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Blue Paper

Economic viability hold's the key to hydrogen's success in India

Part -9 (Hydrogen cost benchmarks, demand built-up, transport infra & market size evaluation for India)

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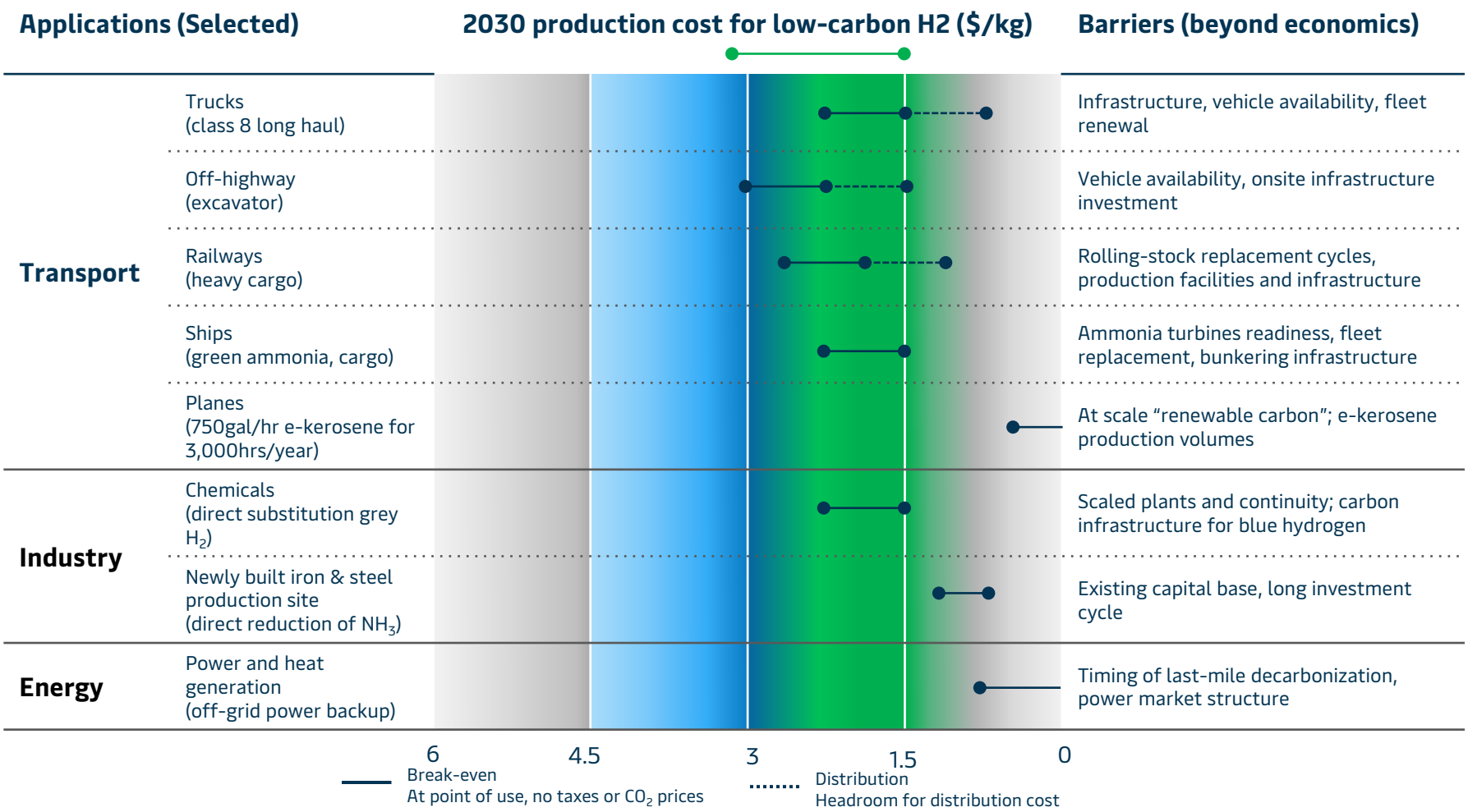
Economic viability holds key to hydrogen's success as a clean source of energy in India

Infrastructure, availability of vehicles and at-scale equipment are key barriers, beyond unit economics and the cost gap

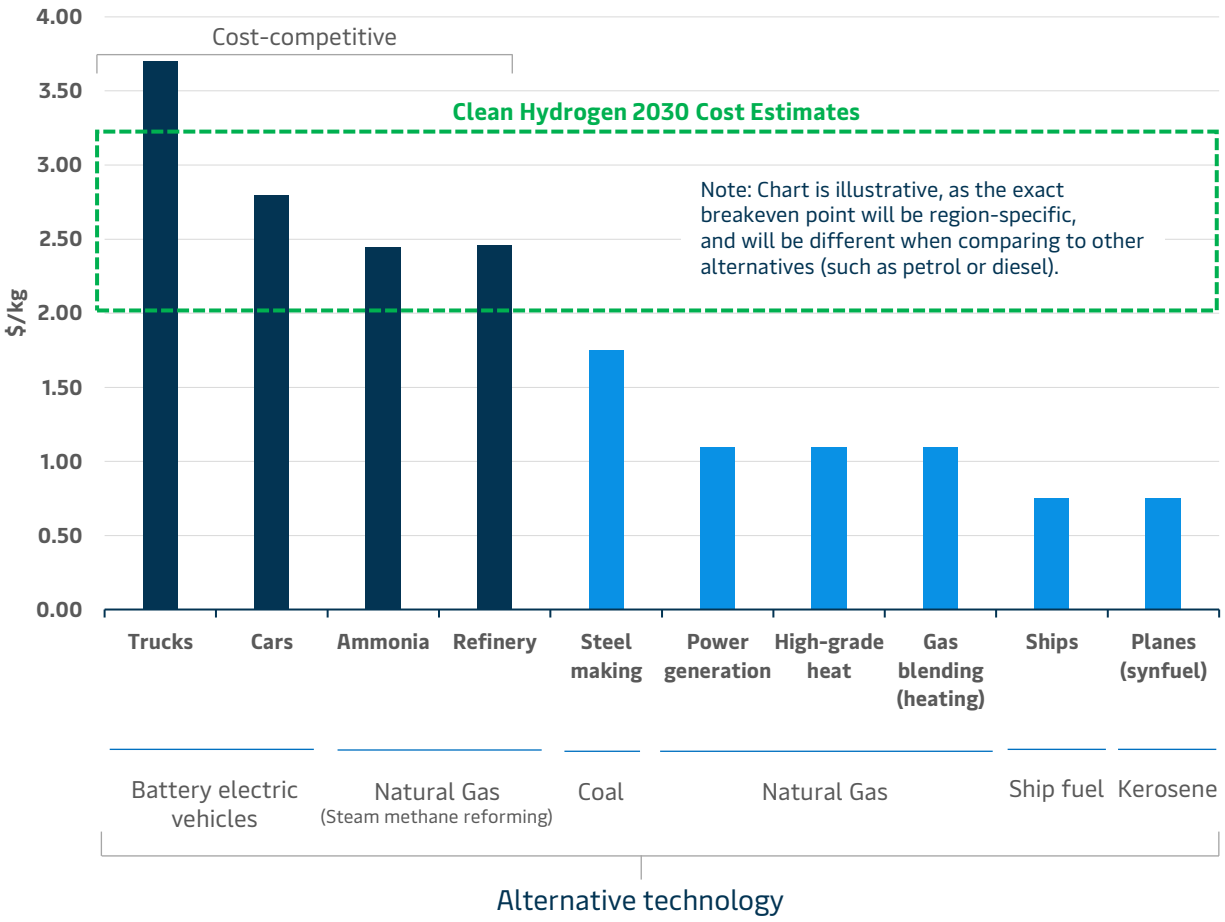


Source : eninrac research & analysis, Channel checks & BCG

Global attempt to increase momentum for clean H_2

Australia, Japan, China & Republic of Korea in Asia Pacific region have already made commitments to use clean hydrogen and decarbonize their energy systems. Clean hydrogen is gaining grounds in Europe as well as in US and is having good hopes in India as well for registering growth. Globally, industries such as shipping, steel making, and chemical production see hydrogen as a long-term alternative to their dependence on fossil fuels. Interest has been bolstered by the falling costs to produce and use hydrogen. Over the past decade, for example, the cost of generating electricity from wind has fallen by about 70%, and from solar PV by about 80%. The cost to make a hydrogen fuel cell, meanwhile, has fallen by about 60% since 2006. With foreseeable technology improvements and higher manufacturing volume, it is anticipated that the cost of fuel cells might fall by about another 30% by 2025. The cost of storing hydrogen will also become cheaper with scale, technology and efficiency improvements – by up to 40% as ammonia and up to 80% as liquid hydrogen. As costs fall, clean hydrogen will become increasingly competitive. When and where this occurs will also depend on factors such as the cost of alternatives.

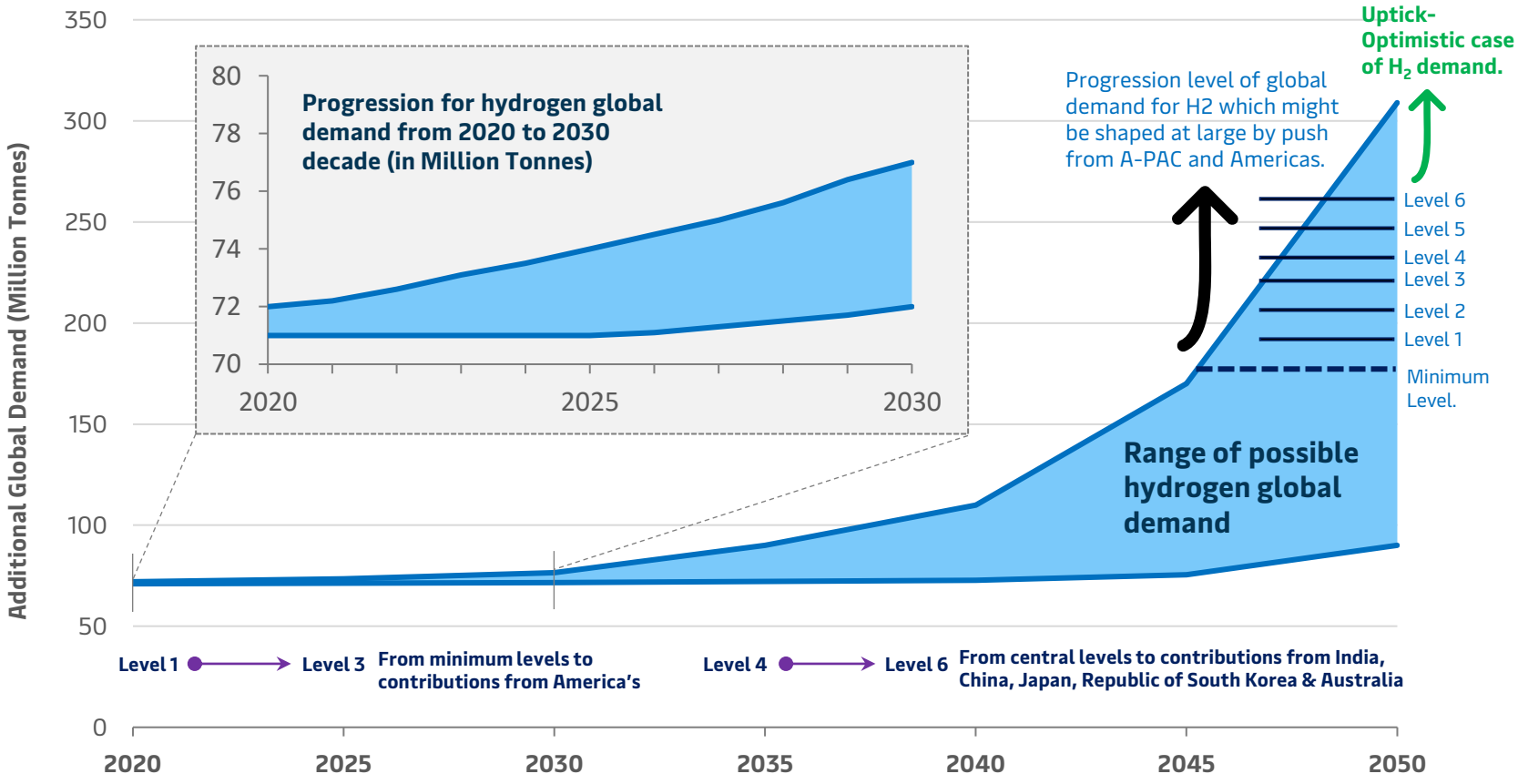
Exhibit: Breakeven cost of hydrogen against alternative technology for major applications, in 2030.



Source : eninrac research & analysis, Channel Checks & D2I Model Interpretations

The International Energy Agency and International Renewable Energy Agency are among those predicting significant growth in global demand for hydrogen. Analysis undertaken for the Strategy also indicates growth in demand. The exhibit below depicts **the global demand outcomes to 2030 and 2050.**

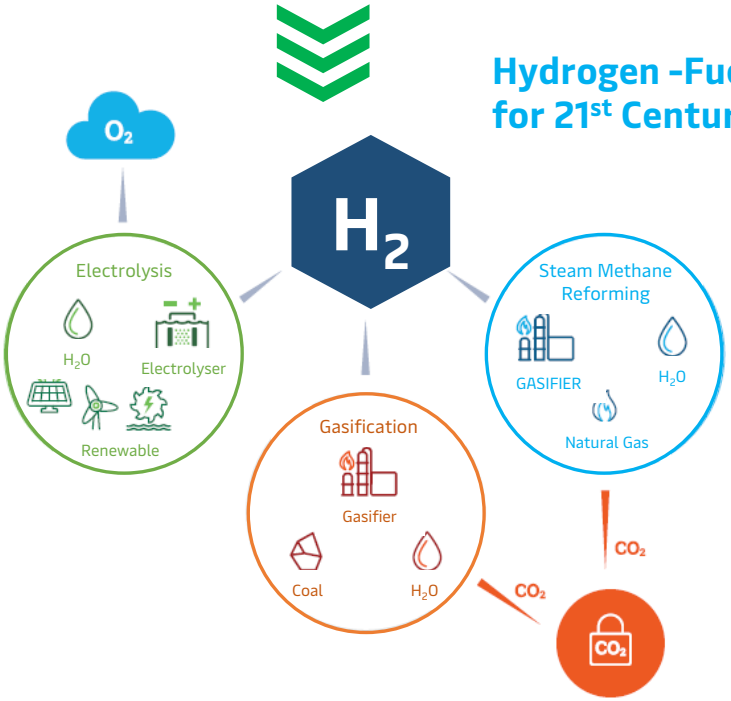
Range of possible hydrogen demand over the next three decades (From 2020 to 2050)



Source : eninrac research & analysis, Channel Checks, IEA & IRENA

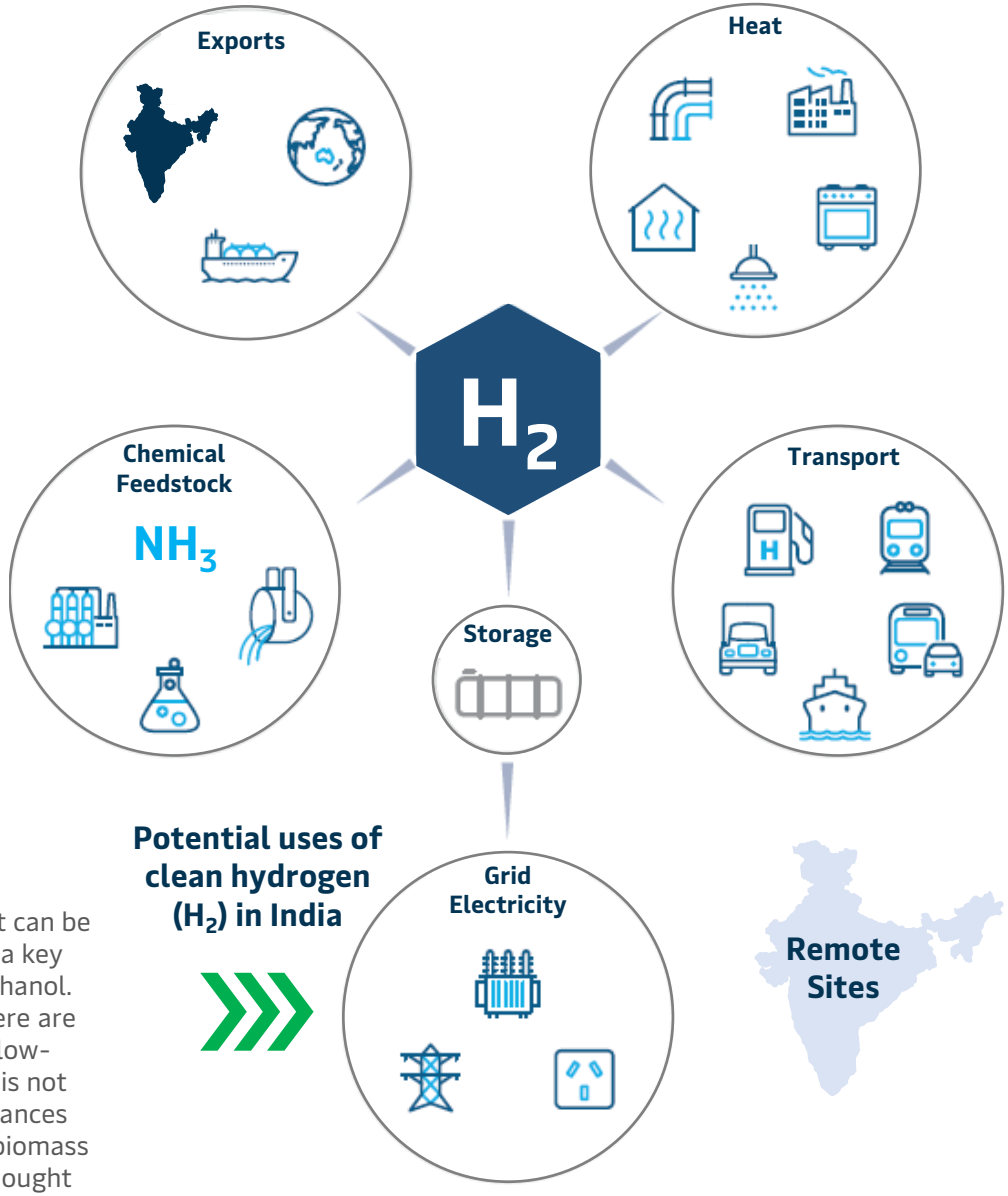
Production pathways of clean hydrogen (H_2) in India

Hydrogen -Fuel for 21st Century



Hydrogen is a flexible, safe, transportable and storable fuel. It can be used to power vehicles and generate heat and electricity. It is a key ingredient for producing chemicals such as ammonia and methanol. When used as a fuel, hydrogen's only by-product is water. There are no carbon emissions. But whether hydrogen is truly a zero or low-emissions fuel depends on how it is produced. Pure hydrogen is not found naturally on Earth. It must be extracted from the substances that contain it – water mainly, but also coal, natural gas and biomass – and this takes energy. Because of this, hydrogen is better thought of as an energy carrier than an energy source.

Potential uses of clean hydrogen (H_2) in India



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at connect@eninrac.com
+91 93190 48963/47963, +91 72900 16953