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NATIONAL GREEN HYDROGEN MISSION

"Of every effort being made by India today, the thing that is going to help India with a quantum leap in terms of climate is the field of Green Hydrogen. To achieve the goal of Green Hydrogen, I am announcing the National Hydrogen Mission today with this tricolour as a witness."

-Prime Minister Sh. Narendra Modi

(75th Independence Day address from the Red Fort, 15 August 2021)

India is undertaking a resolute march towards a sustainable energy future. In line with announcement made by Hon'ble Prime Minister at COP26, India is committed to achieve 500 GW of installed electricity capacity from non-fossil fuel sources by 2030.The thrust towards a low-carbon economy currently hinges on an accelerated transition towards a higher share of renewables in the electricity grid complemented by electrification of end uses such as transportation[1].

The Union Cabinet approved National Green Hydrogen Mission on 04 January 2023. The Mission will result in the following **likely outcomes** by 2030:

- Development of green hydrogen production capacity of at least 5 MMT (Million Metric Tonne) per annum with an associated renewable energy capacity addition of about 125 GW in the country;

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[1] https://www.niti.gov.in/sites/default/files/2022-06/Harnessing_Green_Hydrogen_V21_DIGITAL_29062022.pdf

- Over Rs. Eight lakh crore in total investments;
- Creation of over Six lakh jobs;
- Cumulative reduction in fossil fuel imports over Rs. One lakh crore; and
- Abatement of nearly 50 MMT of annual greenhouse gas emissions.

Initial outlay for the Mission is **Rs.19,744 crore**, which includes:

- Rs.17,490 crore for the Strategic Interventions for Green Hydrogen Transition Programme (SIGHT) programme;
- Rs.1,466 crore for pilot projects;
- Rs.400 crore for R&D; and
- Rs. 388 crore towards other Mission components.

The Mission will have wide ranging **benefits**-

- Creation of export opportunities for Green Hydrogen and its derivatives;
- Decarbonisation of industrial, mobility and energy sectors; reduction in dependence on imported fossil fuels and feedstock;
- Development of indigenous manufacturing capabilities;
- Creation of employment opportunities; and
- Development of cutting-edge technologies.

The Mission will facilitate demand creation, production, utilization and export of Green Hydrogen.

Under the Strategic Interventions for Green Hydrogen Transition Programme **(SIGHT)**, two distinct financial incentive mechanisms will be provided under the Mission which are[2]:

- Targeting domestic manufacturing of electrolysers; and
- Production of Green Hydrogen.

Hydrogen Energy:

Hydrogen is emerging as an important source of energy since it has zero carbon content and is a non-polluting source of energy in contrast to hydrocarbons that have net carbon content in the range of 75–85 per cent. As per International Renewable Energy Agency (IRENA), Hydrogen shall make up six per cent of total energy consumption by 2050. The Hydrogen Council Report, 2021 also mentions that, global investments on hydrogen will constitute around 1.4 per cent of the total global energy funding by 2030.

[2] https://pib.gov.in/PressReleasePage.aspx?PRID=1888547

The current global demand for hydrogen is 70 million metric tons per year, more than 76 per cent of which is being produced from natural gas, 23 per cent comes from coal and the remaining is produced from electrolysis of water[3].

> The Green Hydrogen Mission aims to make India a Global Hub for production, utilization and export of Green Hydrogen and its derivatives and will help in India becoming energy independentand in Decarbonisation of major sectors of the economy.

Policy Framework

Hydrogen and Ammonia are envisaged to be the future fuels to replace fossil fuels. Production of these fuels by using power from renewable energy, termed as green hydrogen and green ammonia, is one of the major requirements towards environmentally sustainable energy security of the nation.

The policy provides as follows:

- Green Hydrogen / Ammonia manufacturers may purchase renewable power from the power exchange or set up renewable energy capacity themselves or through any other, developer, anywhere.
- Open access will be granted within 15 days of receipt of application.
- The Green Hydrogen / Ammonia manufacturer can bank his unconsumed renewable power, up to 30 days, with distribution company and take it back when required.
- Distribution licensees can also procure and supply Renewable Energy to the manufacturers of Green Hydrogen / Green Ammonia in their States at concessional prices which will only include the cost of procurement, wheeling charges and a small margin as determined by the State Commission.
- Waiver of inter-state transmission charges for a period of 25 years will be allowed to the manufacturers of Green Hydrogen and Green Ammonia for the projects commissioned before 30th June 2025.
- The manufacturers of Green Hydrogen / Ammonia and the renewable energy plant shall be given connectivity to the grid on priority basis to avoid any procedural delays.
- The benefit of Renewable Purchase Obligation (RPO) will be granted incentive to the hydrogen/Ammonia manufacturer and the Distribution licensee for consumption of renewable power.
- To ensure ease of doing business a single portal for carrying out all the activities including statutory clearances in a time bound manner will be set up by MNRE.

[3] https://static.pib.gov.in/WriteReadData/specificdocs/documents/2022/mar/doc202232127201.pdf

- Connectivity, at the generation end and the Green Hydrogen / Green Ammonia manufacturing end, to the ISTS for Renewable Energy capacity set up for the purpose of manufacturing Green Hydrogen / Green Ammonia shall be granted on priority.
- Manufacturers of Green Hydrogen / Green Ammonia shall be allowed to set up bunkers near Ports for storage of Green Ammonia for export / use by shipping. The land for the storage for this purpose shall be provided by the respective Port Authorities at applicable charges[4].

An enabling policy framework will be developed to support establishment of Green Hydrogen ecosystem. A robust Standards and Regulations framework will be also developed. Further, a public-private partnership framework for R&D (Strategic Hydrogen Innovation Partnership – SHIP) will be facilitated under the Mission; R&D projects will be goal-oriented, time bound, and suitably scaled up to develop globally competitive technologies. A coordinated skill development programme will also be undertaken under the Mission[5].

India's Progress towards Green Hydrogen[6]: 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.

- In 2020, India's hydrogen demand stood at 6 million tonnes (MT) per year. It is estimated that by 2030, the hydrogen costs will be down by 50 per cent.
- The demand for hydrogen is expected to see a five-fold jump to 28 MT by 2050 where 80 per cent of the demand is expected to be green in nature.
- Some of the prominent industrial mammoths such as Reliance Industries Limited (RIL), Gas Authority of India Limited (GAIL), National Thermal Power Corporation (NTPC), Indian Oil Corporation (IOC) and Larsen and Toubro (L&T) plan to foray into the green hydrogen space. RIL plans to become a net-carbon zero firm by 2035 and invest nearly INR 750 billion over the next three years in RE.
- India has declared its ambition to become an exporter of hydrogen to Japan, South Korea, and Europe. Various hydrogen powered vehicles have been developed and demonstrated under projects supported by Government of India. These include 6 Cell buses by Tata Motors Ltd., 50 hydrogen enriched CNG (H-CNG) buses in Delhi by Indian Oil Corporation Ltd. in collaboration with Govt. of NCT of Delhi, 2 hydrogen fueled Internal Combustion Engine buses (by IIT Delhi in collaboration with Mahindra & Mahindra).

Challenges[7]

[4] **https://pib.gov.in/PressReleasePage.aspx?PRID=1799067**
[5] https://pib.gov.in/PressReleasePage.aspx?PRID=1888547
[6] https://static.pib.gov.in/WriteReadData/specificdocs/documents/2022/mar/doc202232127201.pdf
[7] **https://www.niti.gov.in/sites/default/files/2022-06/Harnessing_Green_Hydrogen_V21_DIGITAL_29062022.pdf**

Disparity in sources and consumption of green hydrogen is bound to create markets for green hydrogen as a tradeable energy commodity in the long term, albeit with challenges.

Significant challenges for the emergence of a hydrogen economy need to be addressed to enable this hydrogen transition. Costs of production are currently higher, making all green hydrogen-based products more expensive than fossil fuel-based alternatives. Transporting and storing hydrogen are costly, and significant build-out of infrastructure is required to bring down the costs of delivered hydrogen. Regulations and standards are still not clear, and financing remains a big challenge. Decreasing renewable prices and economies of scale promise to make green hydrogen economical going forward.

International Scenario[8]

There is also an increased consensus around the world that concerted steps need to be taken to reduce global warming to levels less than 2°C and if possible to cap it at 1.5°C higher than pre-industrial levels. Various countries have pledged their Nationally Determined Contributions to ensure energy transition and reduce emissions.

To provide clear long-term investment signals in green hydrogen, a number of countries have begun to address these challenges strategically:

Japan - Japan became one of the first countries to roll out a basic hydrogen strategy in 2017, which seeks to achieve cost parity with competing fuels, such as liquefied natural gas for power generation. It has also set out concrete cost and efficiency targets per application, targeting electrolyzer costs of $475/kW, efficiency of 70% or 4.3 kWh/Nm ^{3}, and a production cost of $3.30/kg by 2030.

South Korea - In January 2019, South Korea announced its Hydrogen Economy Roadmap, which outlines a goal of producing 6.2 million fuel cell electric vehicles, rolling out at least 1,200 refilling stations by 2040, and supplying 15 GW of fuel cells for power generation by 2040.

Australia - Established in November 2019, Australia's national hydrogen strategy launched the "H2 under 2" target, which sets a production cost of below AU$2/kg of hydrogen.

Netherlands - In April 2020, the Dutch government noted that a completely sustainable energy supply in 2050 requires that at least 30% and up to 50% of final energy consumption be via gaseous energy carriers, such as biogas and hydrogen.

Norway - Unveiled in June 2020, Norway's strategy seeks to expand the use of hydrogen as an energy carrier in the maritime sector.

Germany - In June 2020, Germany rolled out a national hydrogen strategy that eyes a 200-fold increase in electrolyzer capacity—of up to 5 GW by 2030.

[8] https://www.powermag.com/countries-roll-out-green-hydrogen-strategies-electrolyzer-targets/

European Union - A hydrogen strategy published in July 2020 sets explicit electrolyzer capacity targets of 6 GW by 2024 and 40 GW by 2030, as well as production targets of 1 million and 10 million tonnes of renewable hydrogen per year for those two milestone years.

France - A September 2020 national hydrogen strategy provides an investment of €7.2 billion by 2030 and a hydrogen production capacity target of 6.5 GW by 2030. About €1.5 billion will be spent on construction of electrolysis plants.

Spain - Issued in October 2020, Spain's hydrogen strategy foresees installations of 4 GW of electrolyzer capacity by 2030, with near term goals of at least 300 MW to 600 MW by 2024.

Chile - Chile launched its national strategy in November 2020, seeking to become the world's cheapest green hydrogen producer and a leading exporter by the 2030s. Its strategy sets a target of 25 GW by 2030 with a remarkable hydrogen production cost of less than $1.50/kg.

Canada - Launched in December 2020, Canada's hydrogen strategy anticipates that by 2050 hydrogen will deliver up to 30% of Canada's end-use energy.

Conclusion

India is at a crucial juncture in terms of its energy landscape and green hydrogen has a critical role to play to make the nation self-reliant and energy-independent. This transition can be synergistic with the scale, ambition, and economic competitiveness of its renewable industry. Unlike fossil fuels which have resource and geography constraints, green hydrogen can be produced anywhere in India as it is blessed with the ample renewable potential. This will enable the emergence of an energy carrier that is domestically produced, reducing the dependence on imports for key energy commodities like natural gas and petroleum. Hydrogen can be an energy molecule that is truly 'made-in-India' and that can contribute to the country's energy security and long-term economic competitiveness[9].

[9] https://www.niti.gov.in/sites/default/files/2022-06/Harnessing_Green_Hydrogen_V21_DIGITAL_29062022.pdf