Visions of hydrogen futures

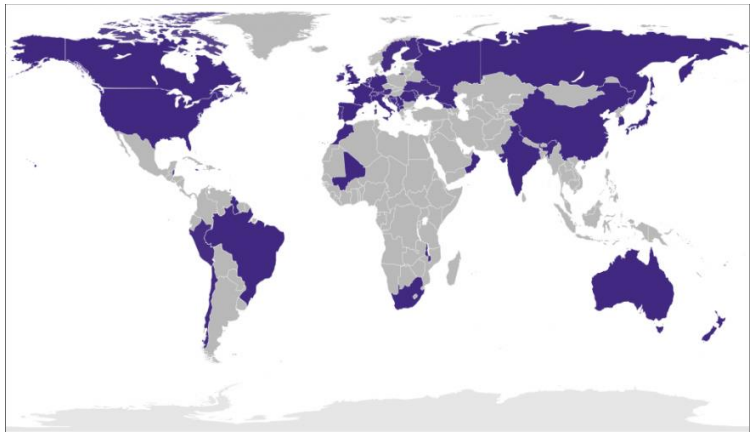
David Hart

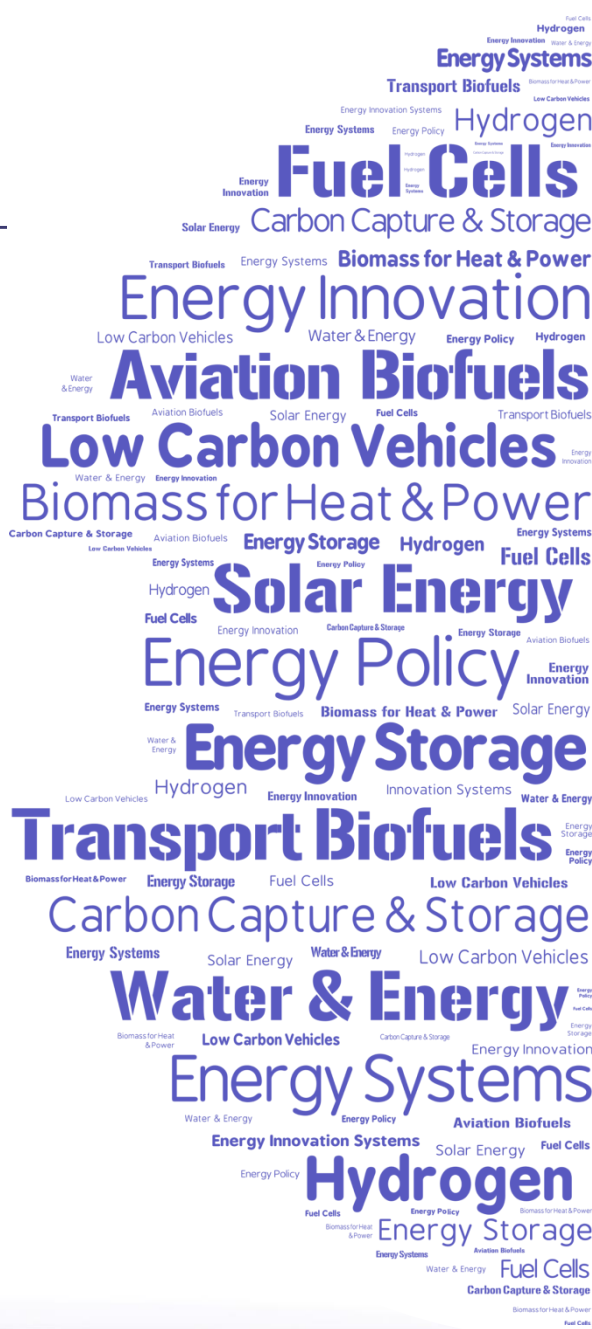
IEA Hydrogen Workshop, Paris

11 February 2019

E4tech perspective:
Strategy | Energy | Sustainability

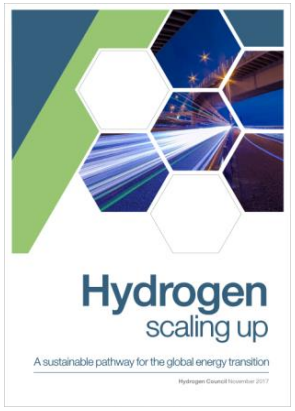
- International consulting firm, offices in UK and Switzerland
- Focus on sustainable energy (and **hydrogen**) – ahead of the curve
- 22 years old this year, always independent
- Deep expertise in technology, business and strategy, market assessment, techno-economic modelling, policy support…
- A spectrum of clients from start-ups to global corporations

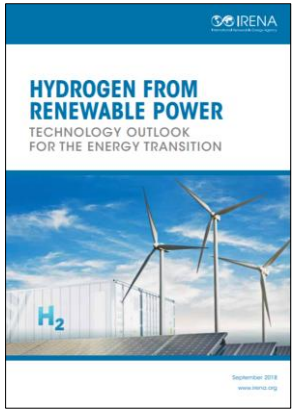


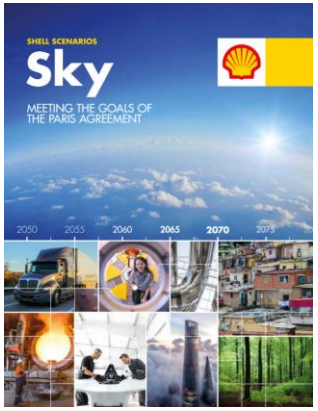


Hydrogen increasingly figures in mainstream future energy outlooks

- Hydrogen as part of energy system models has moved from being an academic curiosity to a deep decarbonisation ‘necessity’. Models suggest:
  - It enables decarbonisation of hard-to-electrify sectors
  - It can speed decarbonisation
  - It brings important system benefits
  - It can reduce decarbonisation cost
  - It can help economic development

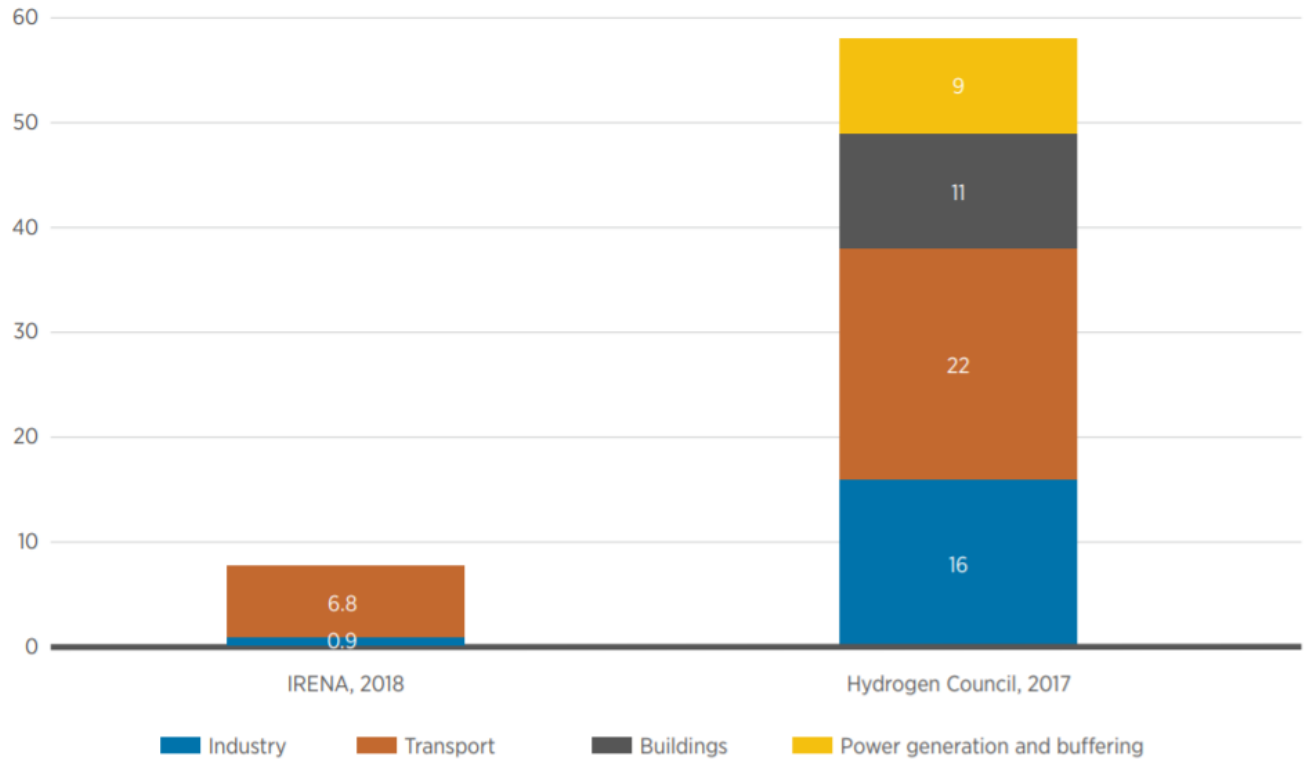






Scenarios vary widely in ‘ambition’. The Hydrogen Council projections aim high in several sectors

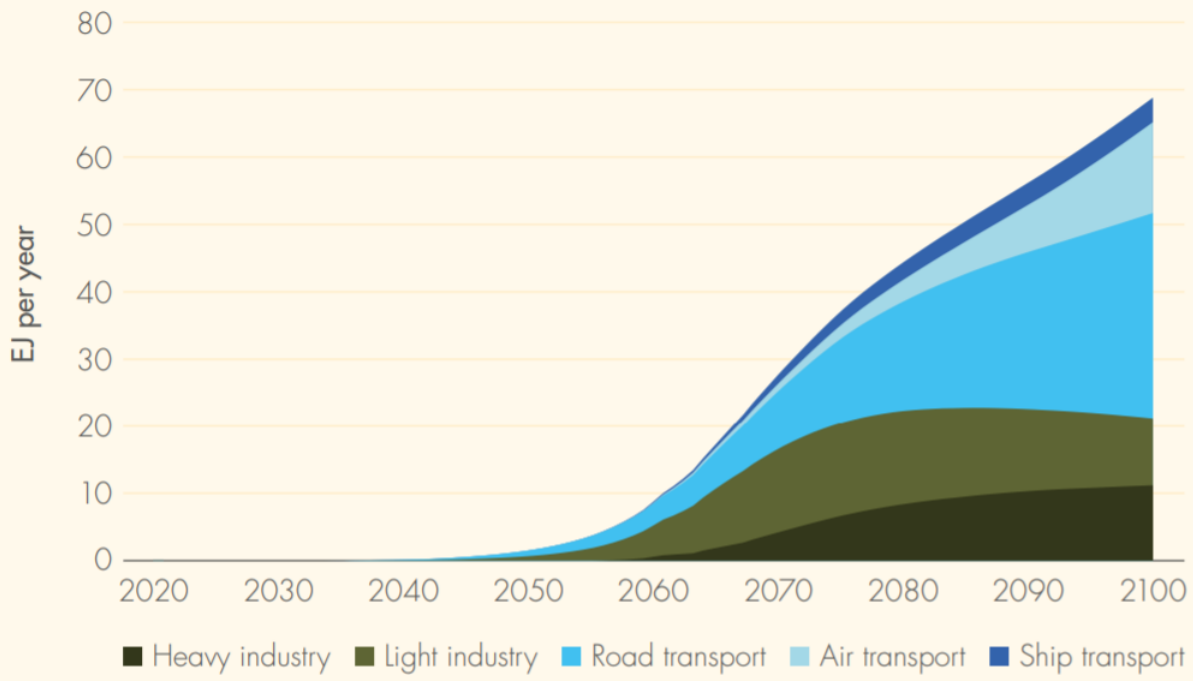
Figure 14: 2050 potential for hydrogen in total final energy supply (all values in EJ)



Sources: IRENA (2018), Hydrogen Council (2017).

Shell suggests a post-2040 role for hydrogen; little in 2050

IN **SKY**, HYDROGEN EMERGES AS A MATERIAL ENERGY CARRIER AFTER 2040, PRIMARILY FOR INDUSTRY AND TRANSPORT

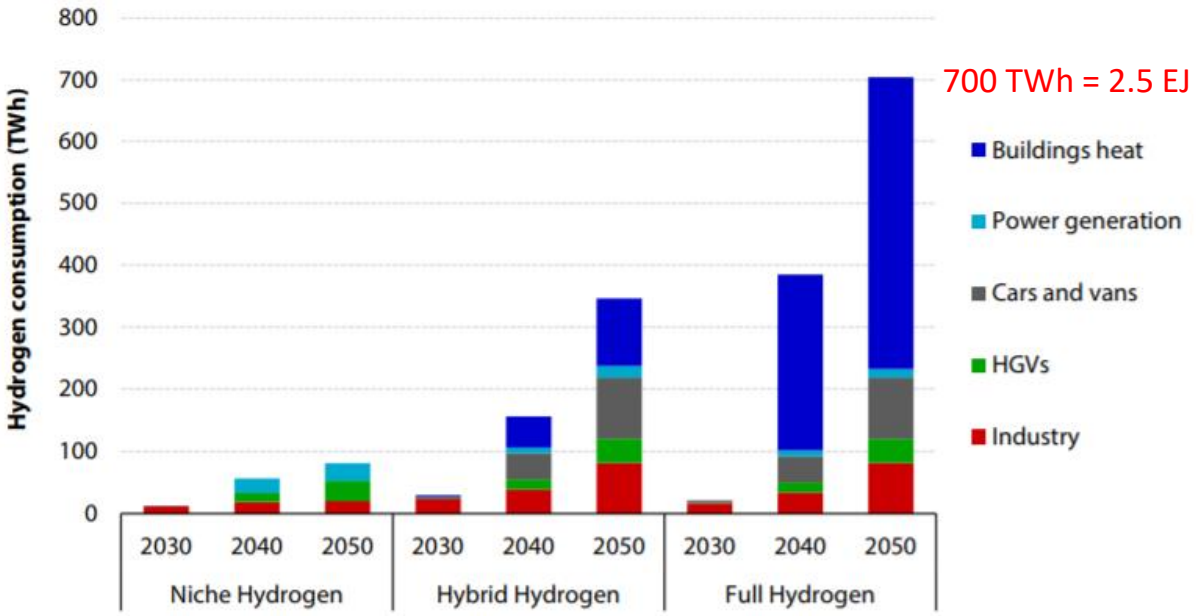


Note: By 2100, hydrogen supplies a quarter of all transport energy demand and over 10% of industrial energy

Source: Shell analysis

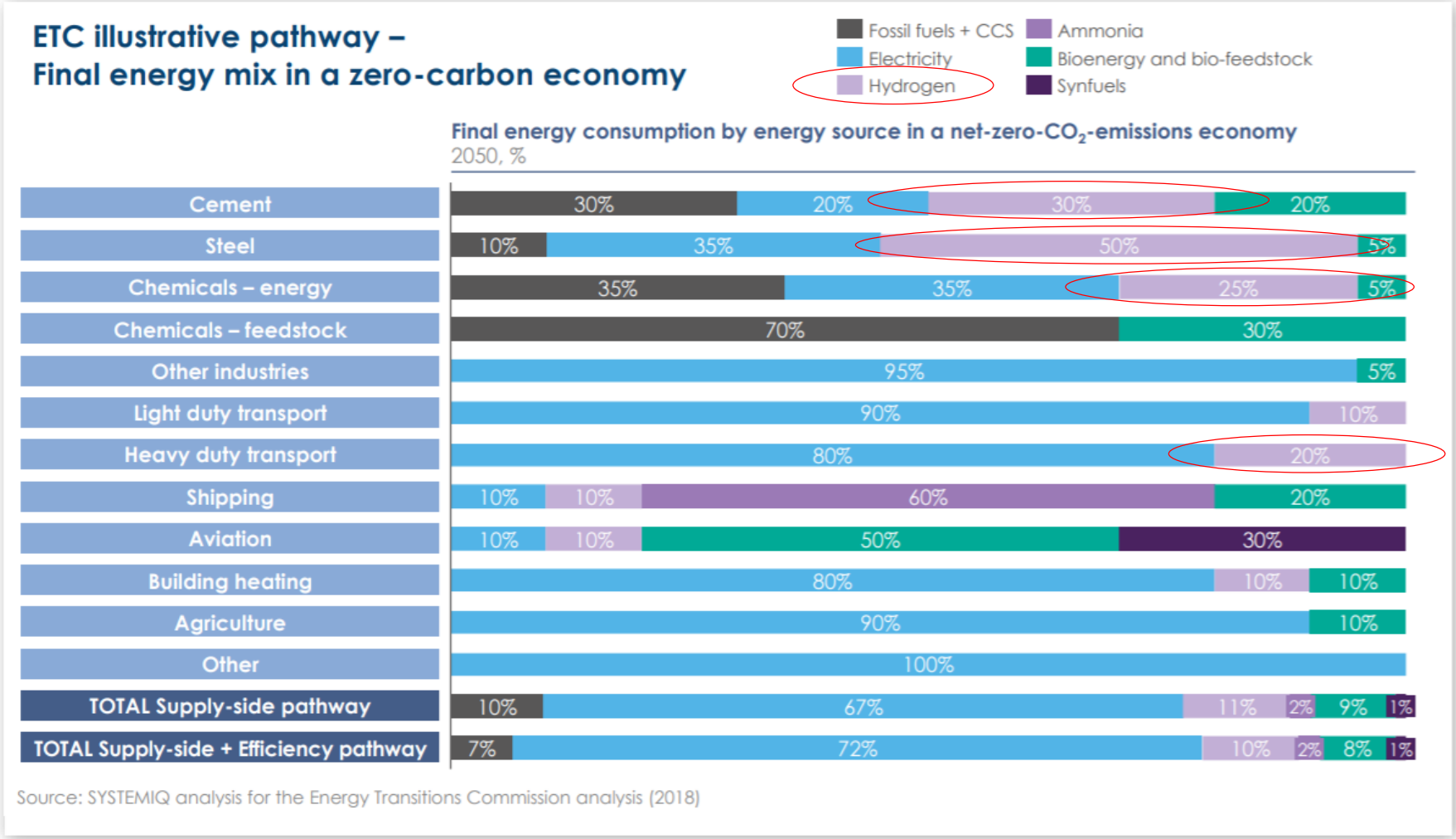
The UK's Committee on Climate Change shows uptake in buildings, transport and industry

Figure 4.1. Demands in the Full Hydrogen, Hybrid Hydrogen and Niche Hydrogen scenarios (2030-50)



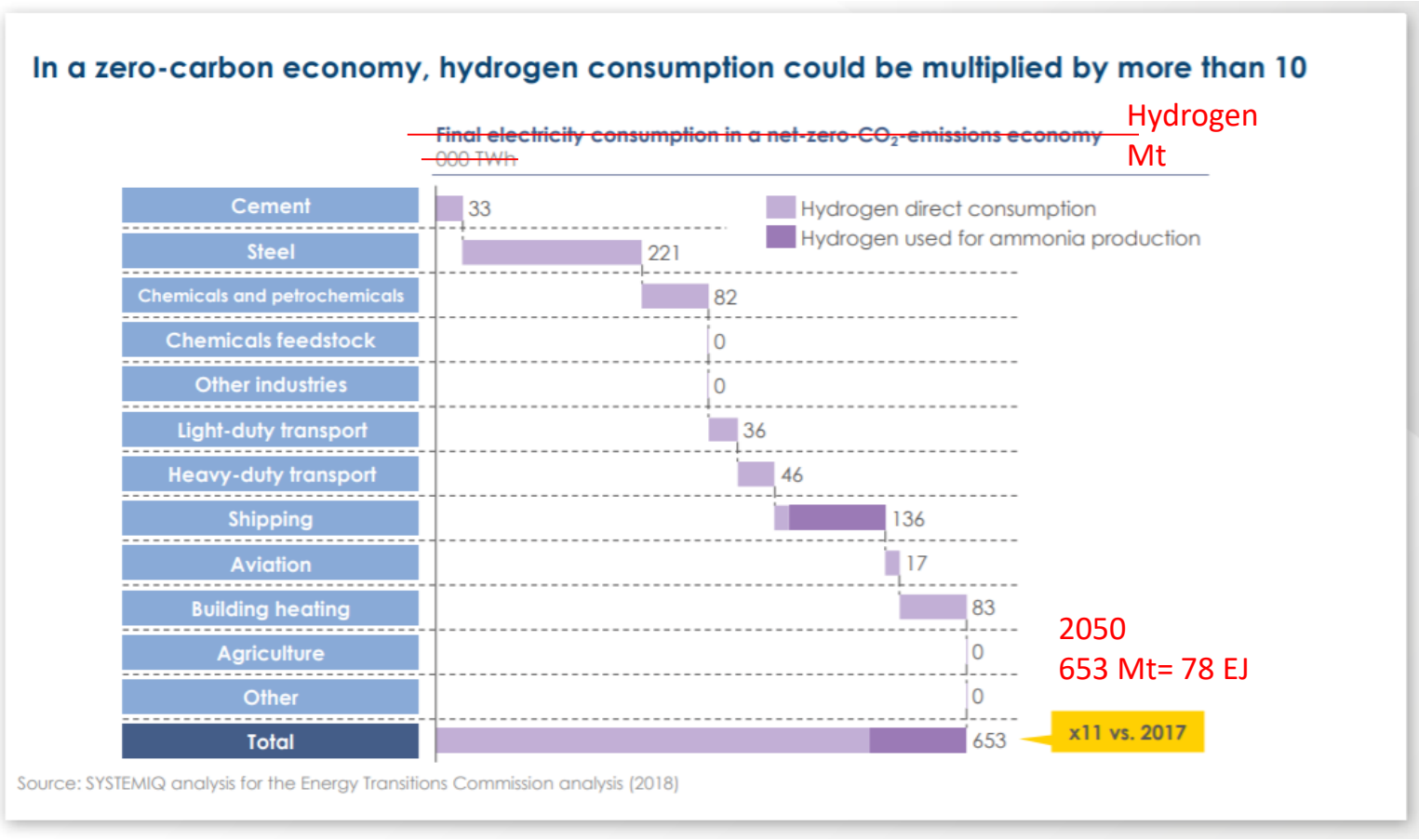
Source: CCC runs of the Energy System Catapult's ESME model with data and assumptions updated by the CCC.
Notes: Hydrogen consumption in buildings and transport was fixed at the values shown above for the ESME runs for all scenarios. For power generation, the model was free to select the cost-optimal level of consumption in all scenarios. For industry: for the niche scenario, the model could use hydrogen only where CCS or electrification options were not available; for the Hybrid and Full scenarios, hydrogen is assumed to be deployed wherever feasible.

The Energy Transitions Commission suggests mainly industry and some heavy transport



Source: SYSTEMIQ analysis for the Energy Transitions Commission analysis (2018)

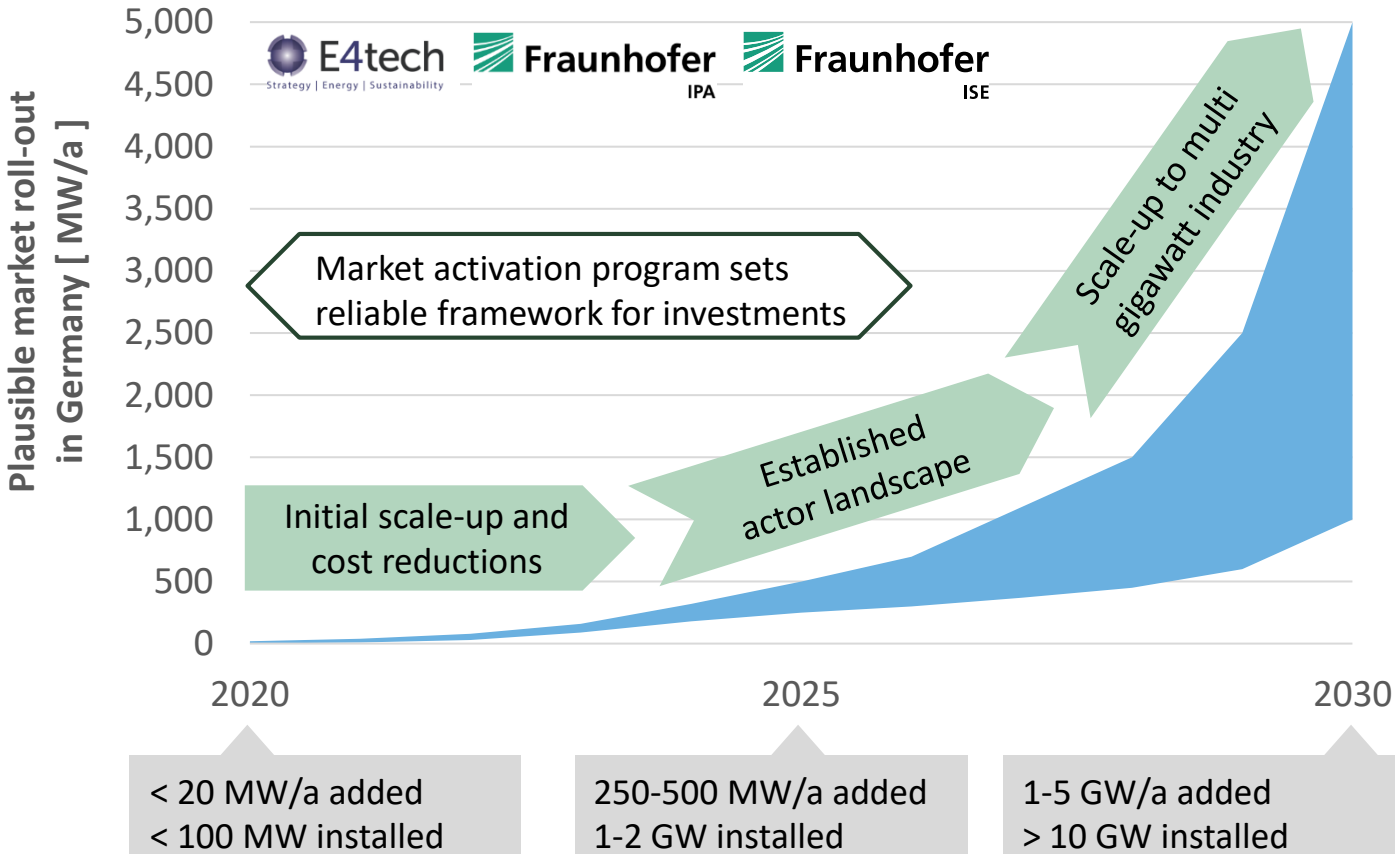
Hydrogen use could increase by an order or magnitude under one ETC option



What should we take away?

- While the benefits of hydrogen seem plausible, even likely:
  - We are only on the inflection point of the curve
  - Industry development is still required
  - Supply chains have to firm up and grow
  - Large-scale demonstration/pilot/first plant must show it works
  - Synergies and system solutions must still be enabled and proven
  - Markets and financial structures need to be suitable
  - Policy will need to cut across sectors (e.g. energy/transport/agriculture)
  - The *value* of hydrogen as well as its cost will be essential to factor in to any analysis

Ramping up industry requires concerted policy drivers and market priming



Industrialisation of water electrolysis in Germany: Opportunities and challenges of sustainable hydrogen for transport, electricity and heat
https://now-gmbh.de/content/1-aktuelles/1-presse/20180917-aktuelle-studie-zeigt-wege-zur-industrialisierung-der-wasserelektrolyse/indwede-studie_v04.1.pdf

Thank you

David Hart

david.hart@e4tech.com

www.e4tech.com

E4tech (UK) Ltd

83, Victoria Street
London SW1H 0HW
United Kingdom

+44 (0)20 3008 6140

enquiries@e4tech.co.uk

E4tech's annual Fuel Cell Industry Review

www.FuelCellIndustryReview.com

E4tech Sàrl

Av. Juste-Olivier 2
1006 Lausanne
Switzerland

+41 (0)21 331 15 70

enquiries@e4tech.ch