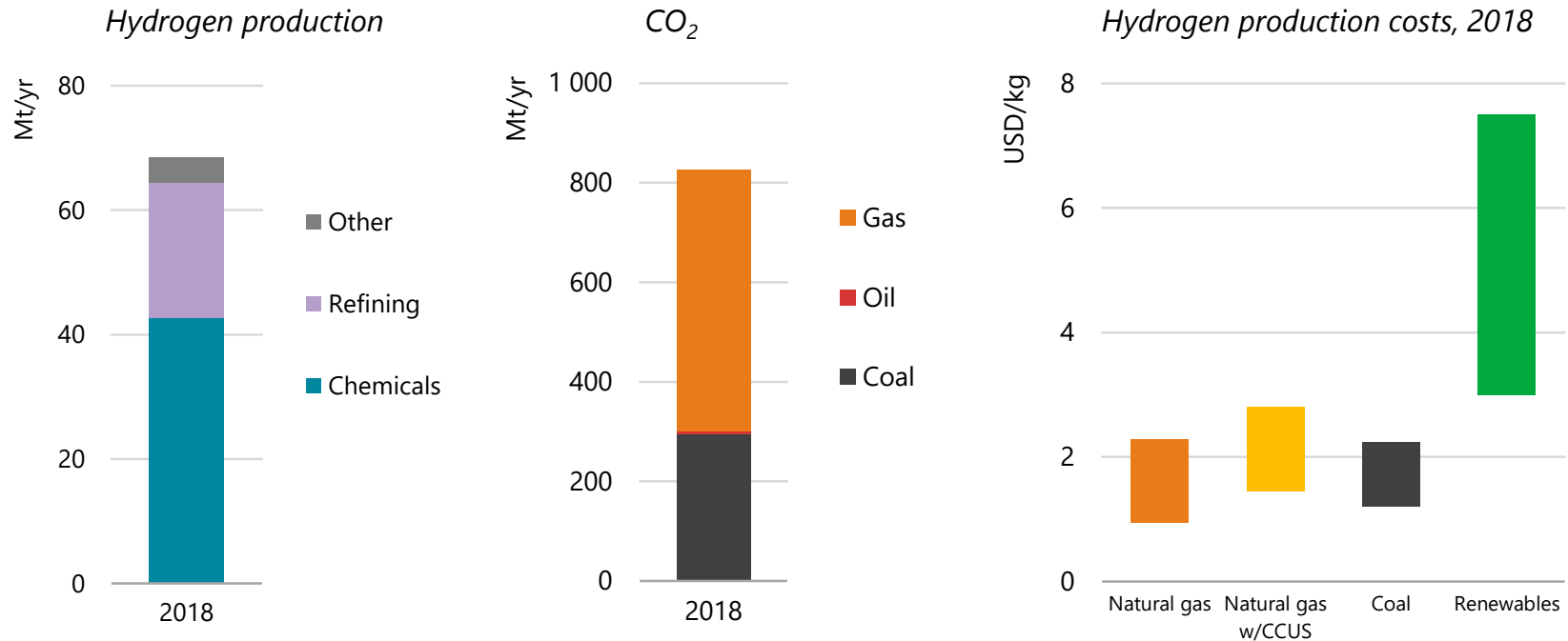
Nuclear energy beyond electricity, IFNEC Working Group Meeting, Warsaw, 24 September 2019

# Hydrogen – A common *element* of our energy future ?

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- Momentum currently behind hydrogen is unprecedented, with more and more policies, projects and plans by governments & companies in all parts of the world
- Hydrogen can help overcome many difficult energy challenges
  - **Integrate more renewables**, including by enhancing storage options & tapping their full potential
  - **Decarbonise hard-to-abate sectors** – steel, chemicals, trucks, ships & planes
  - **Enhance energy security** by diversifying the fuel mix & providing flexibility to balance grids
- But there are challenges: **costs** need to fall; **infrastructure** needs to be developed; **cleaner hydrogen** is needed; and **regulatory barriers** persist

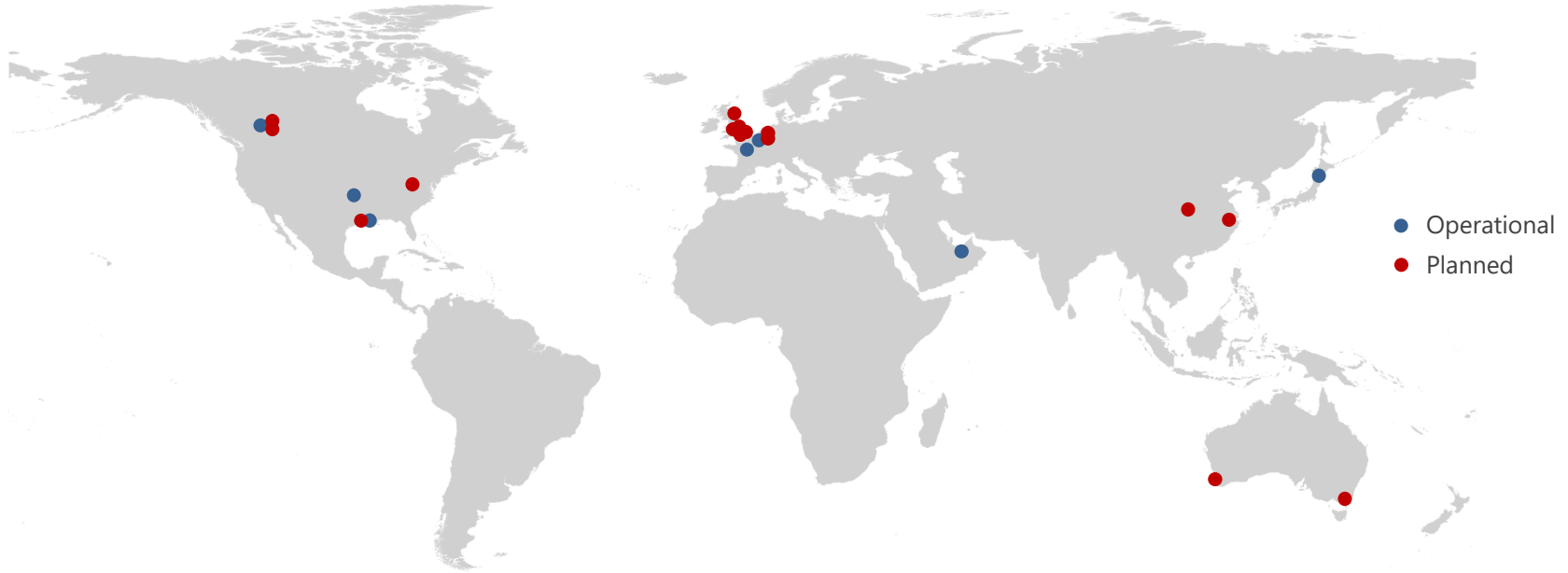
# Hydrogen is already part of the energy mix



Dedicated hydrogen production is concentrated in very few sectors today, and virtually all of it is produced using fossil fuels, as a result of favourable economics.

# Hydrogen production with CO<sub>2</sub> capture is coming online

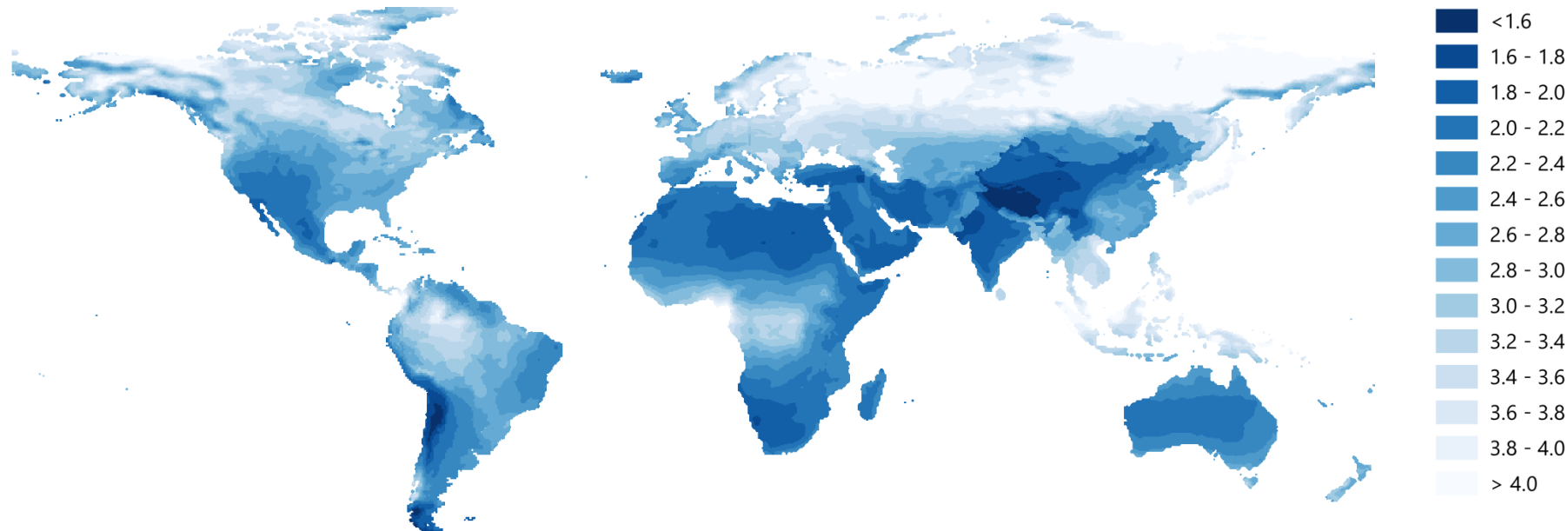
Facilities with hydrogen production and CCUS



Low-carbon hydrogen from fossil fuels is produced at commercial scale today, with more plants planned. It is an opportunity to reduce emissions from refining and industry.

# Renewables hydrogen costs are set to decline

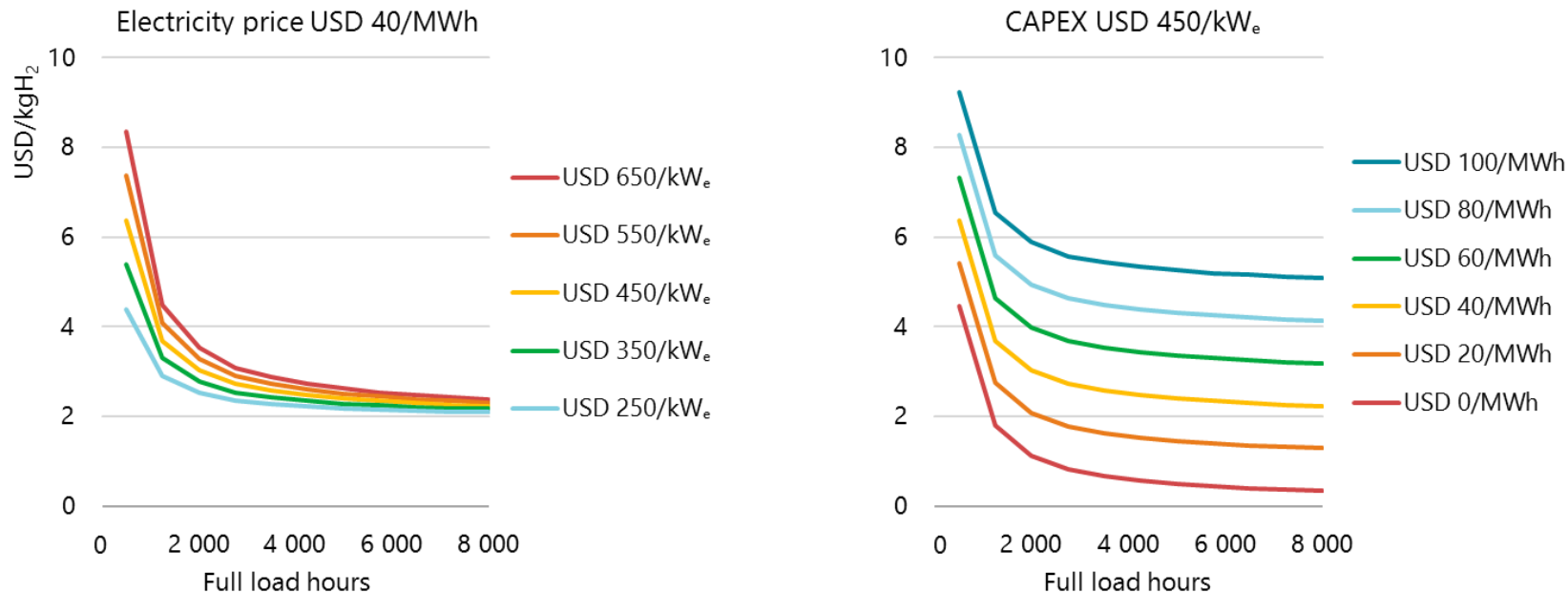
Long-term hydrogen production costs from solar & wind systems



The declining costs of solar PV and wind could make them a low-cost source for hydrogen production in regions with favourable resource conditions.

# Low-cost electricity critical for low hydrogen costs from electrolysis

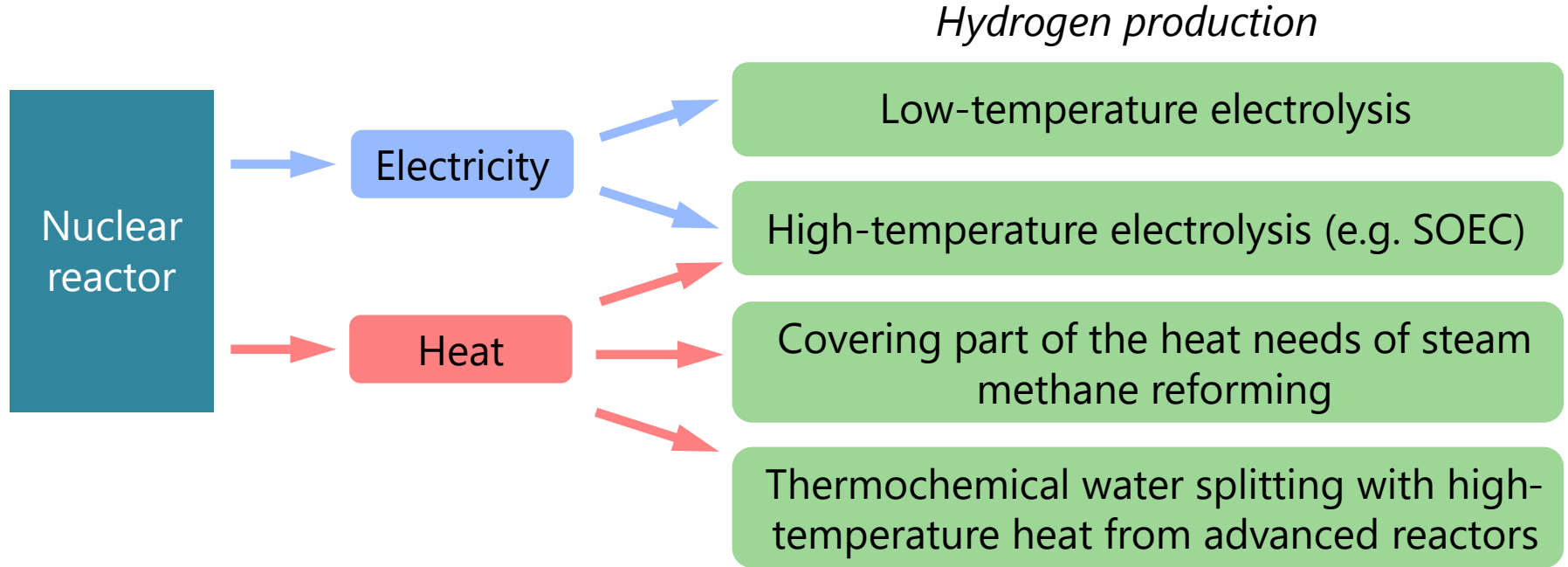
Levelised hydrogen production costs from water electrolysis



With increasing full load hours, the impact of CAPEX on hydrogen costs declines and the electricity becomes the main cost component for water electrolysis.

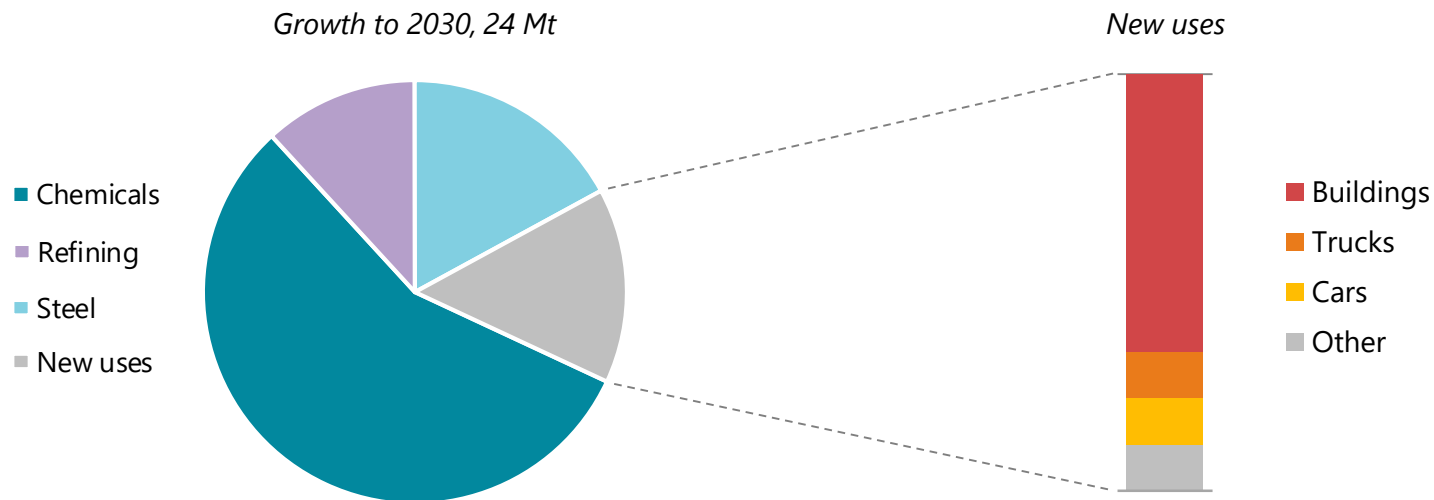
# Hydrogen production from nuclear energy

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# The challenge to 2030: expand hydrogen beyond existing applications

Global growth in hydrogen use based on announced policies, 2018-2030

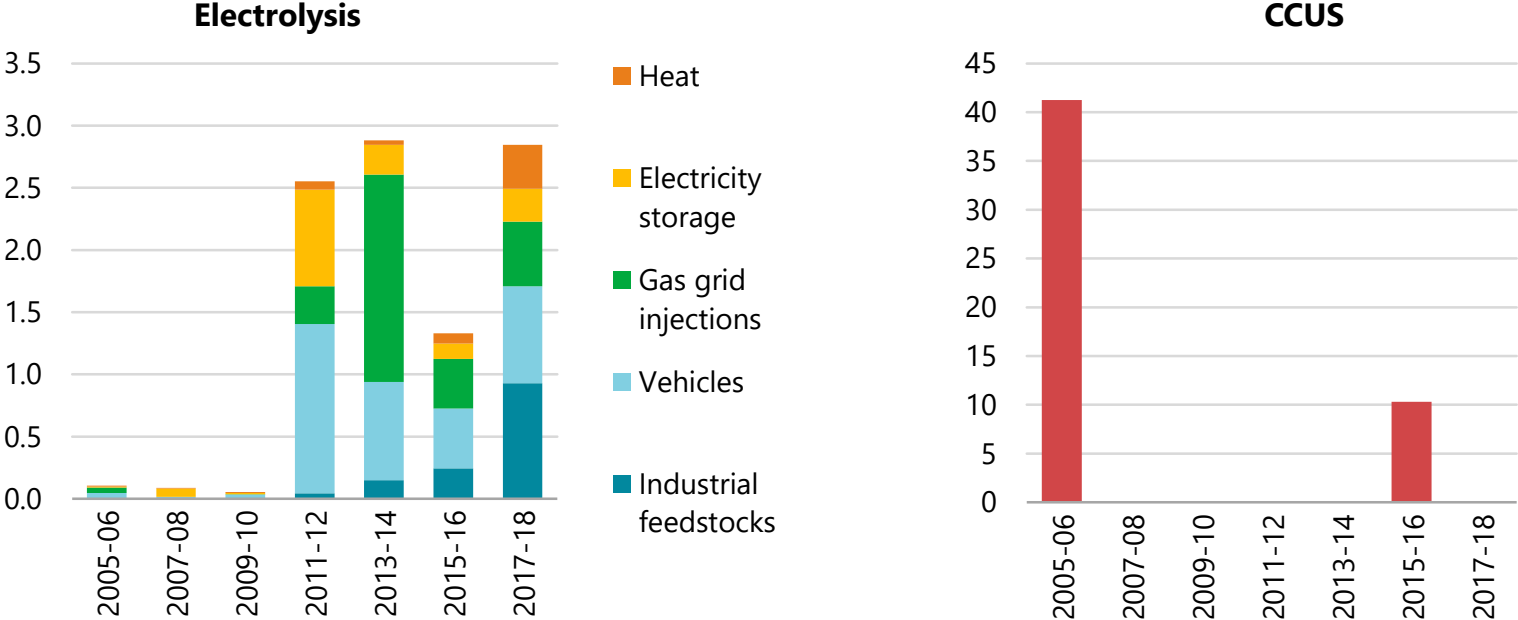


Dependable demand from current industrial applications can boost clean hydrogen production; policies & industry targets suggest increasing use in other sectors, but ambition needs to increase.



# Europe is a global pioneer for clean hydrogen projects

Clean hydrogen production capacity additions in Europe (thousand tonnes/year)



Electrolysis projects have expanded in Europe, but have much less potential to produce clean hydrogen than two CCUS projects.

# Four key opportunities for scaling up hydrogen to 2030



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