# Why production of low carbon hydrogen stands a priority in India

Part -8 (Hydrogen cost benchmarks, demand built-up, transport infra & market size evaluation for India )

# Hydrogen Competitiveness – End Use Application in India

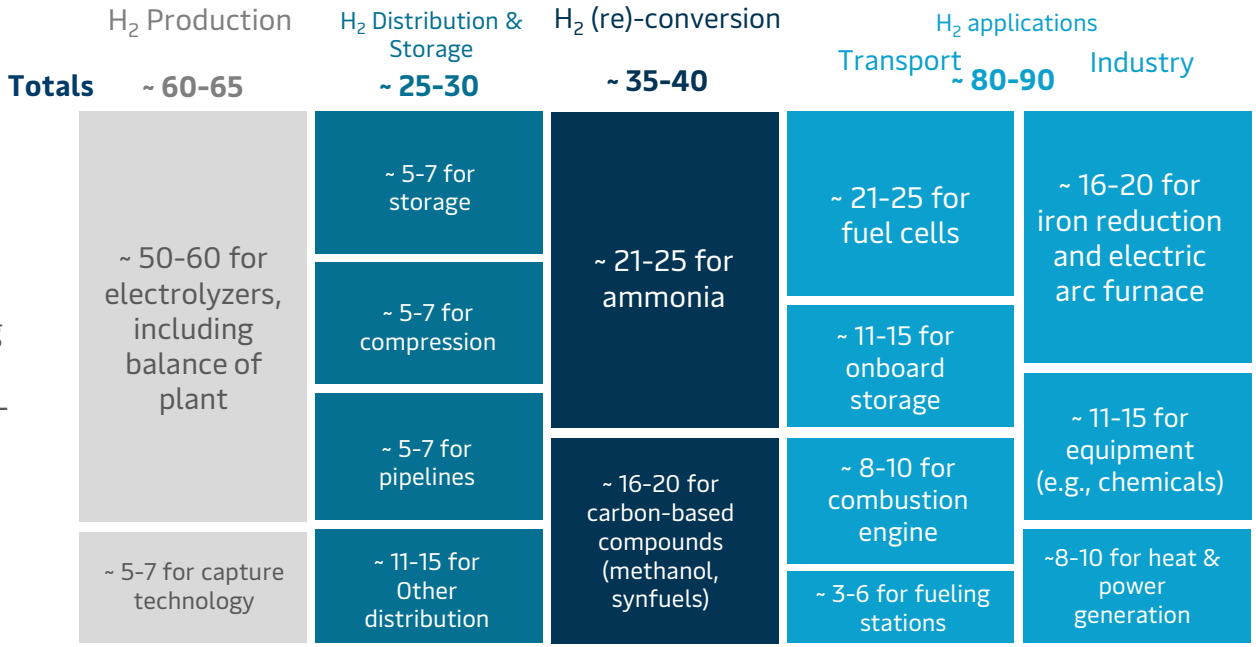
**India will almost double in market size for hydrogen by demand from 2020 levels by 2030. The chief contributors to this growth shall be the ammonia based fertilizers, petroleum refineries and chemicals industries**

## MAKING LOW CARBON HYDROGEN IN INDIA – PRIORITY FOR COUNTRY

To maximize its environmental benefits, hydrogen must be "green"—made entirely from renewable-energy sources. Other methods, however, will also continue to be employed, some cleaner than others. Currently, the most common method, gray H2, involves using a fossil fuel to heat water into steam, mixing the steam with methane, and capturing the H2 released. Adding a filter to trap the GHGs emitted results in so-called "blue" hydrogen. Blue hydrogen is likely to remain economically favorable in places with an abundance of methane, especially once carbon capture technologies fully evolve.

> Potentially by 2050, it is expected that around US$ 200 billion in annual capital pending shall be done which offers huge potential for machinery makers

Exhibit 8.1: 2050 Market Potential for Equipment & Components ($ Billions)




Source : eninrac research, channel checks, BCG

# HOW MUCH HYDROGEN IS REQUIRED FOR TRAVEL, FUEL CELL & NATURAL GAS REPLACEMENT IN INDIA

**1 kg** of hydrogen is enough to travel up to **100km** in **Hyundai Nexo**

Travelling in a **Hyundai Santa Fe** uses **7.5L** of diesel or **9.3L** of petrol

Driving a **Hyundai Nexo** compared to a diesel **Hyundai Santa Fe** avoids 0.2kg $CO_2$-e/km driven or 20 kg $CO_2$-e/kg of hydrogen used

**1kg** of hydrogen in a fuel cell could power a **1,400-watt** electric split-cycle air conditioner for **14.5 hours**

Replacing Indian Grid electricity with electricity from **hydrogen** avoids **0.75 kg $CO_2$ – e/kwh**, of **15kg of $CO_2$ – e/kg** of hydrogen used

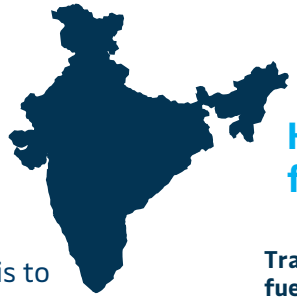
**1 tonne** of hydrogen is equivalent to around **3.4 times** the average annual consumption of Indian house with gas

Replacing **natural gas** with **hydrogen** avoids **0.052 tonnes $CO_2$-e/GJ** of **natural gas** or **6.2 tonnes $CO_2$-e/tonne** of **hydrogen**


**Replacement Scenarios in India**

Source : eninrac research, channel checks, Ministry of Natural Gas, Govt. Of India

For a country like India, full benefits of hydrogen and fuel cell technologies play out when deployed at scale and across multiple applications



**2020-2022: Immediate next steps**

In the first two three years, the aim is to establish dependable and technology-neutral decarbonization goals in a greater number of states in the country and at the central level produce comprehensive guide which will serve input to regulatory & policy dynamics.

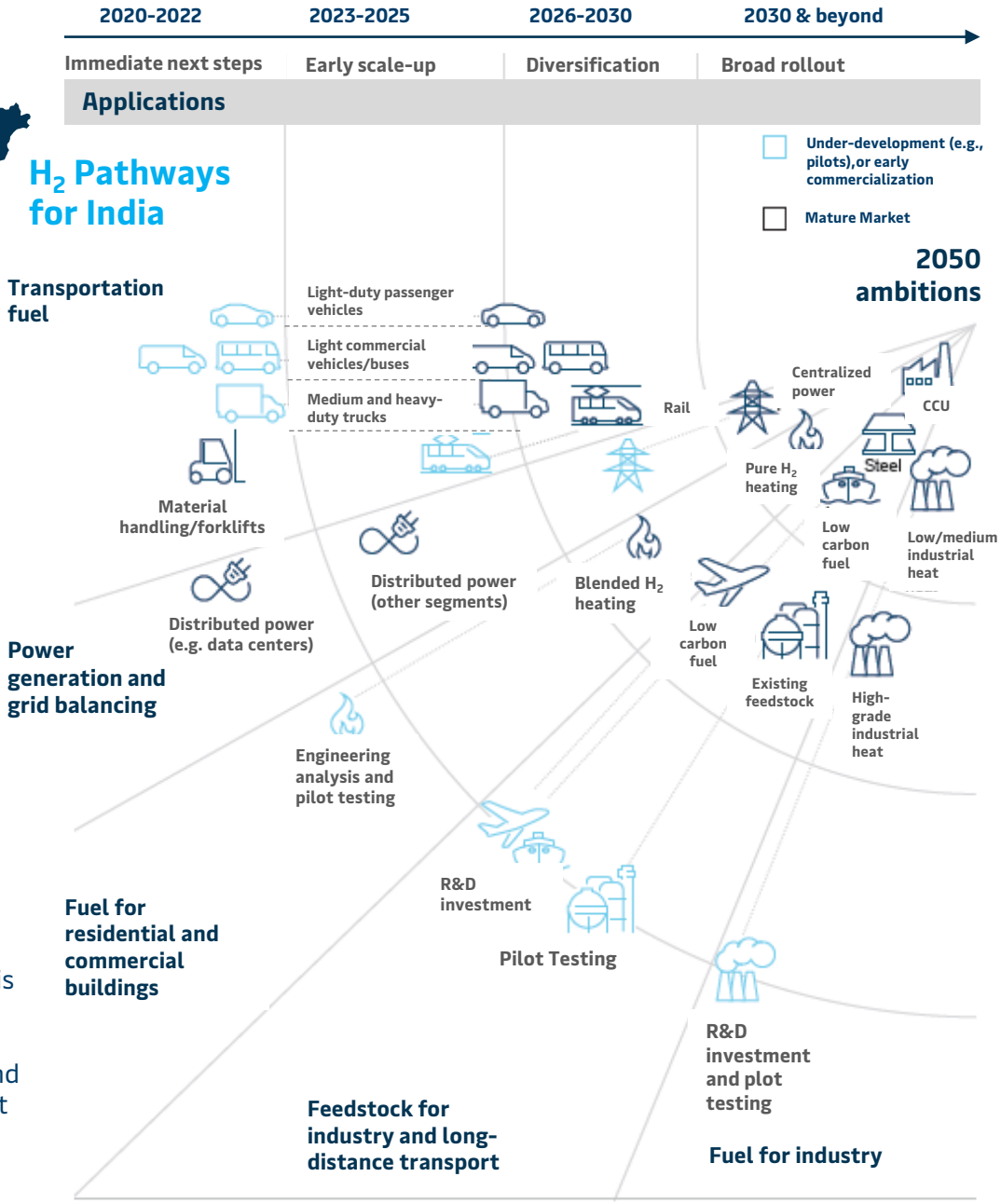
**2023-2025: Early scale-up**

By 2025, large-scale hydrogen production in the country is anticipated to be developed. This shall be done by bringing the cost down and kicking off scale up applications. Policy incentives in early markets being transitioning from direct support to scalable based mechanisms.

**2026-30 & Beyond: Diversification & broad roll-out**

The 2026 to 2030 phase is about diversification beyond early adopter segments and early adopter states such as transportation and backup power, and about scaling up infrastructure across the country. After 2030, hydrogen is deployed at scale in India, across regions and industries. Most applications achieve cost parity with fossil fuel alternatives through sufficient pricing of externalities, and public support for market introduction can be phased out

Source : eninrac research & analysis, Channel checks



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