

ENERGY INDEPENDENCE THROUGH HYDROGEN

Relevant for: Indian Economy | Topic: Infrastructure: Energy incl. Renewable & Non-renewable

Hydrogen could completely transform India's energy ecosystem. | Photo Credit: Getty Images/iStockphoto

India's [Green Hydrogen Policy](#) released on February 17, 2022 has addressed several critical challenges such as open access, waiver of inter-state transmission charges, banking, time-bound clearances, etc., and is expected to further boost India's energy transition.

India's per capita energy consumption is about one-third of the global average and one-twelfth of the U.S. Increasing growth and economic prosperity would significantly increase India's energy appetite furthering import dependence. This, coupled with volatility in prices, as seen during the Russia-Ukraine crisis and the roller-coaster ride of energy prices from historic lows in 2020 to record highs in 2021, could pose a serious threat to our energy security, accentuating an unequivocal need to strive for energy independence. The new age fuel, hydrogen, is touted as India's gateway to energy independence. Hydrogen has a multifaceted role to play in the futuristic energy landscape, be it energy storage, long-haul transport, or decarbonisation of the industrial sector.

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In the long run, two envisioned prominent fuels are hydrogen and electricity. Though both are energy vectors, hydrogen can be stored on a large scale and for a longer duration explicitly affirming its huge potential to become a great balancer to the ever-increasing supply of variable renewable energy. It will complement and accelerate renewables into India's clean energy transition, thereby supporting India's ambitious plan to achieve 500 GW renewable capacity by 2030.

Hydrogen has a major role to play in the decarbonisation of India's transport sector. The advantages of fuel cell vehicles over battery electric vehicles are faster fuelling and long-driving range thereby making them ideal for long-haul transportation which is a major constraint with Li-Ion batteries. In the industrial segment, hydrogen can de-carbonise 'hard-to-abate' sectors such as iron and steel, aluminium, copper etc. It is a huge prospect to produce fuels such as methanol, synthetic kerosene and green ammonia.

India's hydrogen consumption was around 7 Mt in 2020 and according to The Energy and Resources Institute (TERI), it is anticipated to leapfrog to about 28 Mt in 2050. Assuming 25% export capacity, we can expect a requirement of 35 Mt by 2050. On the basis of this assumption, we can calculate that India would require a tentative capacity in the range of 192 GW to 224 GW of electrolyzers by 2050, assuming all of it is green hydrogen. The global capacity of electrolyzers has just crossed 300 MW in 2021. This signifies that India itself would require an electrolyser capacity of 640 to 750 times the current global capacity, by 2050.

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This would entail an exponential increase in electricity demand of around 1,500 to 1,800 TWh, implying that just for hydrogen production; India would require 110-130% of its current total electricity generation (2020-21) by 2050. Therefore, a road map for rapid growth in demand for electricity, especially from renewables should be prepared.

Apart from the ever-increasing electricity demand, the high cost of hydrogen manufacturing and water scarcity could also pose a challenge. Production of 1 kg of hydrogen by electrolysis requires around nine litres of water. Therefore, hydrogen project planning should be holistic and targeted in areas that are not water-scarce.

Creating a hydrogen economy is a chicken and egg problem as consumers seek lower costs which could be possible with scalability and large investments, but for those, producers seek assured demand. Hydrogen fulfils the three Es of India's energy road map — energy security, energy sustainability and energy access — and India should strive to seize one more E, viz. economic opportunity so that industry can be encouraged to its full potential.

On the demand side, a five-step strategy should be devised. Firstly, to create an initial demand, a mandate should be given to mature industries such as refining and fertilisers, with adequate incentives. Secondly, industries manufacturing low emission hydrogen-based products inter alia green steel and green cement need to be incentivised by government policies. Thirdly, blending hydrogen with natural gas can act as a big booster shot which can be facilitated by framing blending mandates, regulations and promoting H-CNG stations. Further, to promote FCEVs, hydrogen fuel stations may be planned on dedicated corridors where long-distance trucking is widespread. Lastly, the concept of carbon tariffs needs to be introduced on the lines of European countries.

On the supply side too, a five-step strategy should be devised. Firstly, investment in R&D should be accelerated to bring its cost at par with fossils. Secondly, Sustainable Alternative Towards Affordable Transportation (SATAT) scheme with a target to produce 15 MMT of compressed biogas could be leveraged by exploring biogas conversion into hydrogen. Thirdly, to commercialise and scale-up nascent technologies, a Viability Gap Funding (VGF) scheme may be introduced for hydrogen-based projects. Further, to secure affordable financing, electrolyser manufacturing and hydrogen projects need to be brought under Priority Sector Lending (PSL). Lastly, since two dominant cost factors for green hydrogen are renewable energy tariffs & electrolyser costs, and India has the advantage of one of the lowest renewable tariffs; the thrust should be on reducing the cost of electrolysers by implementing the Production Linked Incentive (PLI) scheme. This could help India become a global hub for electrolyser manufacturing and green hydrogen.

On the transportation front, ammonia, having high energy density could be promoted as a mode of transportation. A hydrogen transportation system could also be built on the foundation created for natural gas by using its existing infrastructure. Additionally, hydrogen transportation projects may be integrated with PM Gati Shakti Master Plan.

Hydrogen could completely transform India's energy ecosystem by shifting its trajectory from an energy importer to a dominant exporter over the next few decades. India could export to projected future import centres like Japan, South Korea, etc.

With hydrogen, India could lead the world in achieving Paris Agreement's goal to limit global warming to 2°C compared to pre-industrial levels. Hydrogen could lay the foundation of a new India which would be energy-independent; a global climate leader and international energy power. In COP 26, Prime Minister Narendra Modi had given a clarion call of *panchamrit* (five goals), with an ambitious target to achieve Net Zero by 2070. Hydrogen will certainly play a decisive role in India's Net Zero ambition and in making India 'Aatmanirbhar in energy'.

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