Current global H2 demand is around 90 MMT/year, which grew at 2% since 1975; demand will increase further as countries set targets.

Source:
Current demand of hydrogen in India is ~6 MTPA; driven by captive consumption of refineries and fertilizer units.
India’s hydrogen demand could reach anywhere between 15 (conservative) – 25 (optimistic) MTPA by 2040.

- Increased decarbonisation initiatives coupled with reducing prices could lead to significant rise in green H2 consumption by 2040.
- We expect demand to be anywhere between 15–25 MTPA depending on market development and policy initiatives. Demand is likely to be driven by mainly driven by refinery and fertilisers sectors.

Source: ICF Analysis

Low Case: When the additional demand of hydrogen on a year over year (YOY) basis is decided based purely on the market dynamics (considering cost of green hydrogen production and supporting infrastructure)

High Case: When the additional demand of hydrogen on YOY basis is fulfilled based on obligation/government push/ supporting policies.
H2 demand in India is expected to increase by 2.5–3.5 times by 2040 but is still not expected to meet more than 5% of total primary energy consumption of India by 2040.
The green hydrogen market (sales) is likely to reach ~$10 billion by 2030 & ~$35 billion by 2040 in India (per annum figures).

The green hydrogen developers can generate significant annual profits by 2040 (considering 10% margin on the business).

Green hydrogen market is likely to be at $30–35 billion by 2035–2040 in India (under the optimistic demand case).

Source: ICF Research & Analysis; based on Case 3 of demand estimation
The hydrogen demand in each state is excluding refinery and fertilizer hub demand and is shown separately in legend.

- Hydrogen demand is likely to be concentrated in regions with refineries and fertilizer plants.
- Green hydrogen supply hubs near the demand centers will provide cost effective solution to meet the demand.

Source: ICF Analysis

The hydrogen demand in each state is excluding refinery and fertilizer hub demand and is shown separately in legend.
Gaseous and liquid H2 are the primary methods of storage across the globe.

- Hydrogen is mainly being stored in gaseous tanks or cryogenic tanks across the world. Based on geographical availability, some countries (UK and US) have utilized salt caverns.

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<tr>
<th>Higher storage costs for liquid hydrogen make it unviable at small distances.</th>
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<tbody>
<tr>
<td>Due to high liquefaction costs and cryogenic storage required for liquid hydrogen, on-site storage cost of liquid hydrogen is approximately 5 times that of gaseous H2, making it unviable at extremely small distances.</td>
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<th>Larger transport capacity of liquid hydrogen makes it cost effective for medium distances.</th>
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<tbody>
<tr>
<td>One single liquid H2 trailer can deliver 10-15 times more hydrogen than a single gaseous H2 trailer, so, at medium-range distances, liquid H2 becomes more viable than gaseous H2 due to fewer trucks/trips required.</td>
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<th>For large capacities, pipeline transport is cheapest.</th>
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<tr>
<td>With increasing capacities, pipeline costs reduce drastically at smaller capacities. The cost of H2 transportation by pipelines is 8.8% the cost of gas tank trailers and 20% of liquid trailers for a 20-inch pipeline for 120 km.</td>
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<th>Ammonia is used for extremely long-range transport—intercontinental distances.</th>
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<tr>
<td>Ammonia with a volumetric hydrogen density about 45% higher than that of liquid hydrogen, so it becomes an excellent choice for transport at intercontinental distances.</td>
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</table>

Green hydrogen production hubs near demand centres make more commercial sense.
Green vs. grey hydrogen economics will depend on fossil fuel prices, carbon prices, cost reduction and efficiency improvements in electrolysers and Government support for green hydrogen.

- Solar module costs may not reduce much further, but electrolyser costs are likely to drop rapidly over next few years.
- Higher natural gas costs or carbon prices on fossil fuels can further accelerate the cost parity of green hydrogen with grey hydrogen.

Source: ICF Research & Analysis
SMR: Steam Methane Reforming; PEM: Polymer Electrolyte Membrane
Measures taken in India to date

India can achieve savings of $15–20 billion in fossil fuel imports by replacing them with locally-produced green hydrogen.

- At present, India spends more than $160 billion every year on energy imports.
- India can replace fossil fuels by hydrogen in transport, iron and steel, CGD, and large industries.

Source: ICF Analysis
Conclusions
### H2 demand in India

- **Demand**: Expected to increase by *2.5–3.5 times* by 2040; it is still not expected to meet more than 5% of total primary energy consumption of India by 2040.

- **Market**: The H2 market in India is likely to reach ~$30n–35 bn/yr by 2035 – 2040.

- **RE Power Requirement**: RE power requirement for green hydrogen will be significant at **400 GW**.

- **Cost Parity**: Cost parity between green hydrogen and grey hydrogen will depend on factors such as fossil fuel prices, carbon market prices, cost reduction and efficiency improvements in electrolysers, and, importantly, government support/incentives for green hydrogen.

- **Savings**:
  - India can achieve savings of *$15–20 billion per year* in fossil fuel imports by replacing fossil fuels with locally produced hydrogen in end use sectors.

→ **Summing up**
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