The Future of Hydrogen

Uwe Remme, Energy Policy Division

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International Energy Agency

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

- 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

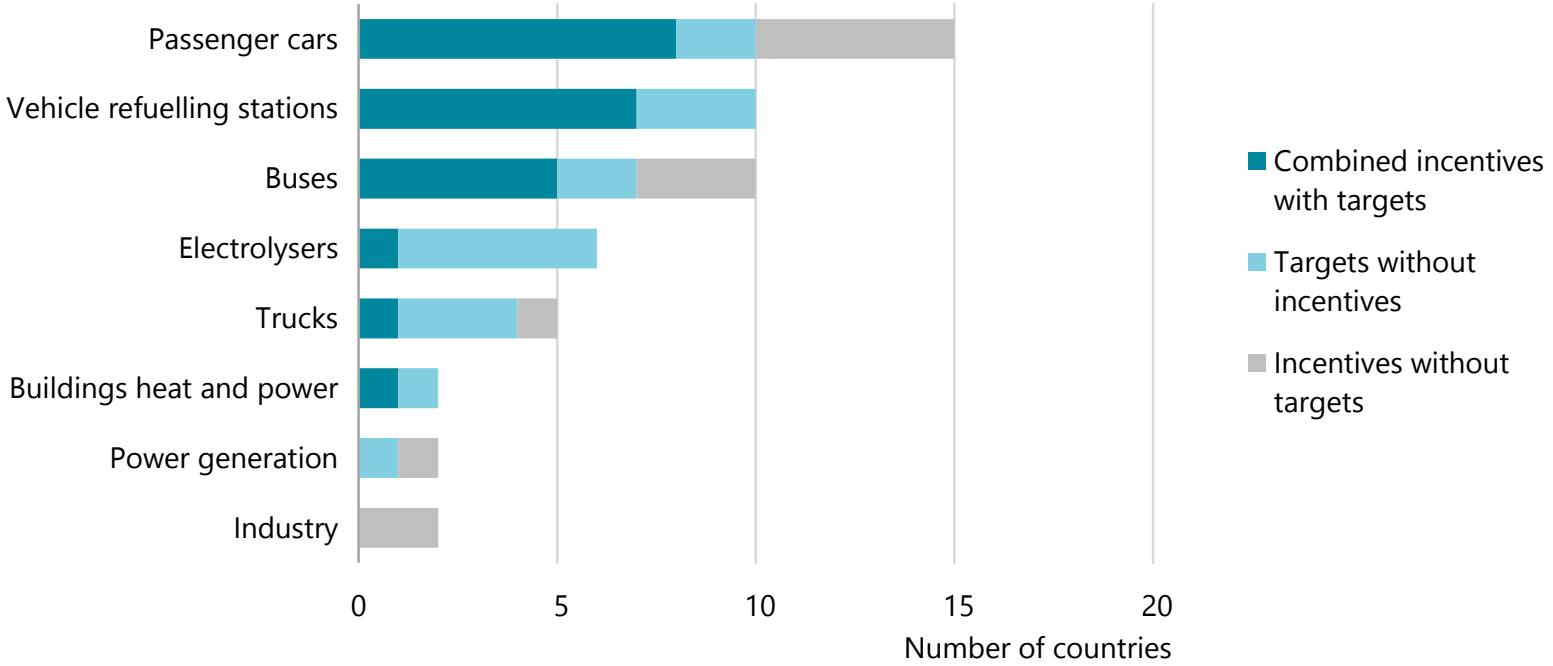
  - ***Integrate more renewables***, including by enhancing storage options & tapping their full potential

  - ***Decarbonise hard-to-abate sectors*** – steel, chemicals, trucks, ships & planes

  - ***Enhance energy security*** by diversifying the fuel mix & providing flexibility to balance grids

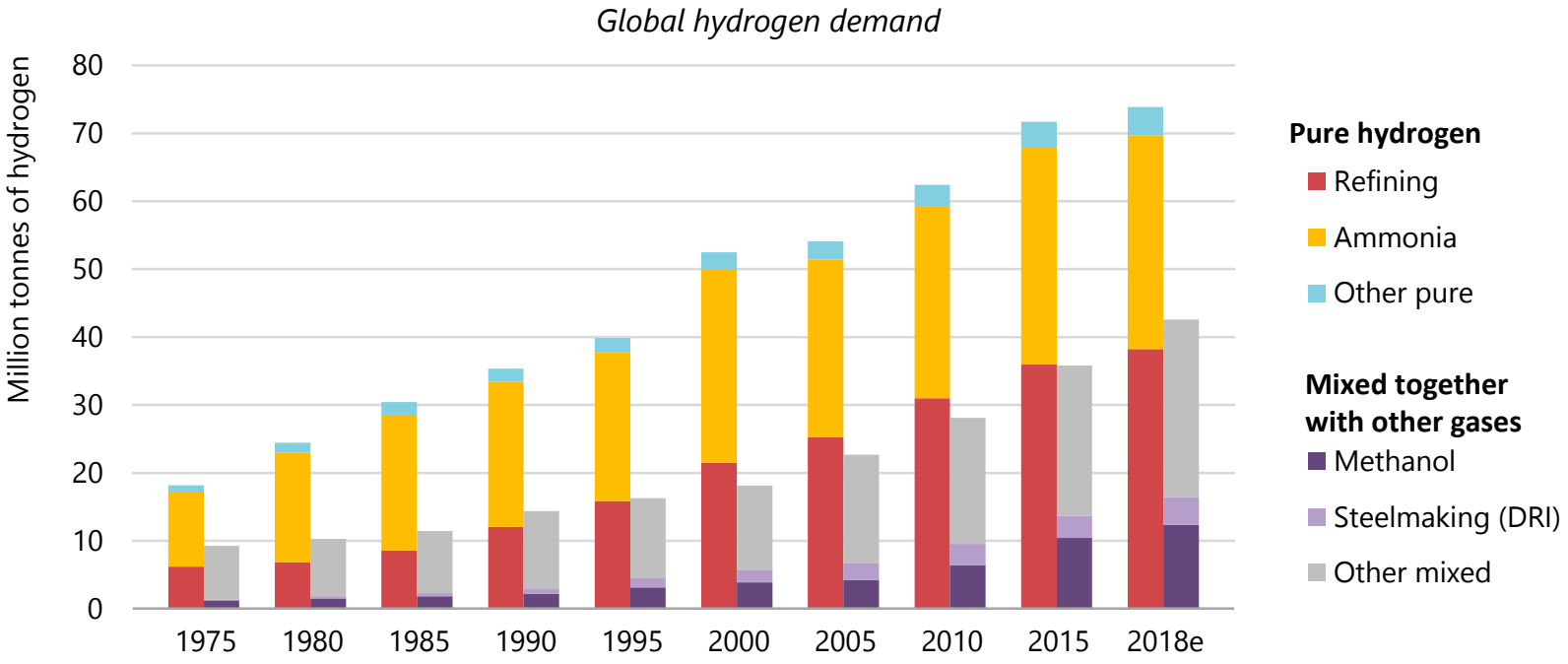
- But there are challenges: ***costs*** need to fall; ***infrastructure*** needs to be developed; ***cleaner hydrogen*** is needed; and ***regulatory barriers*** persist

Policy support for hydrogen is increasing



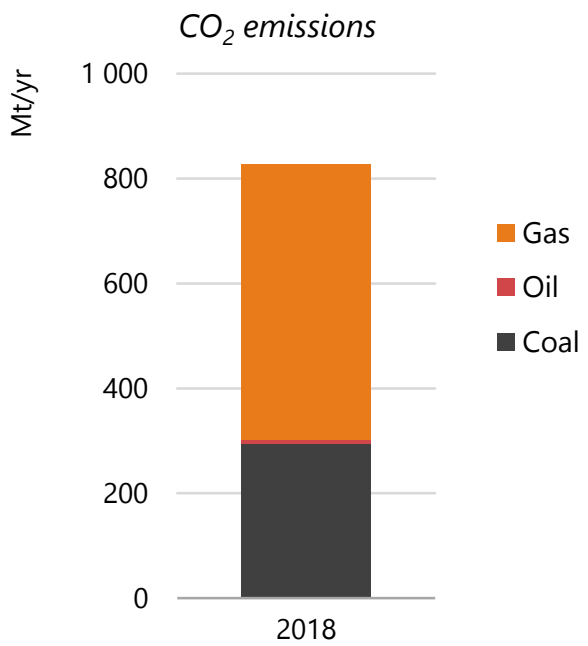
A growing number of countries have policies to encourage hydrogen deployment, predominantly focusing on transport.

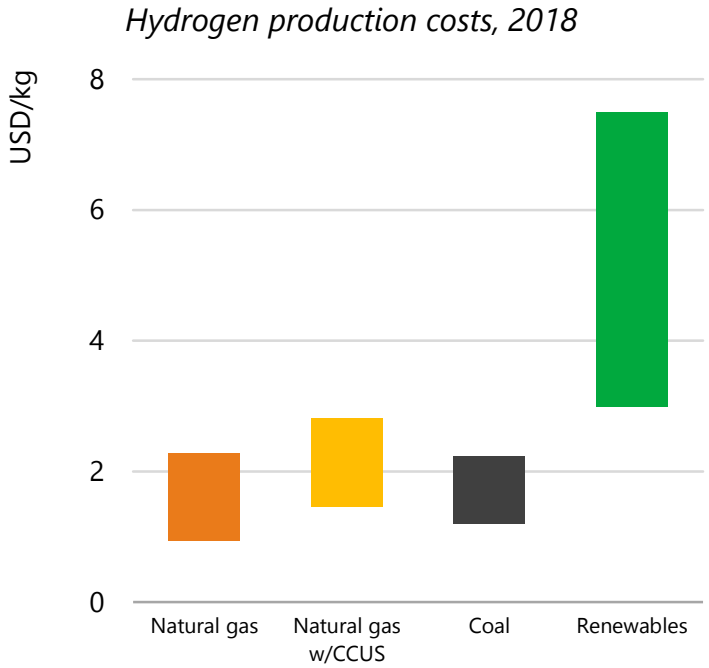
Hydrogen is already with us, for a long time



Global demand for hydrogen in pure forms has grown steadily over the past 50 years to around 70 Mt today. More than 40 Mt is also produced in a mixture of other gases.

The current state of hydrogen production

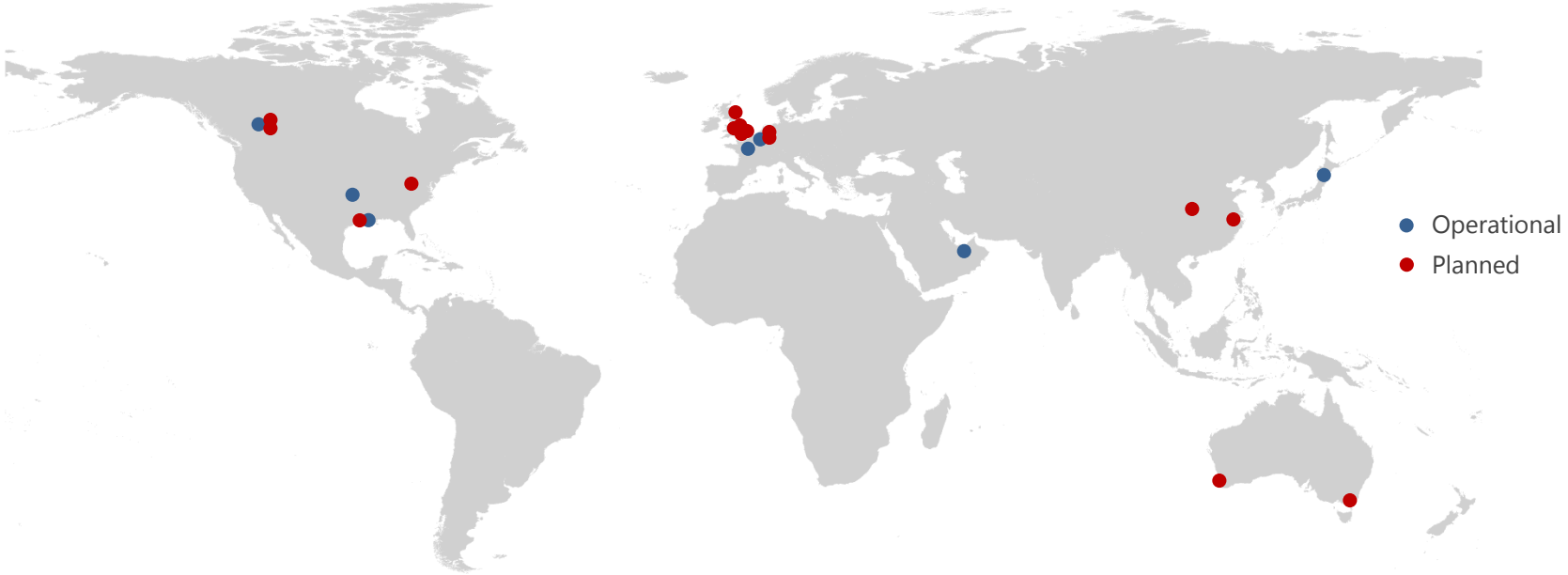




Virtually all hydrogen today is produced using fossil fuels, as a result of favourable economics.

Hydrogen production with CO_2 capture is coming online

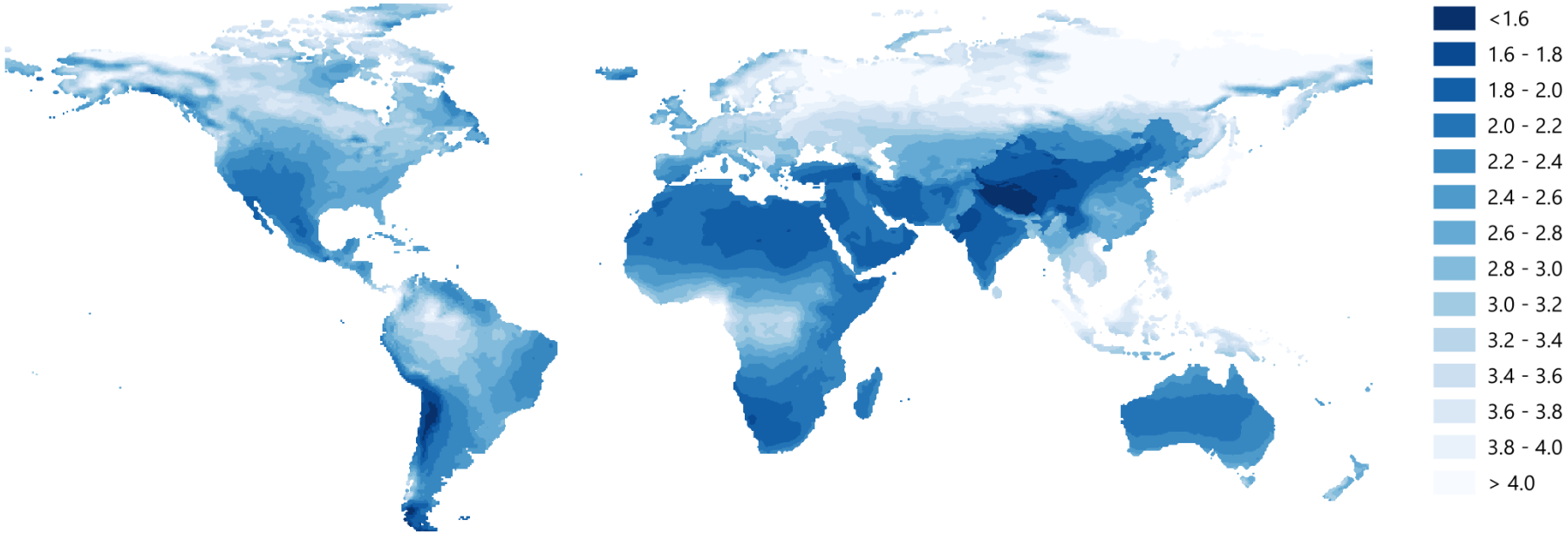
Facilities with hydrogen production and CCUS



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.

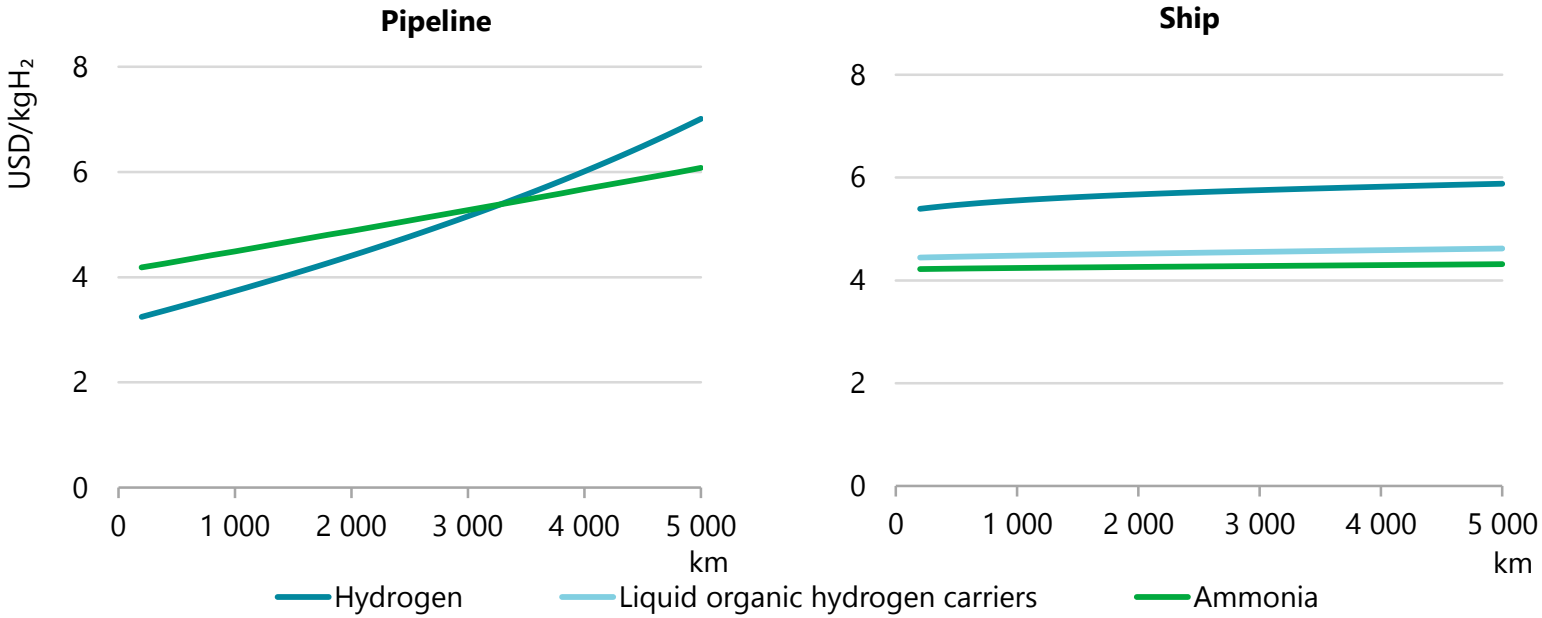
Renewables hydrogen costs are set to decline

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.

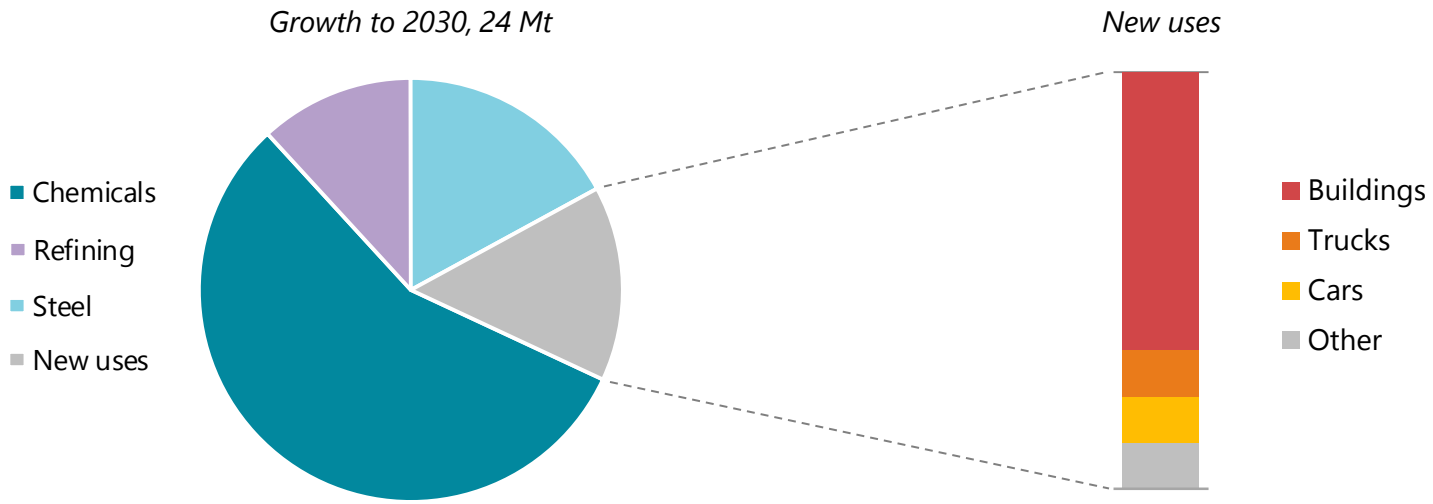
How much does it cost to transport hydrogen?



Delivering hydrogen to the industrial sector is cheaper by pipeline for distances below 1 500 km; above 1 500 km hydrogen-rich fuels are cheaper options.

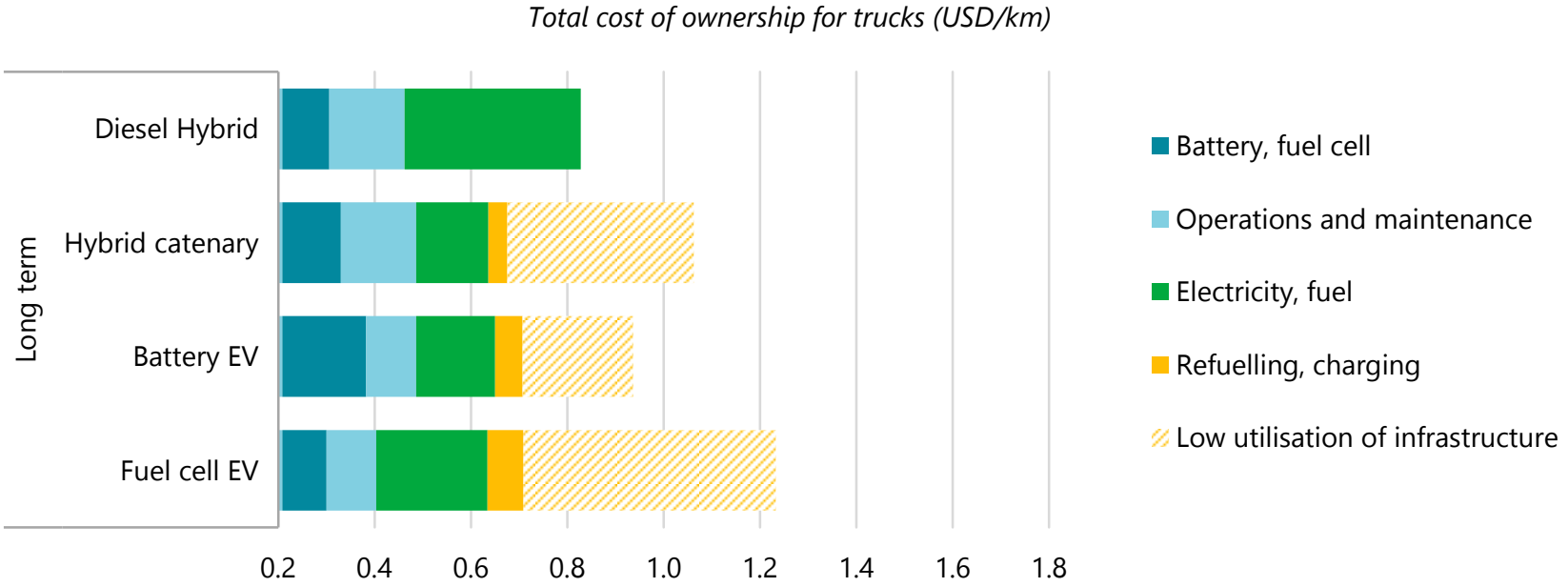
The challenge to 2030: expand hydrogen beyond existing applications

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.

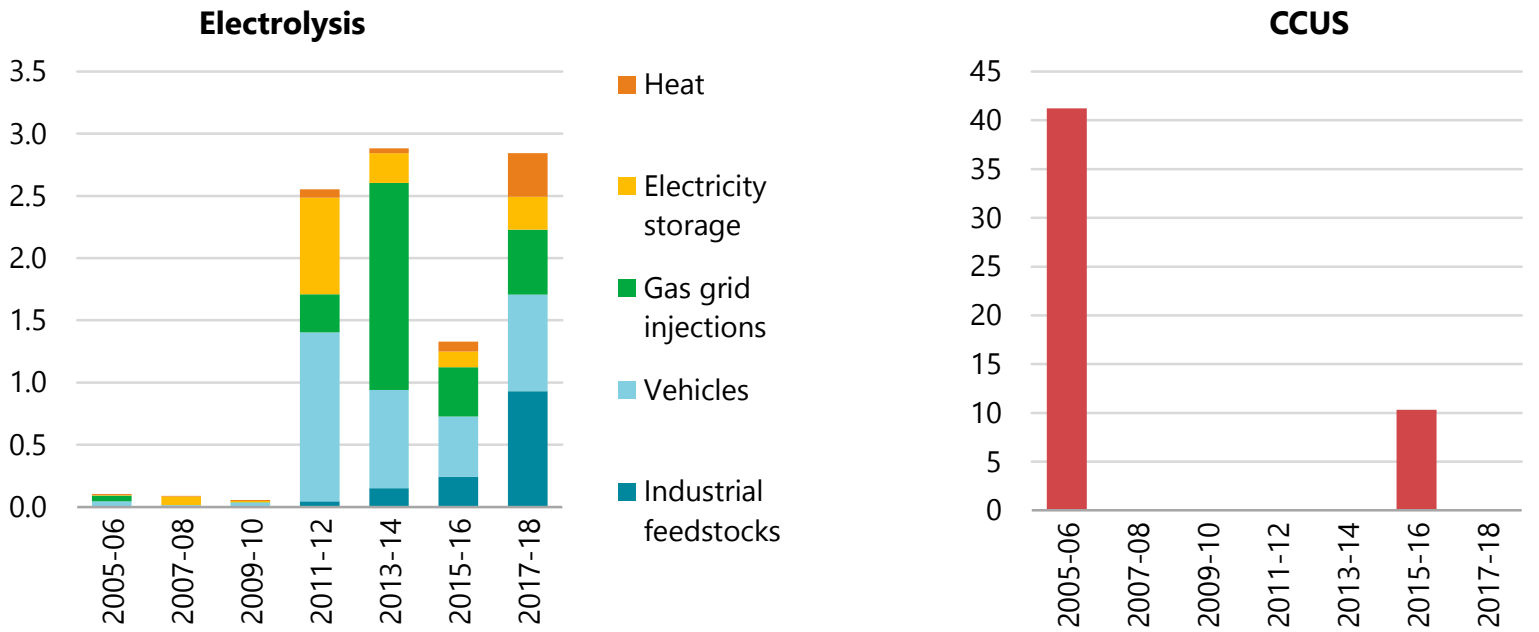
A low carbon future for trucks?



Fuel costs make up about half of the total cost of ownership for heavy-duty trucks, so the focus on should be on bringing down the delivered price of hydrogen.

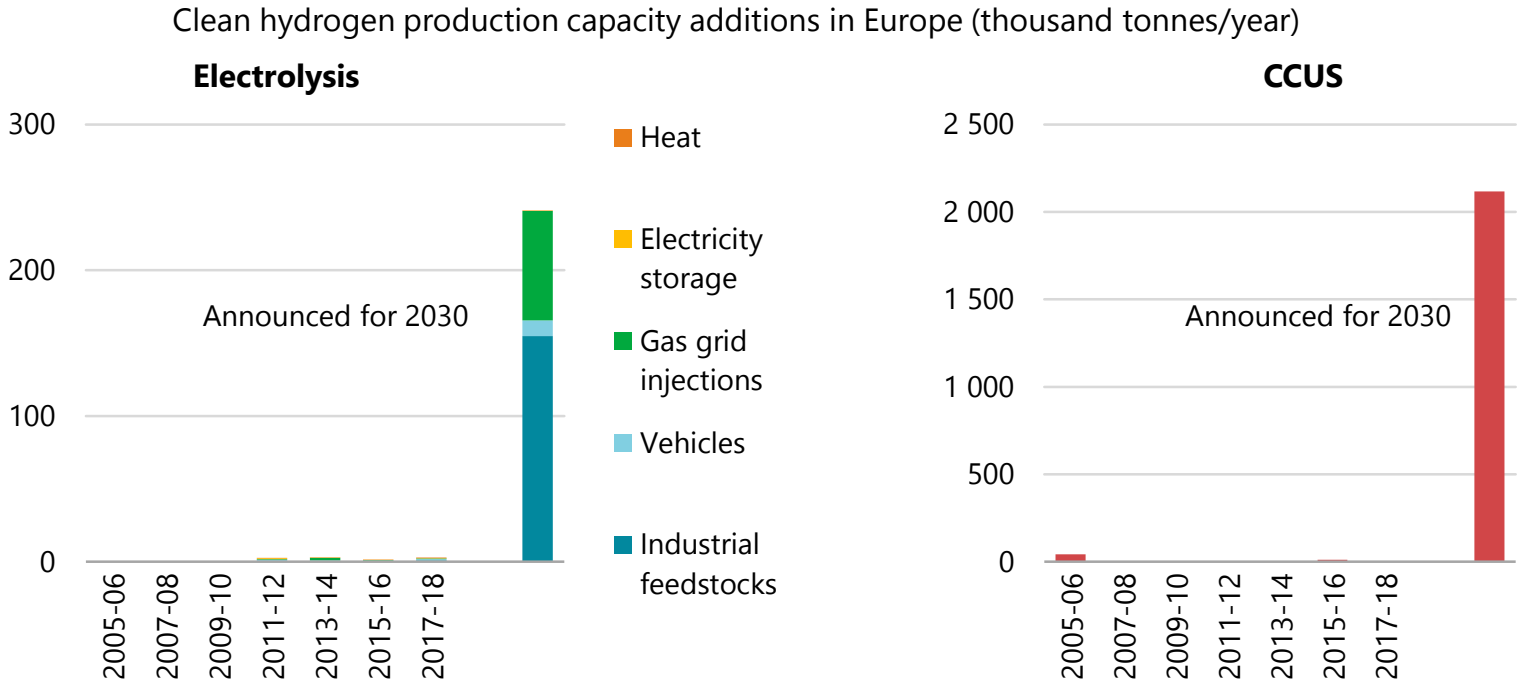
Europe is a global pioneer for clean hydrogen projects

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.

But policy, not just funding, is needed to realise planned projects



Electrolysis projects have expanded in Europe, but have much less potential to produce clean hydrogen than two CCUS projects. With commercial investment, announced projects could scale up all options

Four key opportunities for scaling up hydrogen to 2030