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On Point

Evaluating the utility of hydrogen refueling stations in reducing cost of hydrogen

Part -5 (Hydrogen cost benchmarks, demand built-up, transport infra & market size evaluation for India)

RAEninrac

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Retrofitted pipelines can achieve very low H2 transportation cost i.e. less than or equal to USD 0.1/kg for upto 500 kms

HYDROGEN REFUELING STATIONS

While economies of scale in station component manufacturing are expected to reduce the delivered cost of hydrogen for vehicles. Hydrogen refuelling stations with higher capacities will also have a lower levelized cost of dispensed hydrogen. Increasing station size from 350 kg/d to 1000 kg/d could cut the cost of dispensed hydrogen. As both station capacity and vehicle demand increase , pipeline delivery will become more profitable and could further reduce the overall cost of dispensed hydrogen. Station utilization is another important factor. While utilization tends to align with vehicle deployment , early FCEV fleet deployment can help ensure a certain level of utilization, lowering hydrogen prices. Stations designed to serve both LDVs and HDVs may be able to increase utilization and reduce overall capital expenditures, though serving both vehicle types will require more equipment to fuel at different pressures or flowrates. The number of suppliers for key HRS components is currently limited, which can restrict station roll-out and prevent the cost reductions that come with market competition. Novel component designs (including for high-throughput compressors, cryogenic hydrogen pumps, hoses and nozzles) and refuelling protocols are needed for fast fuelling of heavy-duty trucks, marine vessels and aircraft.

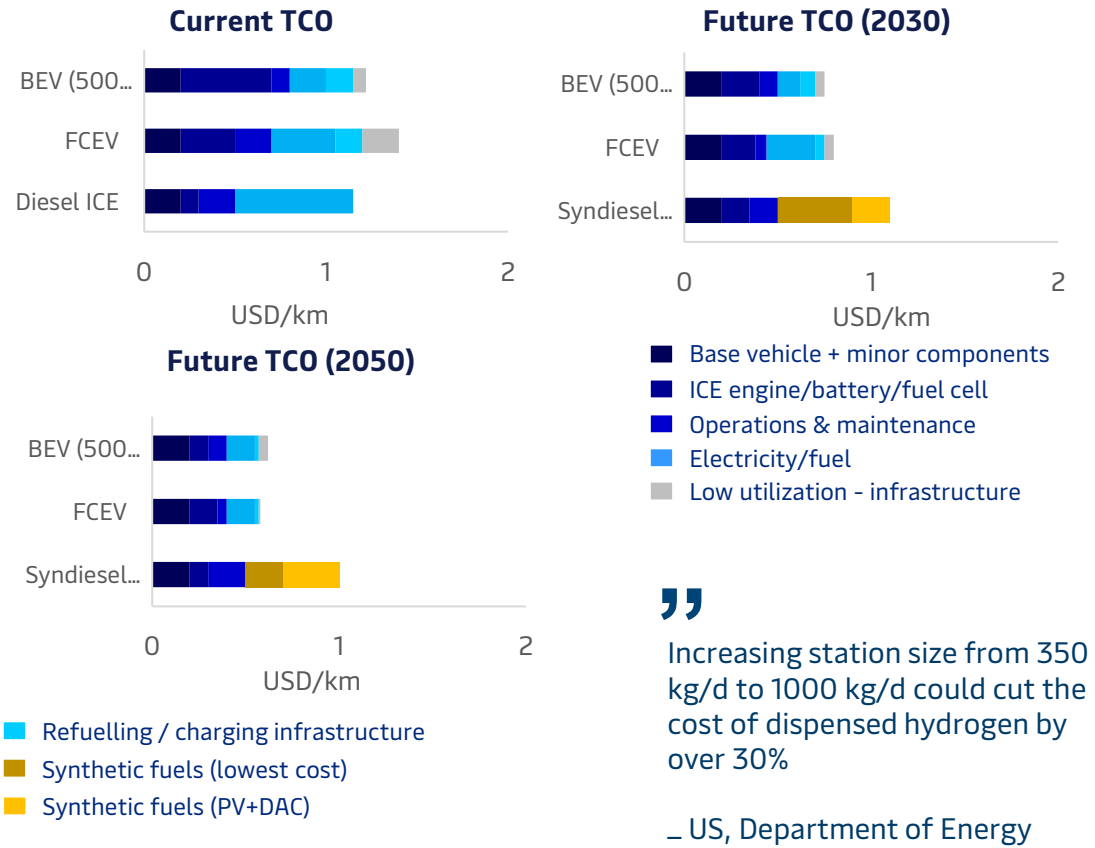
Adoption of FCEVs, especially buses and commercial vehicles, will be determined by how their total cost of ownership (TCO) compares with other vehicle and fuel technologies. The main TCO factors for FCEVs are the delivered hydrogen and fuel cells costs, and station utilisation. In comparison with BEVs, daily range is another key consideration.

> Increasing station size from 350 kg/d to 1000 kg/d could cut the cost of dispensed hydrogen by over 30%
>
> _ US, Department of Energy

Fuel cell trucks begin to have total cost ownership advantage over battery electric at a range of 400-500 km

For long haul HDVs, enabling a sufficient driving range may require additional battery capacity , however the associated weight could limit payload and add to BEV cost. Fuel cell trucks begin to have a TCO advantage over battery electric at a range 400-500 km. The TCO for fuel cell heavy-duty trucks is currently 10-45% higher than for internal combustion diesel trucks. In the announced scenario , as the manufacturing of fuel cells, station components and hydrogen production technologies scales up – while station utilisation also increases – the TCO of fuel cell heavy duty trucks drops 30-40% by 2030 and 50-60% by 2050. Comparing decarbonisation options for this sector, the TCOs of both battery electric and fuel cell trucks are expected to be lower than for hybrid electric trucks running on synthetic diesel. In the medium term, fuel cell and battery electric trucks have comparable TCOs at a 500-km driving range, depending on refuelling or charging infrastructure utilisation.

Current & future total cost of ownership of fuel /powertrain alternatives for heavy-duty trucks



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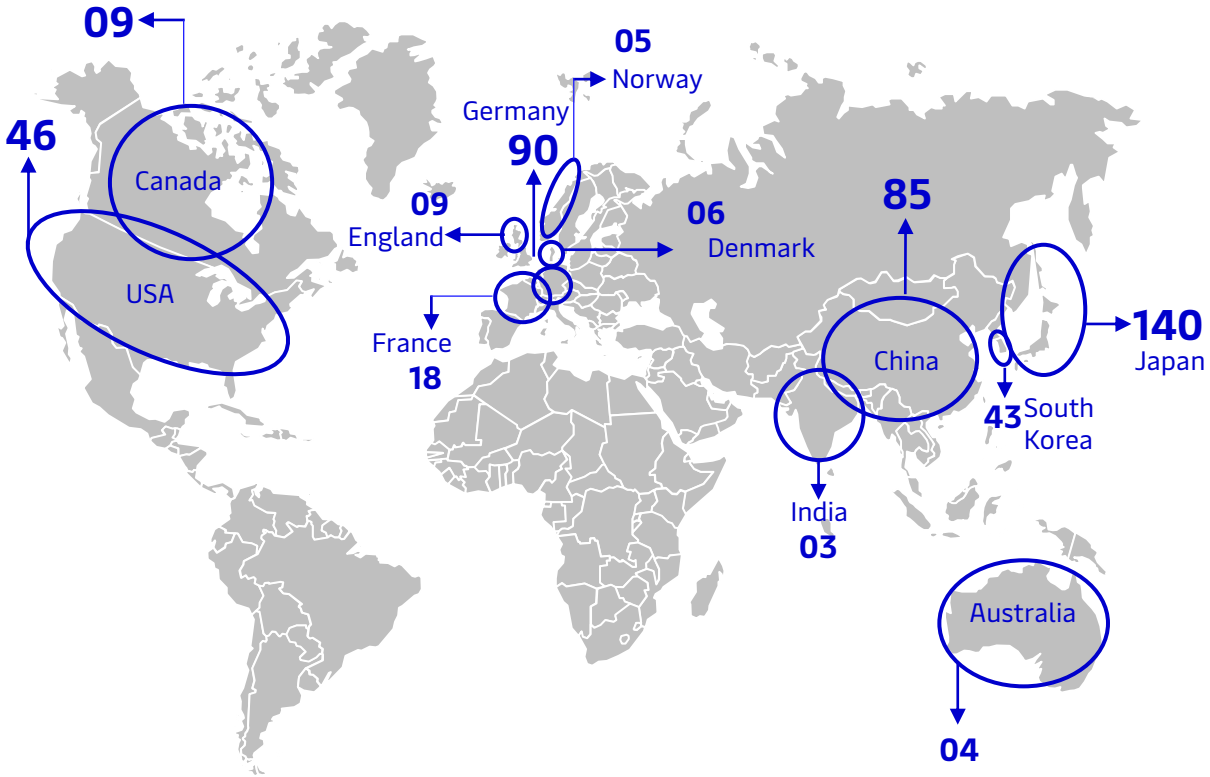
Source: Eninrac research, US Energy Department , Channel Checks

Region wise distribution of hydrogen refuelling stations as of 2021

> 550 Hydrogen Refuelling Station across the Globe as of 2021



Apart from the above indicated hydrogen refuelling stations regions indicated in the map above, few more are indicated below-

01 each in
UAE, Brazil, Costa Rica, Czechia, Italy, Malaysia, Saudi Arabia, Slovenia, Taiwan, Wales, Turkey

03 each in
Iceland, Belgium, Spain

02 in
Scotland

05 each in
Netherland , Austria

04 each in
Sweden, Switzerland

Source: Eninrac research, Hydrogen Council, IEA, Channel Checks

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