

Market Research Report – India, 2021

Hydrogen Market & Opportunity in India

Tracking investment initiatives, cost competitiveness, market movements, distribution & supply chains, hydrogen end use application & implementation roadmap for technologies for transforming India into a green hydrogen global hub & exporter

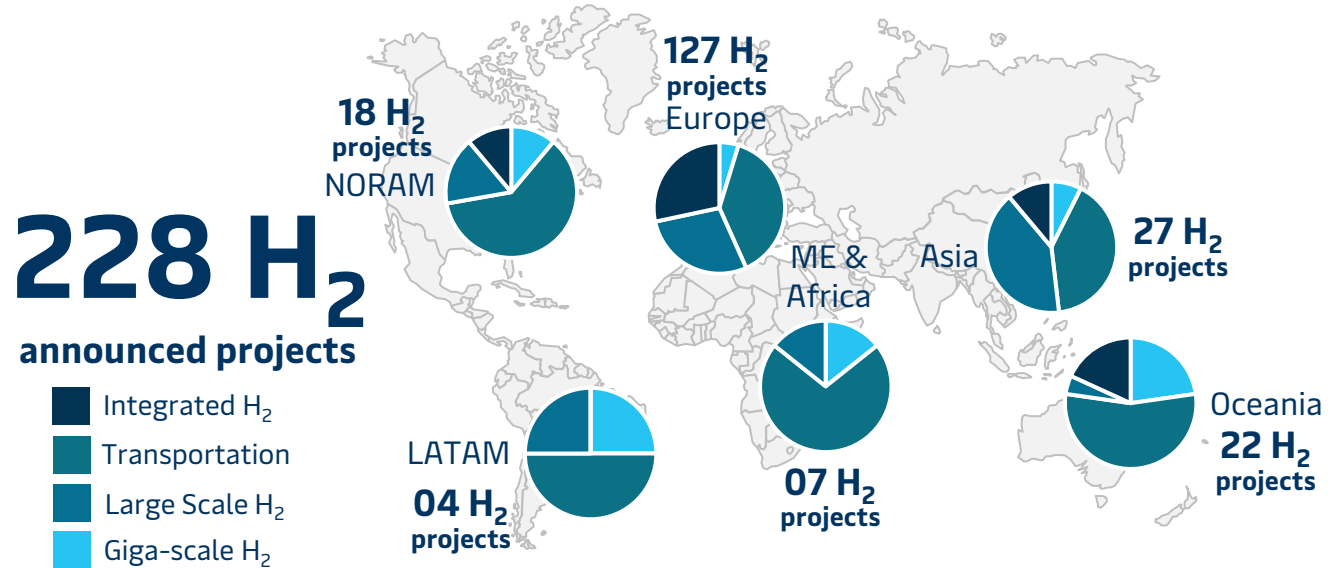
Publishing On: December 2021

Why eninrac's market research on hydrogen market in India, especially in an evolving transportation fuel mix and as cleaner source of energy generation as well across the globe?

Positive market momentum for hydrogen with 200+ projects announced globally – GW scale projects fast catching the pace as well

There has been a great buzz around entire H₂ value chain projects across the globe with around 17 giga-scale production projects (i.e., >1 GW for renewable and over 200 thousand tons per annum of low-carbon hydrogen) already announced. Europe, Asia and Oceania are the leading regions comprising bulk of hydrogen value chain projects. With focus upon greener source of energy generation and reducing carbon emissions in transport projects it is quintessential to look H₂ as a tenable alternative.

Currently, of the total projects close to 55% are housed in Europe. However, the demand centers are spread well across not only in Europe but also in countries like that of Japan and South Korea. The focus for Asian countries lie upon the road transportation applications, green ammonia, LH₂ & LOHC projects, while Europe seems to have championed multiple integrated hydrogen economy projects. The major driver has been the development in cross industry and policy co-operation from which India can draw a leaf in order to build an even environment for H₂ development in the country.



17 Projects

Giga-scale production: Renewable H₂ projects >1GW and low-carbon H₂ projects >200 kt p.a.

90 Projects

Large scale projects: Industrial usage like refinery, ammonia, power, methanol, steel & industry feedstock

53 Projects

Transport projects: Trains, ships, trucks, cars & other hydrogen-based mobility applications

45 Projects

Integrated H₂: integrated H₂ economy, cross-industry and projects with different types of end-uses

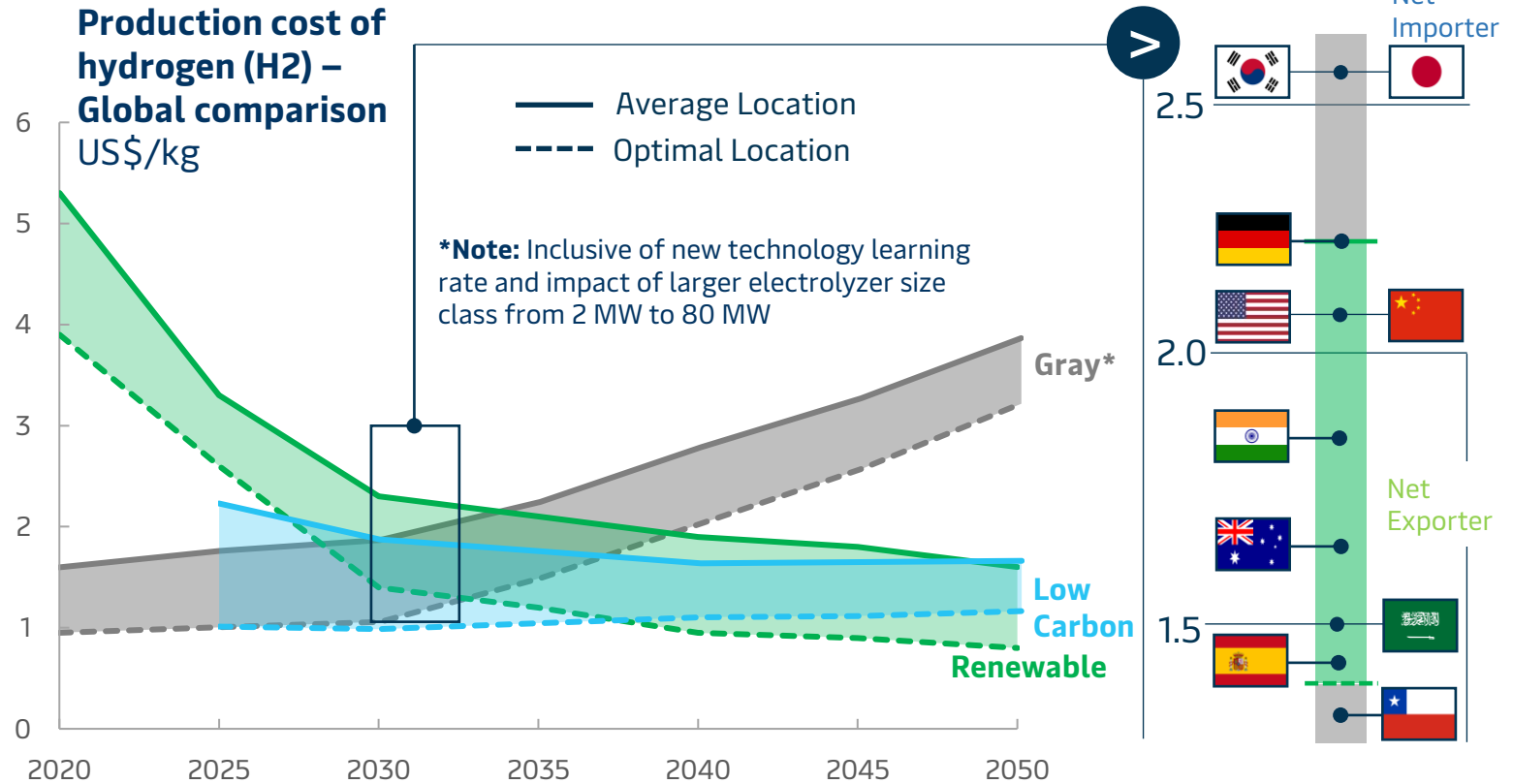
23 Projects

Infrastructure projects: H₂ distribution, transportation, conversion and storage projects distributed across globe with major share in Europe only.

Why green H₂ is pegged as a game changer in India?

India has been no different when it comes to investments for H₂ from the world in terms of sentiments to say the least. With companies like Reliance, Adani, IOCL and NTPC all geared up with ambitious green H₂ plans, India certainly looks poised for a carbon free transition. Also, with National Hydrogen Mission the country aims to become the largest exporter and producer of green H₂. Strategic collaborations, massive technological investments and ideal policy & regulatory interface for Indian firms is shaping the green H₂ market in the country to acquire a fast pace by 2025. This shall be inline with projections that by 2050, 3/4th of all the hydrogen produced shall be green produced by renewable energy and electrolysis.

For India, the scene shall be dominated by low-cost renewable projects like solar PV electrolysis or wind-based electrolysis could see the green hydrogen cost as low as \$1.5/kg to \$2.3/kg which shall increase the competitiveness by 2030, respectively. Thus, India shall be the destination next for global investments for green hydrogen projects .



Source: Eninrac research, National H₂ Mission, McKinsey & Channel Checks

Very good chance of green hydrogen to break even with gray hydrogen in India by 2030 – India might see a break-even for green and gray hydrogen as early as 2030 driven by primarily three factors –

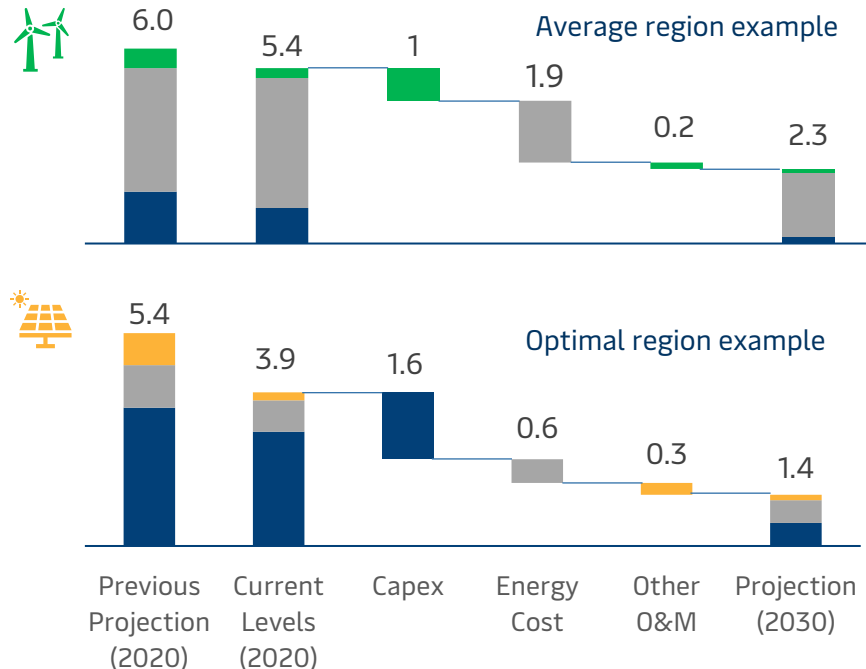
- Falling Capex for electrolyzer
- LCOE for renewable power generation is on continuous decline
- Globally larger capacity utilization for RE based H₂ projects are witnessed

Key Assumptions –

- Gas price \$2.6 – 7/Mmbtu
- Cost of CO₂/Ton in US\$ - \$30 (2020), \$50 (2030), \$150 (2040) & \$300 (2050)
- LCOE ₹1.90 - ₹5.50/kWh (2020), ₹1.00- ₹2.90/kWh (2030) & ₹0.50-₹1.90/kWh

What shall shape the lower cost for green hydrogen in India and transform its competitiveness for the country?

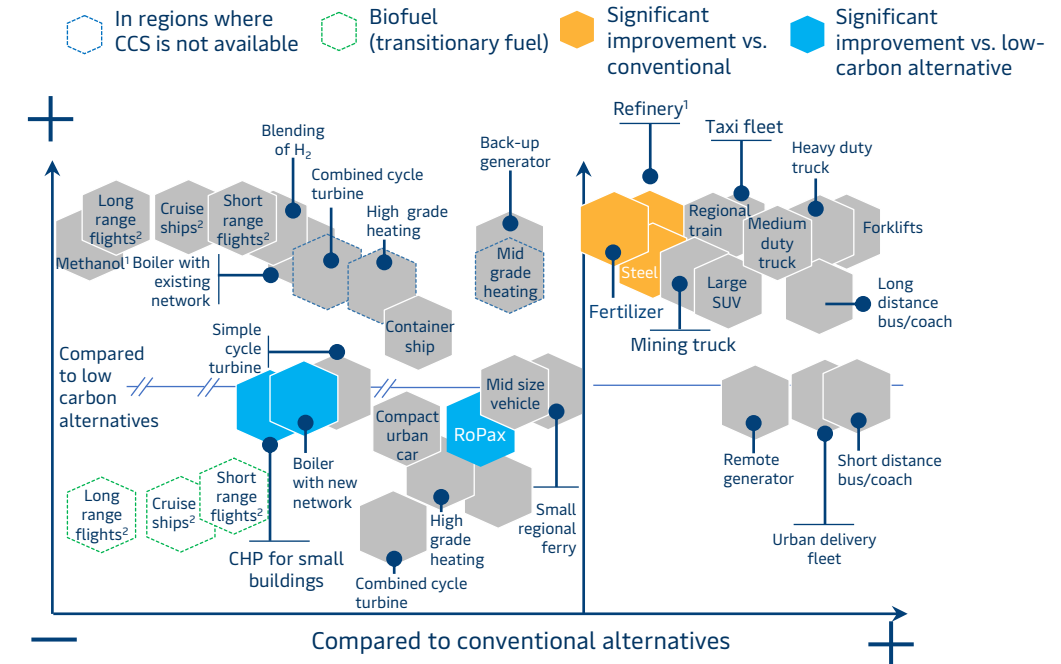
Wind & solar based hydrogen production cost trajectory – Global benchmarks & India (US\$)



Source: Eninrac research & analysis, National H₂ Mission, & Channel checks

With the emergence of demand centers in Asia that shall be dominated by China, Japan & South Korea, India can certainly integrate its renewable capacity built up for both solar PV and wind to generate green hydrogen in bulk and transform it to a net exporter. Having said so, the challenge to be addressed for Indian market to flourish for green hydrogen shall be two layered. First, being the distribution of hydrogen resources and its associated infrastructure. Following this the orientation of end use industries adapting green hydrogen coupled with cost competitiveness available with green hydrogen shall pose a challenge as well.

H₂ competitiveness as per end use application – India & World – 2030 projections



1. Clean H₂ is the only alternative
2. Carbon break-even cost represents average cost over lifetime of asset

Source: Eninrac research & analysis, McKinsey & Channel Checks

The juncture at which India stands as of now for H₂ trajectory thus calls for an in-depth market research covering all the bases of business & dynamics around it. Therefore, as global market research & consultancy eninrac is producing a market research report encompassing business case, current hydrogen market size along with location fitment analysis as well. Consecutively, the report shall also cover cost competitiveness for producing H₂ in India aligned with the objective of being a net exporter. Also, the dossier shall address the adaptability index of H₂ for end application with entire depth & breadth of end use industries.



Key Signpost – The hydrogen market in India can potentially develop at a brisk pace, provided the ecosystem of production, distribution and end use application must be aligned with investments

For India to be a flourishing market for hydrogen the prelude is set and rolling, however the pathways will not be an easy grind. While intent of many big conglomerates and even international players to invest big in H₂ market of India is seen a major driver, it doesn't come with cost competitiveness' guarantee which indeed shall be holding the key to unlock efficient distribution & transmission of H₂ for end use application. Players involved in infrastructure creation for transmission of other forms of energy including electricity and gas must be coherent with idea of distribution of hydrogen for long term as it would be around one-eighth time cheaper while transmitting 10 times the energy content. In the short-to medium-term, the most competitive setup for large-scale clean hydrogen applications involves co-locating hydrogen production on- or near-site. The industry can then use this scaled production to supply the fuel to other hydrogen users in the vicinity, such as refueling stations for trucks and trains, and smaller industrial users.

Prima facie lack of credible market information is another challenge poised to be addressed and at eninrac our focus is to aim for studying the markets which are multi-layered and have challenges for each core segment of market be it input, process or output. Therefore, we are channelizing our resources to deliver an industry first dossier of its kind for hydrogen market in India which covers cost breakdown analysis for production, shipping & distribution, end use application for both domestic and international markets couple with key demand drivers.



What's our difference margin for market research?



1 Our Market Research Coverage Range

- Assessing business case of Hydrogen in India
- Hydrogen market location fitment analysis in India
- Evaluating cost competitiveness of Hydrogen production in India
- Pricing of Hydrogen in India – Scenario based estimation – D2I Model
- Identification of key demand centers of Hydrogen in India



2 Our Market Research DNA & Team of Domain Specialists

- We boast a highly qualified and experienced team of market research professionals having experience of working in top companies across different domains
- Our focus on nurturing industry connect is paramount which helps us generate high quality robust market feed which is filtered and sourced through from different levels
- Any market research report follows strict turn-around-time procedures with cross-vetting from our Knowledge Grid Experts which adds immense value to our research credentials for the deemed subject



MARKET RESPONSE
— eninrac consulting —

3 Our Satisfied Patrons and Retention rate of over 97.6% on yoy basis

We have been bestowed with a phenomenal client retention rate and many satisfied clientele. Our client's have been from wide variety of industry domains and from different geographic locations across the globe. Eninrac consulting is a trusted market research partner and an objective resource augmenting value for more than 327+ group companies & 852+ market research delivered



Contents & Coverage – Hydrogen Market Opportunity in India

01 Assessing business case of hydrogen in India

This section shall cover global development & market momentum of hydrogen, along with evaluation of hydrogen ecosystem in India. Further, private sector investments for hydrogen development in India will also be tracked

04 Hydrogen market location fitment analysis in India

This section shall cover assessment of solar PV, wind, and natural gas resources for renewable hydrogen production. Also, market vicinity for hydrogen transportation development shall also be covered

07 Understanding cost competitiveness of hydrogen for application in India

Assessing cost competitiveness of hydrogen for application in India as per end use, time frame (2025, 2030) and global benchmarks – total cost of ownership (TCO) perspective

10 Risks & challenges for hydrogen market development in India

This section shall cover risks & challenges involved with the hydrogen market development in India under short term, medium term & long term scenarios

13 Hydrogen market trends & outlook 2030 - India

Market outlook shall be tracked till 2030

02 Customer analysis for hydrogen market in India

This section shall analyse the customers for hydrogen in India as per end use applications, as per companies and as per current market standing backed up by primary research (surveys) and CXO's interviews

05 Evaluating cost competitiveness of hydrogen production in India

This section shall cover cost economies involved with the production of hydrogen in India w.r.t. different technologies

08 Hydrogen market competition analysis & benchmarking in India

A detailed competition analysis & company profiling shall be done for the companies venturing/already existing in the market as per their market presence and existing & extended capabilities

11 Pricing of hydrogen in India

A scenario-based (short term, medium term & long term) estimation shall be done based on a D2I model

14 Identification of key demand centers of hydrogen in India

Identification of key demand centers shall be done as per region, end use application, logistics & development of supportive infra index

03 Understanding upstream environment for hydrogen

This section shall cover investment required to realize private sector investments in India also, bottom-up estimation of investments in different technologies shall also be done

06 Analysing shipping costs of hydrogen in & from India

Shipping costs shall be analysed in this section as per distribution & global supply chains and as per distance, terrain and end use

09 Regulations & policy framework examination for hydrogen scale up in India

This section shall involve a holistic view of existing regulations and policy framework involved with the development of hydrogen project in India both at state & central level

12 Scaling up of hydrogen market in India

This section shall involve the type of infrastructure required for scaling up hydrogen market in India

15 Go-to-market (GTM) strategy for market participants

Developing a GTM strategy for technology providers, project developers, end use companies etc.



Key Highlights for Market Research Hydrogen Market in India

1. Assessing business case for hydrogen in India
2. Understanding current hydrogen market size in India
3. Understanding upstream environment for hydrogen – Steps required to realize private sector investments in India
4. Hydrogen market location fitment analysis in India
5. Evaluating cost competitiveness of hydrogen production in India
6. Analyzing shipping costs of hydrogen in & from India
7. Cost comparison pipelines & benchmarks globally
8. Understanding cost competitiveness of hydrogen for end use applications in India
9. Examining regulatory & policy framework w.r.t. hydrogen market in India
10. Risks & challenges for hydrogen market development in India



Differentiating Insights for Market Research on Hydrogen Market in India

1. India as a global hub for hydrogen & exporter – Capability examination and analysing likely demand pockets globally for green hydrogen
2. Analysing & developing hydrogen market's sales strategy for India & exports
3. Devising a Go To Market (GTM) strategy for market participants in India
4. Hydrogen market competition analysis in India
5. Competition analysis of players already present and plans to venture in Indian market
6. Scenario based estimation of pricing strategies for hydrogen in India – D2I model
7. Scaling up hydrogen market in India – key indices identification
8. Identification of key demand centres of hydrogen in India
9. Market trends & outlook for hydrogen in India till 2030
10. Analysing market size & growth drivers for hydrogen in India



Must Buy For

- Wind Project Developers
- Solar Project Developers
- Other RE Developers & OEMs
- Independent Power Producers
- Chemical & Petrochemical Industries
- Liquid hydrogen transport providers
- Port facilitators
- EPC companies
- Logistics companies
- Consulting Agencies
- Government Agencies
- Regulatory Authorities
- Investment Banks
- Funding Bodies



For Queries

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other queries**



Companies Mentioned

- Ballard Power System
- Air Liquide
- Air Products
- Thyssenkrupp
- KBR/Johnson Matthey
- Cummins
- Fuel Cell Energy
- Plug Power
- Bloom Energy
- Linde
- INOX Air
- DCW Limited
- TATA Chemicals
- Boruka Gas
- Air Water
- Grasim Industries
- Reliance Industries Limited
- Adani Enterprises
- Indian Oil Corporation Ltd.
- GAIL (India) Limited



The life of a man consists not in seeing visions and in dreaming dreams, but in active charity and in willing service

- Henry Wadsworth Longfellow

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