

# Evaluation of hydrogen investment ecosystem in India

Part -2 (Hydrogen ecosystem development and identification of key future market growth clusters in India)

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## Evaluating hydrogen investment ecosystem in India

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### **RIL has plans to invest in INR 600 billion to build a 5000-acre green energy complex in Jamnagar, Gujarat**

Hydrogen has been an upcoming sector across the globe with huge industrial applications. Increasing number of companies across the globe are now exploring the green hydrogen. Green hydrogen has been labelled as one of the cleanest forms of energy in the world. It is being looked at as the ultimate solution to achieve net zero emissions. Through the process of electrolysis, all that is needed to produce hydrogen is water, a big electrolyser and electricity. The electric current then splits the water into its two components- hydrogen and oxygen. This means no release of greenhouse emissions since oxygen is the only by product of this process. Additionally, if the electricity used comes from renewable sources, it makes the process completely emission free.

In line with India's ambitious green commitments, Gol aims to transform India into an energy independent nation by 2047 where green hydrogen will play an active role as an alternate fuel to petroleum/ fossil-based products. To keep pace with global companies, National Hydrogen Mission was announced in the Budget FY 2021-22 to produce the hydrogen from green energy sources. The scheme was announced putting Green Hydrogen at the heart of India's energy security and climate change.

Presently, the demand of hydrogen in India hovers around 6 MT per year which is anticipated to reach 28 MT by 2050. The country aims to cater about three-fourth of this demand through green hydrogen produced from renewable resources. Many Indian companies have already started announcing their plans to dip their toes in the green energy sub-sector.

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IOCL has plans to set up a green hydrogen plant at its Mathura Refinery in Uttar Pradesh with a capacity of around 160,000 barrels per day

– IOCL

# L&T and Renew have entered into a partnership to tap the green hydrogen business in India. L&T plans to invest INR 10-15 Billion on its green initiatives

Recently, Reliance has plans to invest in INR 600 billion to build a 5000-acre green energy complex in Jamnagar, Gujarat. The complex will house an electrolyser plant to produce green hydrogen. Larsen and Toubro has also ventured into green hydrogen sector . The company has set an aim to achieve net zero emissions by 2040 and plan to spend INR 10-15 Billion on its green initiatives. In addition to exploring the possibility of manufacturing electrolysers, they are setting up a green hydrogen plant at their Hazira complex, which is scheduled to be completed by March'2022. Establishing India as a global hub for green hydrogen generation, Ohmium International through its subsidiary in India has shipped its first ever unit of electrolyser to the United States. The electrolyser was manufactured in Ohmium's Bengaluru facility which is India's first green hydrogen electrolyser Gigafactory

## Current hydrogen development landscape in India- Key projects

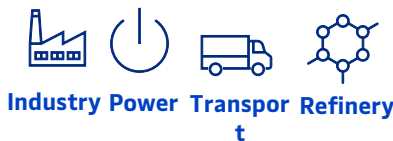
**\$70 Billion**

**Planned investment by Adani till 2030 across renewable energy space and production of cheap hydrogen**

**\$15 Billion**

**Investment required to set up 15 GW green hydrogen electrolyser capacity in India by 2030**

**Industry archetypes focused in India for hydrogen usage**










### Key hydrogen projects of PSUs

Player s	Capacity	Location	Development
GAIL	10 MW	*Vijaipur, Madhya Pradesh	Sites finalization under progress
NTPC	5 MW	Vindhyachal, Uttar Pradesh	EPCC awarded to <b>Technip Energies</b>
IOCL	5000 MTs (installed capacity/ann um)	• Mathura Refinery, Uttar Pradesh	Bids invited
	2000 MTs (installed capacity/ann um)	• Panipat Refinery, Haryana	
BPCL	20 MW	• Madhya Pradesh	Tender to be floated for a 20 MW electrolyser

## Hydrogen Development in India – Participation by private sector



### Key Industry partnerships with global players

Partnership		Country of Origin	Area of Development
Indian Player	International Player		
		Australia	For hydrogen usage in steel making and mobility
	FUSION+FUEL™	Ireland	To develop a demonstrator plant for cost competitiveness
		Norway	To accelerate hydrogen technology development
	Stiesdal	Denmark	To manufacture & set up electrolyzers unit of capacity 2.5 GW
		Italy	Will explore development of industrial projects producing chemicals, ammonia & hydrogen

# Hydrogen Development in India – Participation by private sector (Contd.)



## Key Industry partnerships with global players



## Key Industry partnerships of domestic players

Partnership		Country of Origin	Area of Development
Indian Player	International Player		
Greenko	John Cockerill	Belgium	To jointly develop market initiatives for green hydrogen electrolyzers in India
		USA	To set up 1 GW green hydrogen facilities

Partnership	Area of Development
 LARSEN & TOUBRO ReNew POWER	To develop, own and operate green hydrogen projects in India
 IISc Indian Oil Corporation Limited	To develop and demonstrate biomass gasification based hydrogen generation technology for producing fuel cell grade hydrogen at an affordable price

## Government targets and public sector funding for hydrogen

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### **Ministry of Road and Transport has notified that 18% of the hydrogen to be blended with CNG to make HCNG as an automotive fuel**

Presently, more than 100 research groups are focusing on fuel cell technology. There are a number of international and domestic companies in India that are involved in hydrogen production, storage and its distribution- including Praxair (USA), Linde (global member of hydrogen council), Inox (Indo-US joint venture), Air Liquide (France), SAGIM (France), Air Products (USA), Fuel cell energy (USA), H2Scan (USA), ITM Power (UK), Heliocentris (Germany), Aditya Birla Group, Boruka Gases Limited, Gujarat Alkalies and Chemicals Limited, Gujarat Heavy Chemicals Limited, Air Science Technologies and Sukan Engineering Private Limited.

The Ministry of Road Transport and Highways, India has already notified hydrogen fuel cell vehicles in automotive industry standard (AIS) 157. Also, in September 2020, it has notified that 18% of the hydrogen to be blended with CNG to make HCNG as an automotive fuel. Various hydrogen powered vehicles have been developed and demonstrated under projects supported by the Indian government. These include 6 fuel cell buses (by Tata Motors Ltd.), 50 hydrogen enriched CNG (H-CNG) buses in Delhi (by Indian Oil Corporation Ltd. in collaboration with government of NCT of Delhi), 2 hydrogen fuelled internal combustion engine buses (by IIT Delhi in collaboration with Mahindra & Mahindra), 15 hydrogen fuelled 3 wheelers (by IIT Delhi in collaboration with Mahindra & Mahindra), 2 hydrogen –diesel dual fuel cars (by Mahindra & Mahindra) and 1 fuel cell car (by CSIR – National Chemical Laboratory, CSIR-Central Electrochemical Laboratory and CSIR – National Physical Laboratory).

Further, as a part of the pilot project, NTPC may run super- luxury hydrogen buses between Delhi and Jaipur, one of the busiest routes in north India. Initially, a total of 10 buses and 10 cars for Leh and Delhi is expected to be rolled out. In December 2021, Pune based Sentient Labs launched a 32 seater hydrogen fuel cell bus that shall provide a range 450 kilometers by utilising 30 kg of hydrogen. Sentient Labs has designed and developed the hydrogen bus in collaboration with CSIR. Further, there are plans to convert 5 lakh buses from the total of 20 lakh running on roads into fuel cell powered vehicles.

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at [connect@eninrac.com](mailto:connect@eninrac.com)

+91 93190 48963/47963, +91 72900 16953