Introduction to hydrogen technology

A supply chain overview – production, transportation and end use

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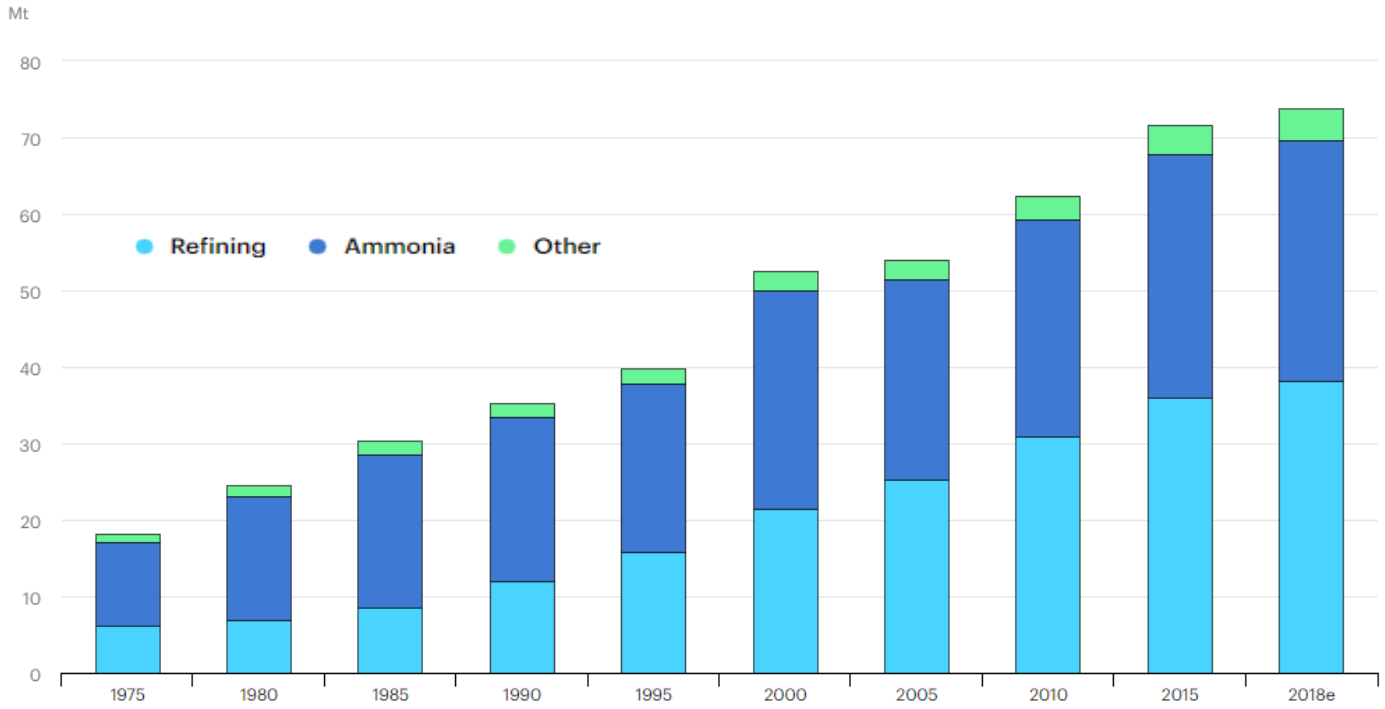
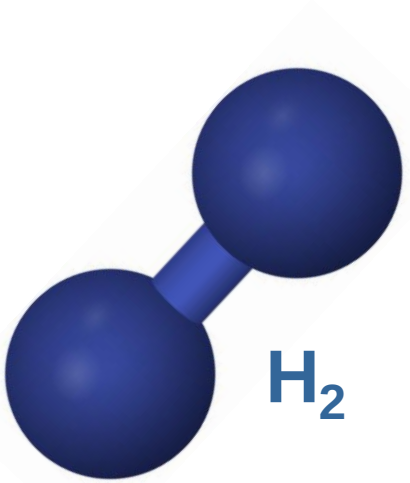
Today hydrogen is used extensively in industrial processes but is almost all produced from fossil fuels giving it a high carbon footprint

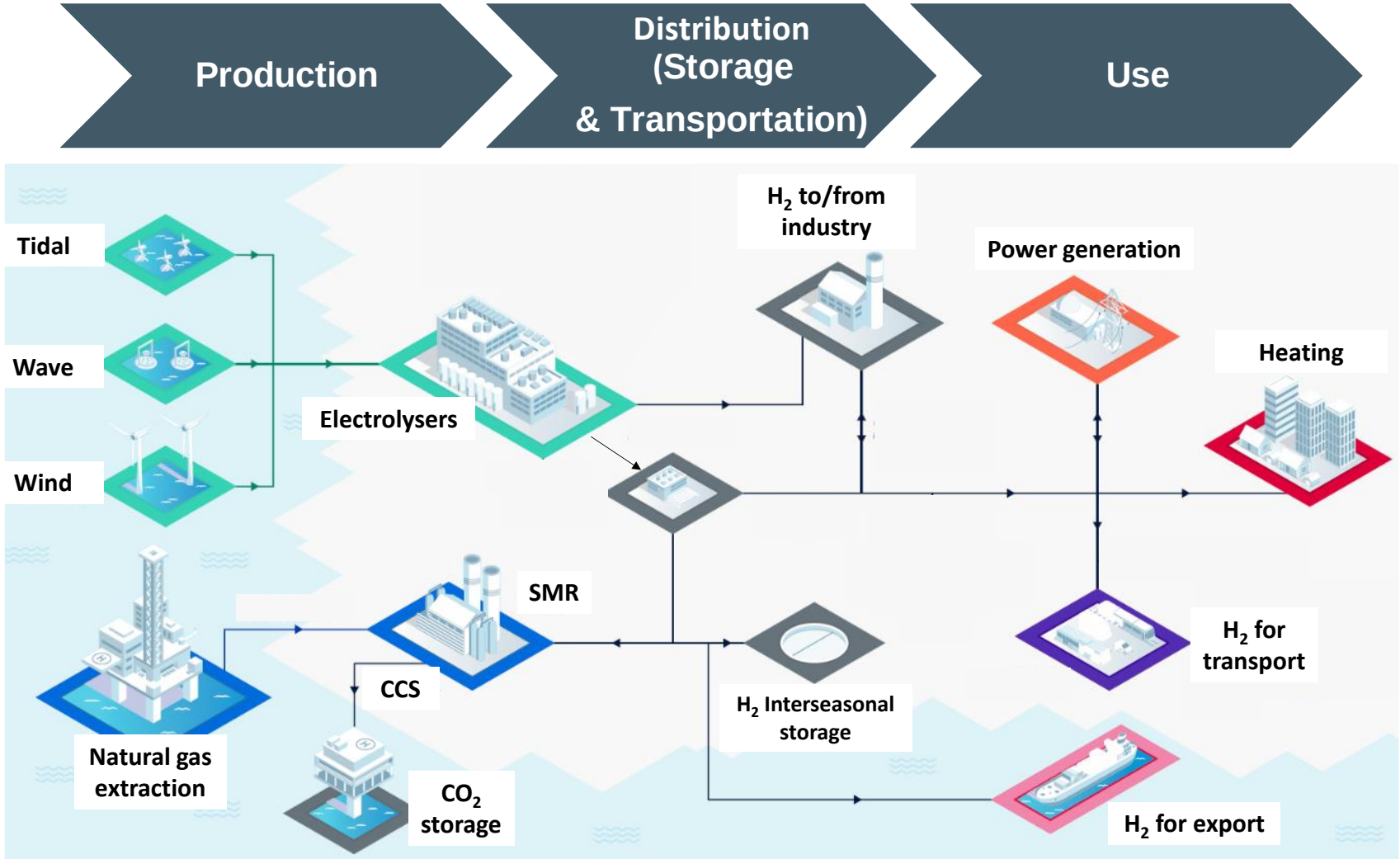
Global demand for pure hydrogen by sector, 1975-2018 (mT)



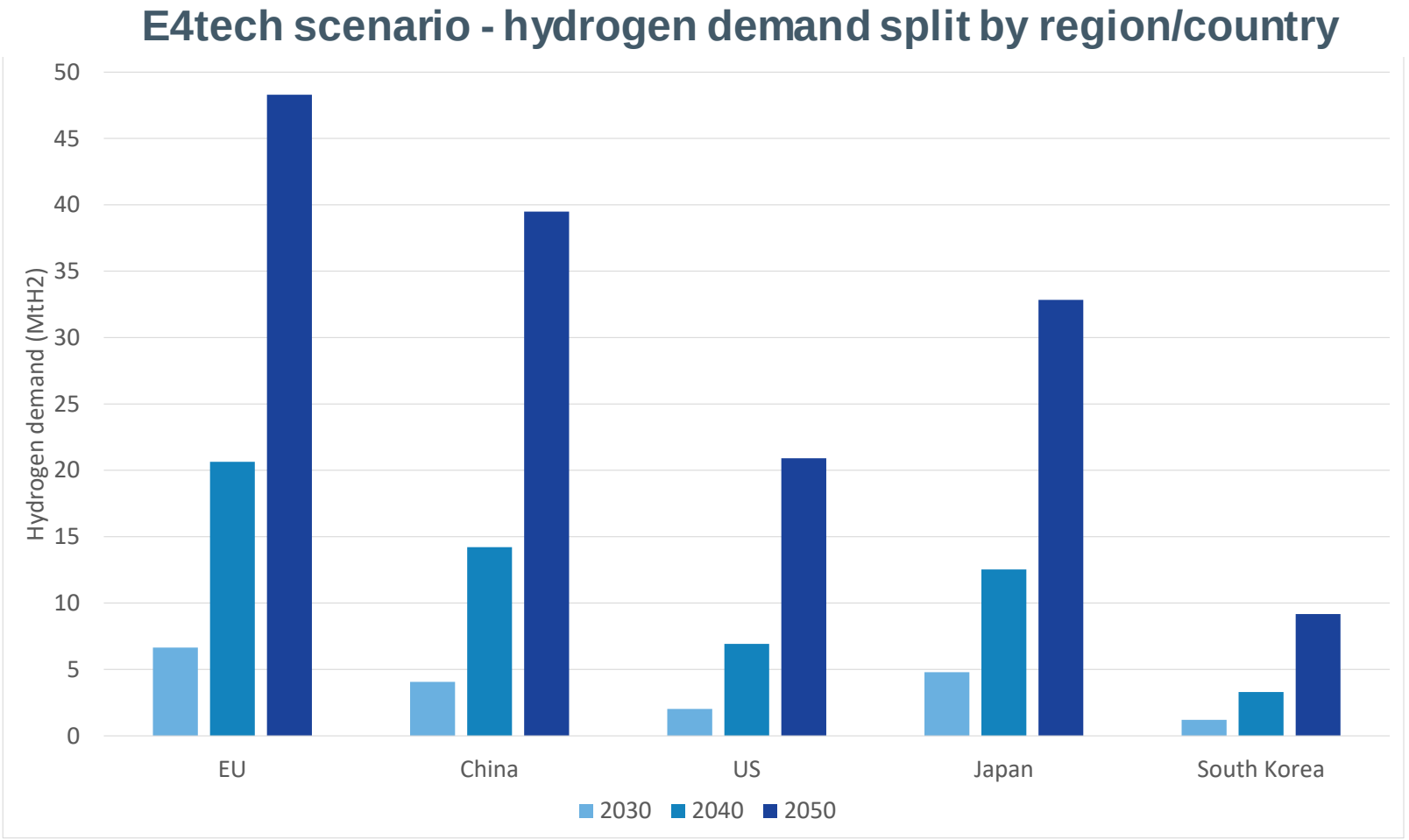


Source: IEA - The Future of Hydrogen Technology report

Low carbon hydrogen can potentially be used as an energy vector alongside electricity in a decarbonised energy system



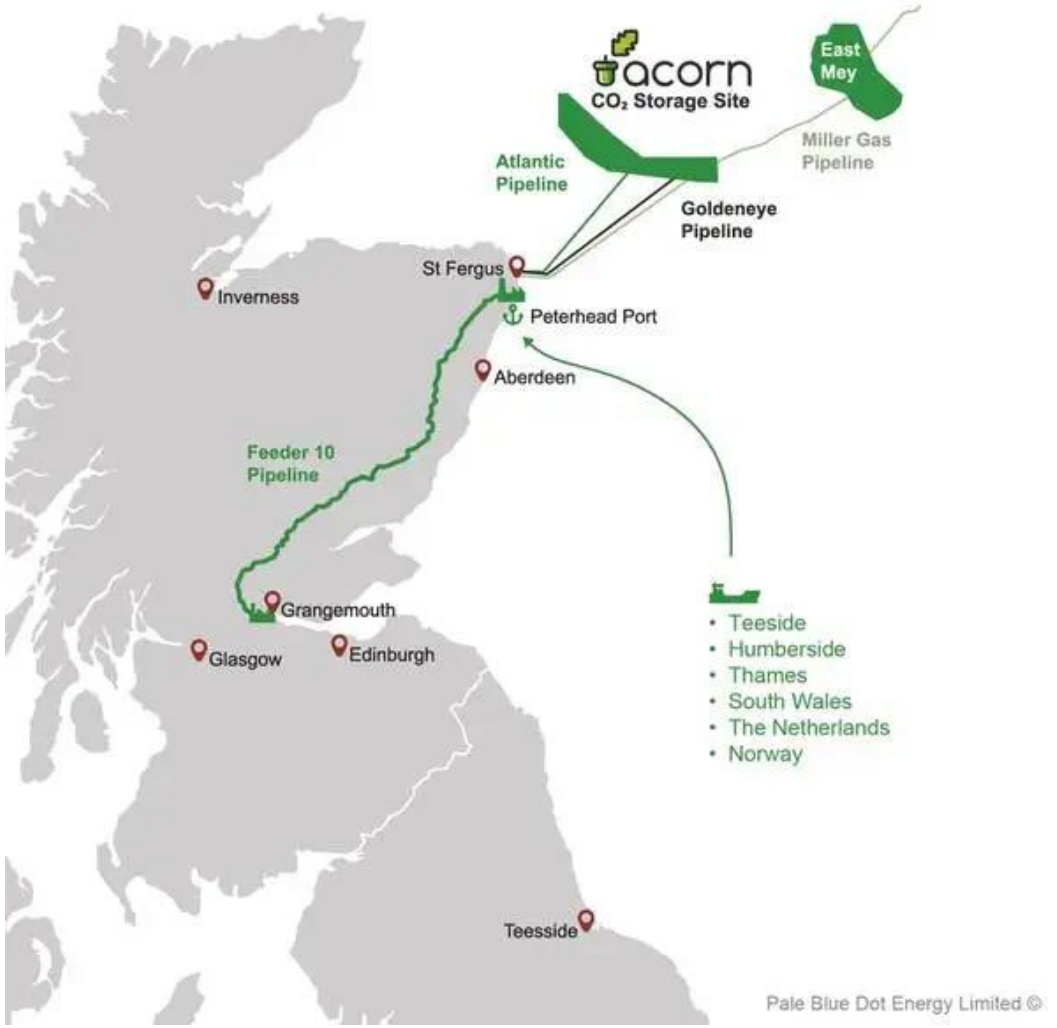
With this new focus for hydrogen as a low carbon energy vector, demand could see a doubling by 2050



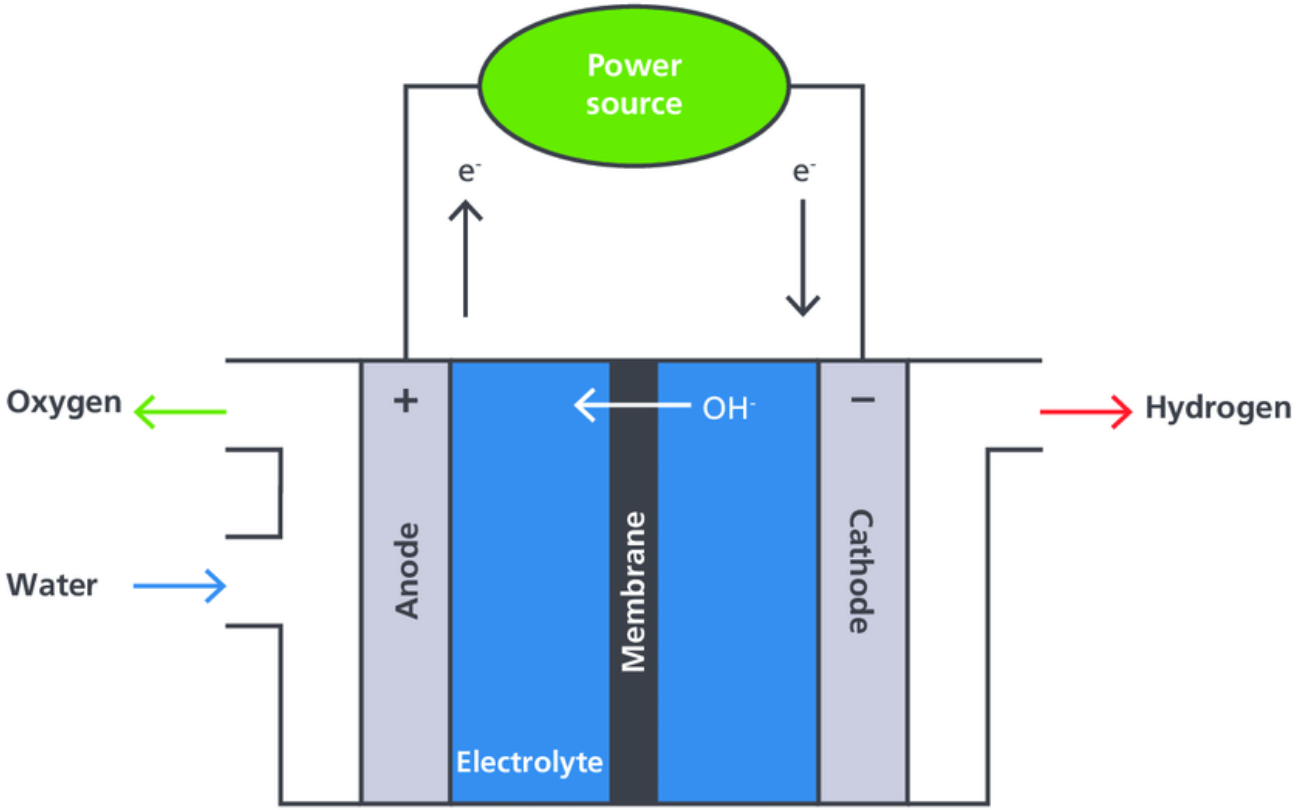
Currently hydrogen is produced by thermochemical routes from fossil fuels but these could be decarbonised using carbon capture and storage

Steam methane reforming plant

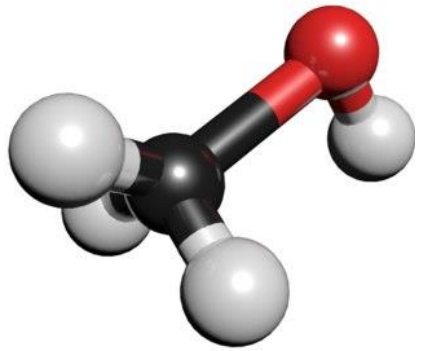
Source: Air Liquide

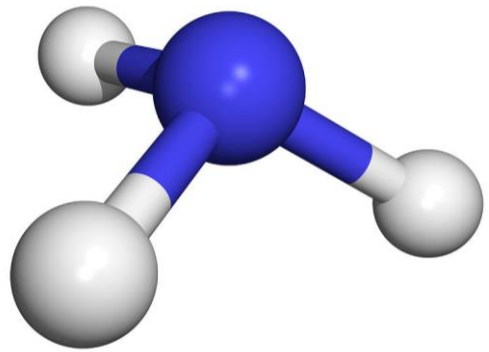


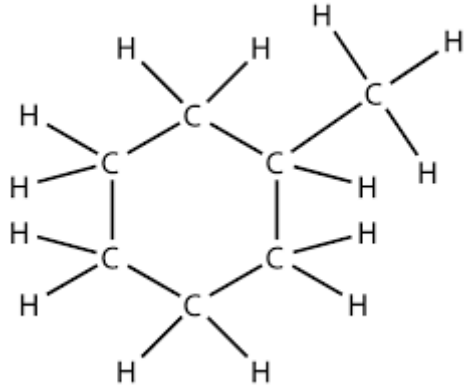
A cleaner way to produce hydrogen is to use renewable electricity to split water into hydrogen and oxygen



Hydrogen can be transported in native form or bound within another molecule which in some cases can be used directly as a fuel







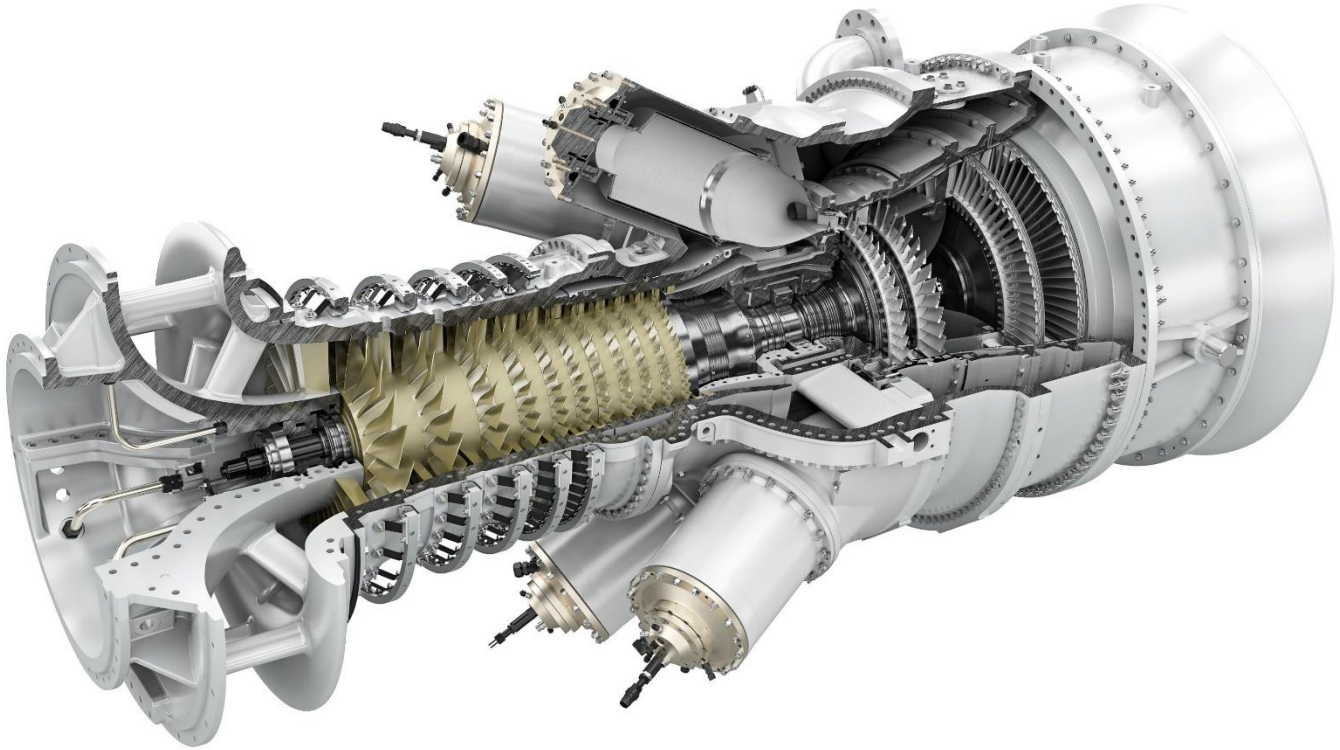
Hydrogen can be stored for long periods in the same way that it is transported and can be dispensed at redesigned vehicle fuelling stations

It is likely that early adopters of low carbon hydrogen will be existing hydrogen consumers but may also encompass new feedstock demand

Combustion of hydrogen is a good source of heat and allows existing pipeline networks to be re-used to heat homes and businesses

$$H_2 + O_2 \rightarrow H_2O$$

Hydrogen can be used in power generation providing opportunities for energy storage and contributing to electricity system stability and resilience



It can be used to decarbonise transport and has benefits over battery electric systems for heavy duty applications

Alstom Coradia iLint FC train

Toyota Mirai FC car

Hydrogen combustion engine

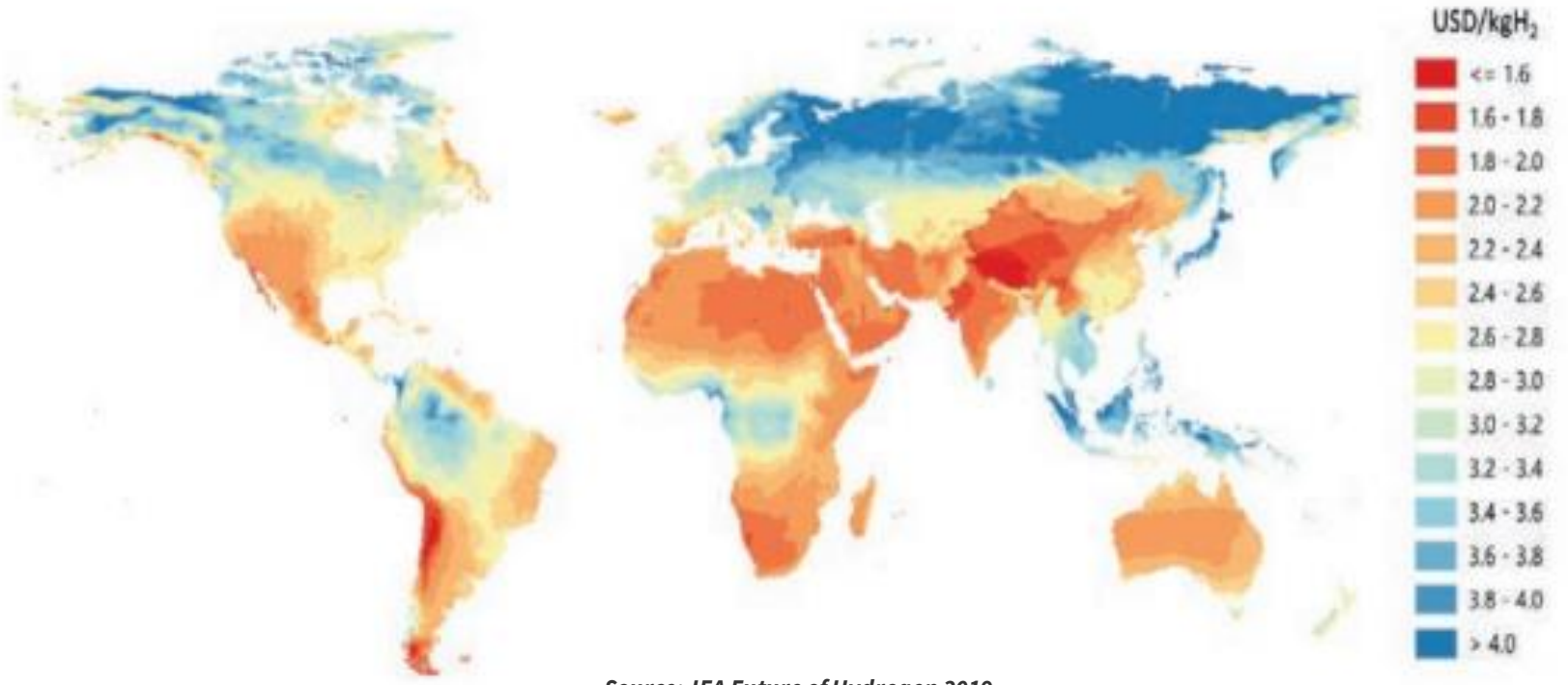
ZeroAvia FC plane

Hyundai Xcient fuel cell truck

FCS Alsterwasser hydrogen ferry

While the present cost of hydrogen-fuelled systems is high, costs are predicted to fall based on cheap abundant renewables

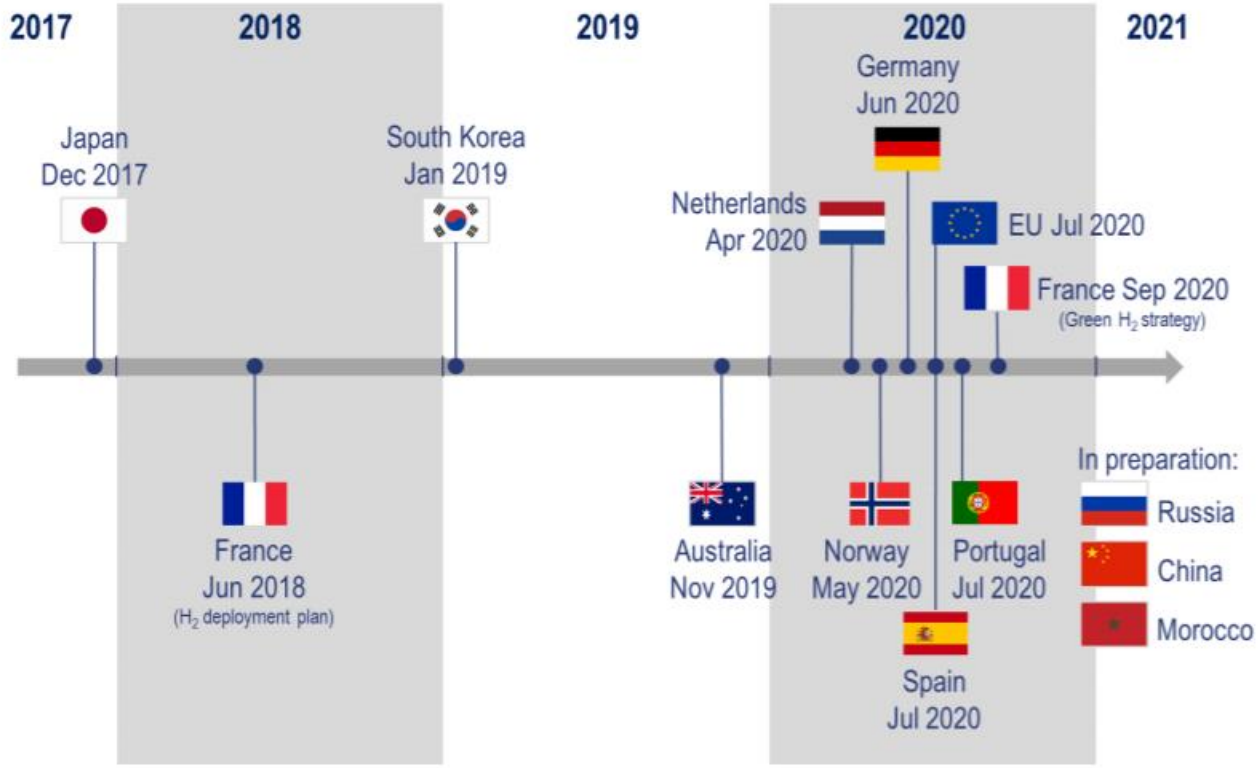
Hydrogen costs from hybrid solar PV and onshore wind systems in the long term



Source: IEA Future of Hydrogen 2019

As a result, there is growing interest in hydrogen at a macro level with many countries setting out hydrogen strategies

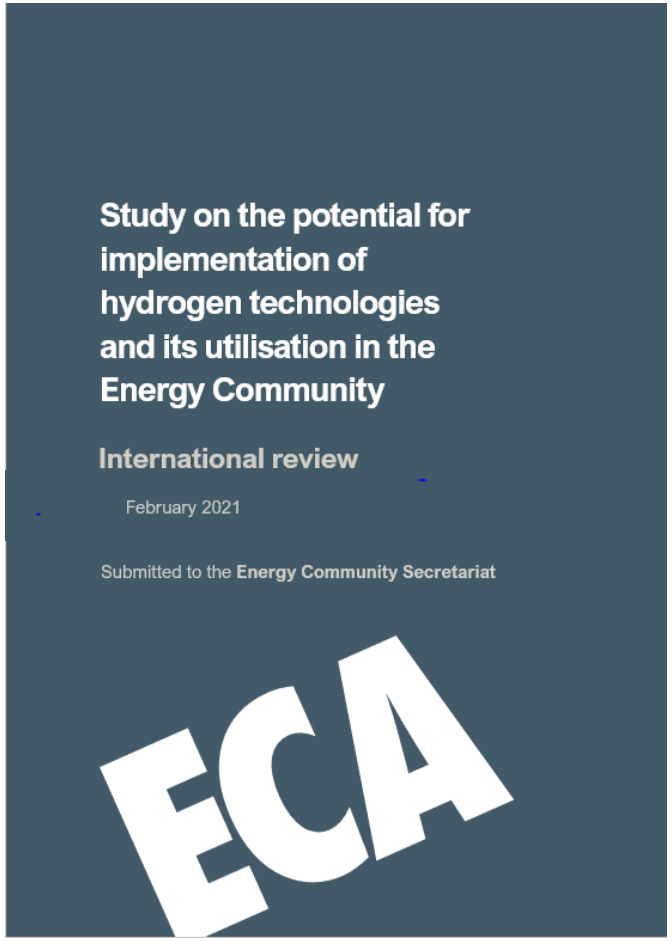
Timeline of some major hydrogen strategy announcements



Source: LBST for the WorldEnergy Council

Innovation is being promoted in R & D throughout Europe and there are various policy initiatives to support hydrogen roll-out

In conclusion, the potential of hydrogen is clear and the International Review provides more details



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