Hydrogen Economy Market Opportunity in India & Outlook 2035

Tracking $500+ Billion Investments for H_2 hub transformation of the country

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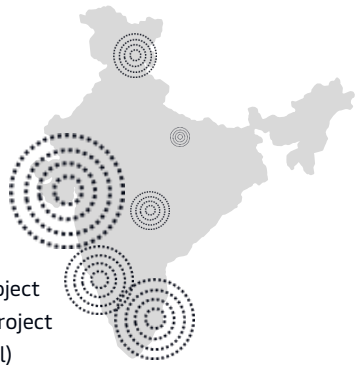
Why assessing opportunity for India to be a hydrogen economy?

Some key aspects for assessment of opportunity in India's transformation to be a 'Hydrogen' based economy could range over fundamentals and could be summarized in following pointers:

- Demand build-up
- Production sources
- Infrastructure as an enabler
- Trade possibilities
- Policy and regulation landscape
- Interests and extent of investors – global and domestic both
- Research and development in H_2 space – private and state-based centers
- Role of hydrogen in India's changing energy landscape & its future
- H_2 to be vital part of net-zero equation quest for India
- Versatility of hydrogen to be adapted under different end-use applications like transport & mobility, industry & power

India is following global footsteps as pedal on large-scale hydrogen projects is high with focus on production, industrial usage, transport & infrastructure

6 announced megawatt-scale projects



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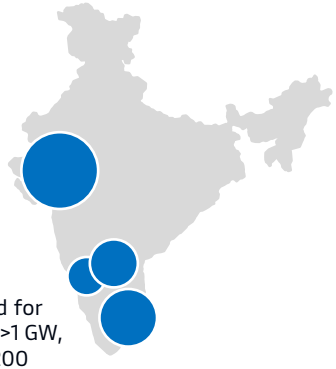
3 H_2 dedicated project

2 NH_3 dedicated project

1 MeOH (Methanol) dedicated project



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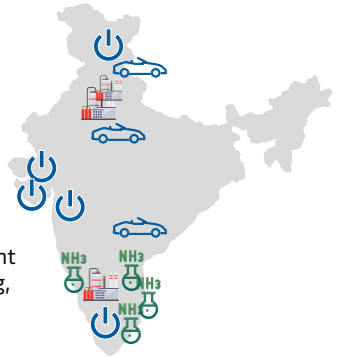
Giga scale projects planned for production REH2 Projects >1 GW, Low-carbon H2 Projects> 200 kilotons per annum



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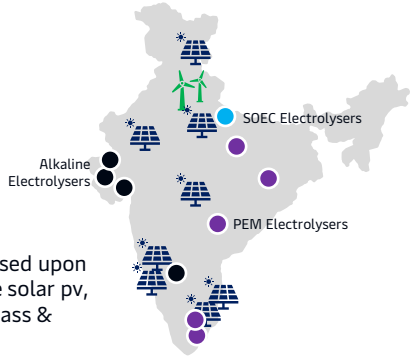
Projects for different end use like refining, power, ammonia, mobility etc. are either under operation or planned to be executed



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Projects shall be based upon renewables and use solar pv, onshore wind, biomass & others etc.

- 5 Green Ammonia planned project
- 8 Power projects using H_2 either planned or under operation
- 4 Mobility projects using H_2 under implementation in India
- 2 Refinery projects under operation & one planned using H_2

Source: eninrac research & EI Project Monitor

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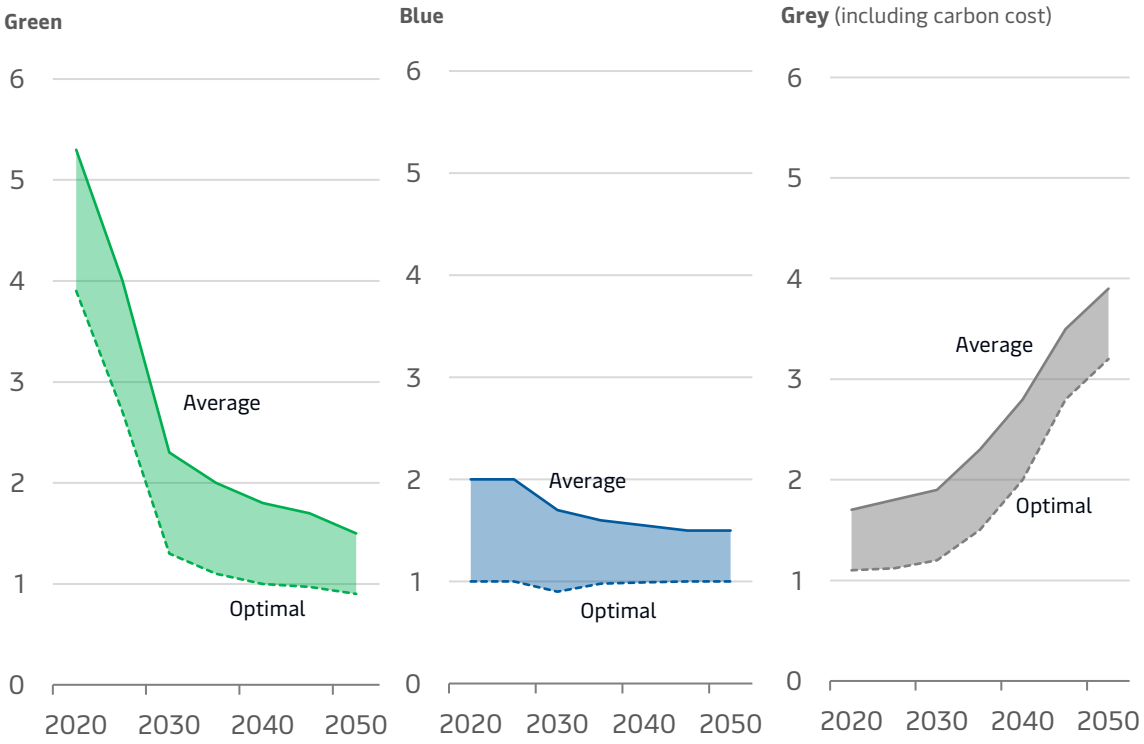
Clean hydrogen can lead to 80 gigatons of CO_2 abatement by 2050, mainly from industrial and transport usage

In India today most of the hydrogen produced is through fossil fuel, also known as grey hydrogen with the quantum approaching 6 MMT. For realizing hydrogen's potential as a contributor for decarbonization in the country shall require a scale up of 5-6 times the current volume at least by FY 29-30. This scale-up also would need a share from green hydrogen as well for which the renewable capacity has to go up and production pathways should see a significant reduction in cost approaching the optimal levels. The road from grey –to- green hydrogen must be traversed via blue hydrogen for a country like India, which also reduces fossil fuel emissions through CCUS (carbon capture, utilization and storage) and shall enable the country reduce the emissions by 50 MMT by 2030. The biggest enabler for this shall be the declining trend of hydrogen costs which if bought to $2 levels/kg basis shall be highly competitive.

India is expected to witness fast decline in clean hydrogen cost by 2035



Source: eninrac research, McKinsey & EI Project Monitor

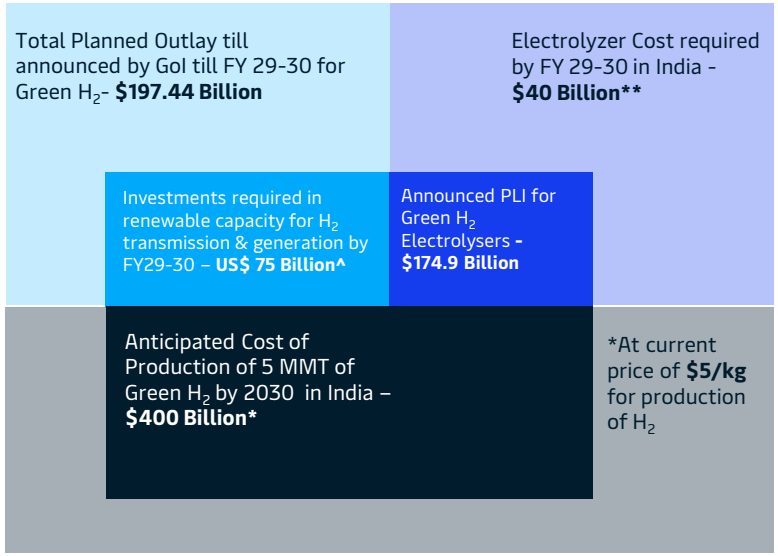
Why India has the potential to transform into a global Hydrogen Hub?

Massive investment roll out anticipated for hydrogen and its ecosystem in India by 2030 for which details are as under:

- ~30 MMT of overall H_2 demand for India
- $175 Billion of PLI scheme for Green H_2 electrolysers
- Additional RE capacity for H_2 transmission and generation tagged at 125 GW
- 100 GW of electrolyzer capacity to be required to fulfil India's green hydrogen aspirations
- Total planned outlay notified by GoI for hydrogen ecosystem is $197 Billion
- ~ 26 MMT of H_2 shall be required as feedstock and fuel for industrial applications involving ammonia, steel and cement production in the country
- 5 MMT of green hydrogen shall be required at an investment of $400 Billion
- Electrolyzer manufacturing in India to go up with many technology tie-ups surfacing like – John Cockerill & Greenko, Cummins & Iberdrola, ITM Power & Linde etc.

Investment in Hydrogen & its development ecosystem is amongst highest in India

Announced & Planned Investment in India's Hydrogen Market until 2030, $ Billion

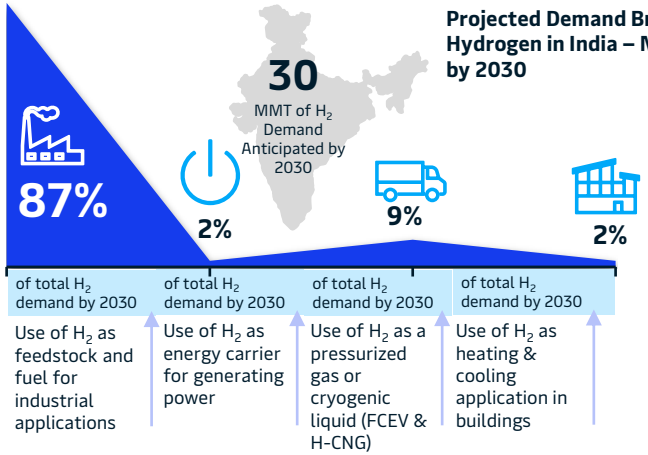


Electrolyzer Cost required by FY 29-30 in India - **$0.40 Bn/GW & at **100 GW** Capacity

^RE dedicated capacity anticipated to be **125GW** by FY 29-30

Anticipated Cost of Production of H_2 by 2030 as per India's Demand - **$2400 Billion***

Projected Demand Break-up of Hydrogen in India – Market Size by 2030



Source: eninrac research, Government Portal & EI Project Monitor

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