



Johnson Matthey
Inspiring science, enhancing life

Hydrogen: From Hype to Reality

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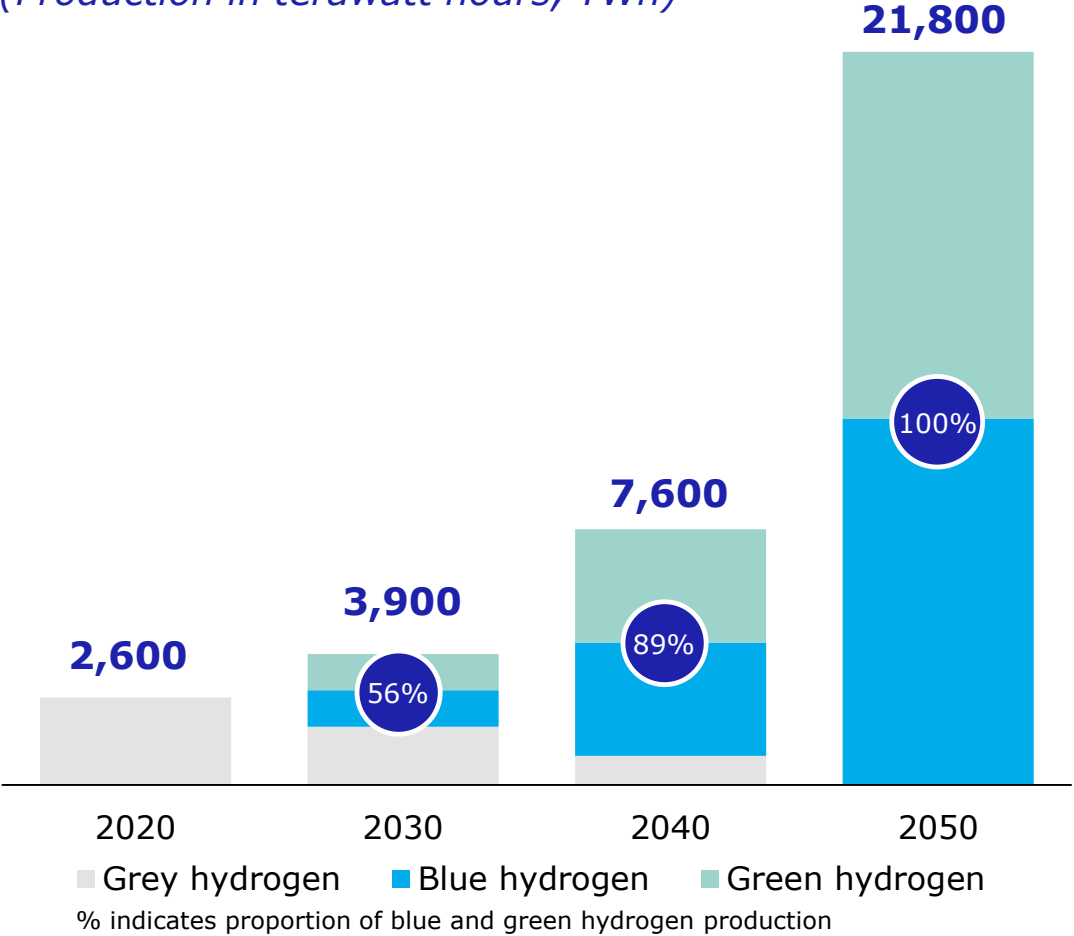
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Blue and green hydrogen are critical in the transition to net zero

Lots of Clean Hydrogen Required!

Split of hydrogen production methods

(Production in terawatt hours, TWh)



Grey share declines with future carbon tax

Blue adoption driven by geology (carbon storage locations), infrastructure (pipelines) and high cost of alternative routes to low carbon hydrogen

Green adoption driven by geography, declining cost of renewable energy and incentives

The Hydrogen Ecosystem needs to form together

Hydrogen production



1 Large scale hydrogen production with carbon capture and storage ("blue") JM

2 Large scale electrolysis ("green") JM

Transportation

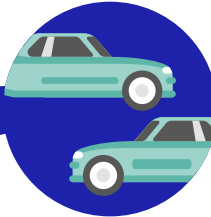
Distribute / transport energy across sectors and regions

4 Catalysts to convert hydrogen into a transportable form JM

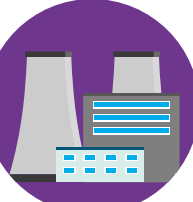


Act as a **buffer** to increase system resilience

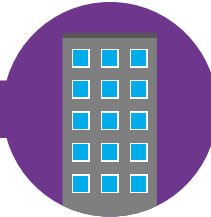
Applications



Decarbonise **transportation**
3 Fuel cells JM



Decarbonise **industry energy use and power generation**



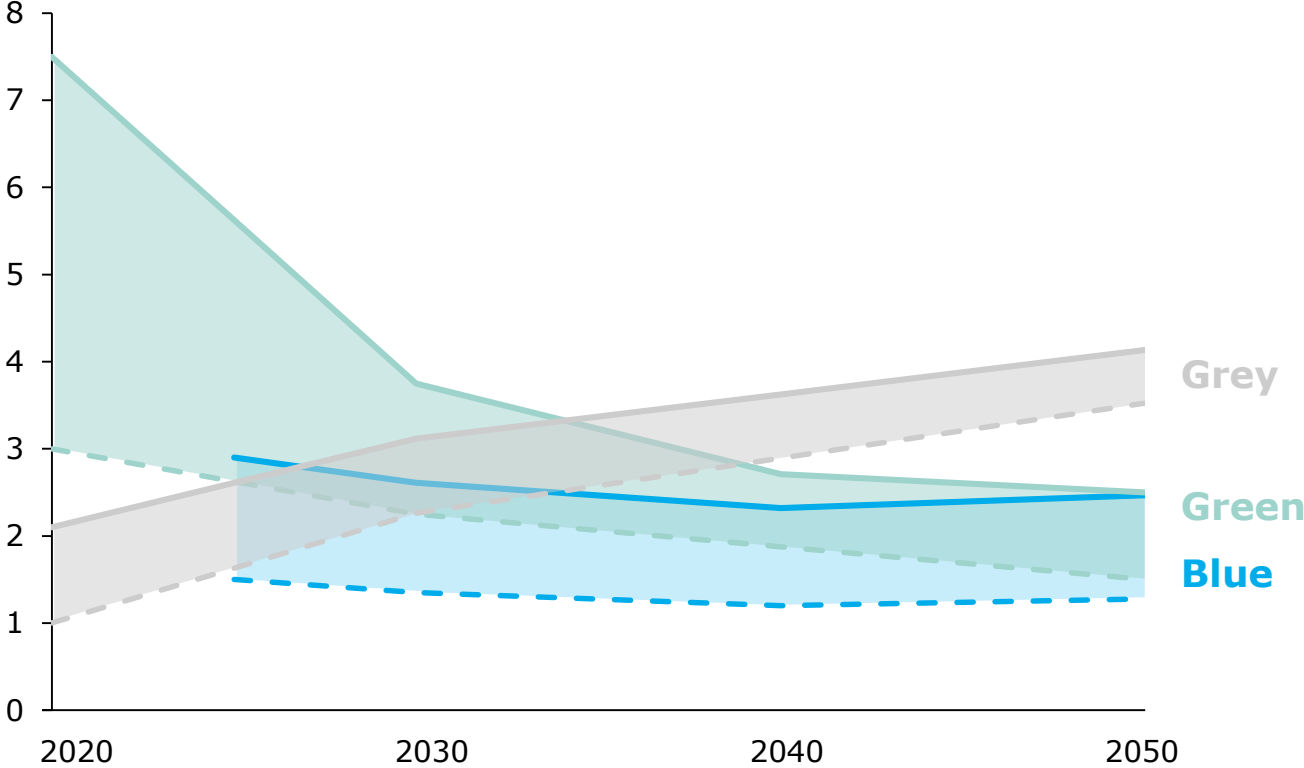
Decarbonise **building heating and power**



Serve as **clean feedstock for industry**
5 Syngas conversion technologies JM

Reality: Clean hydrogen becomes more competitive over the medium term

Estimated hydrogen cost
(\$ per kg H₂)



Blue hydrogen advantaged in certain regions and likely to be a long term solution in places with the right geology and infrastructure e.g. US and UK

Green hydrogen will be a solution in some regions as both renewable energy and capital costs decline

Reality: Real Clean Hydrogen Projects are here!

HyNet Phase 1 North West England

Trialling decarbonised hydrogen
as a fuel and feedstock

Phase 1: 80kt of hydrogen p.a.
Equivalent to world scale hydrogen plant

Used in industry, homes
and transport

Haru Oni: Chile Green H2 to e-methanol & e-gasoline

Phase 1 900 litres pa in 2022

Phase 3: 550 million litres pa by 2026

Enough for 220 000 gasoline vehicles

