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Green Hydrogen: India's Sustainable Fuel of Future

PRAMOD MALLUR¹

ABSTRACT

The world aims to counter the problem of pollution. Biggest cause of pollution is use of non- renewable sources. So, efforts are being made at international level like Paris Agreement where the countries aim to reduce the pollution and tackle the climate change. One of the emerging proposals is use of Green Hydrogen as an alternate fuel. Hydrogen being abundantly available, can be a sustainable fuel for future. For the first time, Indian Union Budget has announced the scheme for Hydrogen which will promote it across the country. This article attempts to portray the benefits, future challenges and opportunities of Green Hydrogen in India.

I. INTRODUCTION

The countries across the globe have aimed at decarbonising the planet. So, countries have boosted production of power from Renewable sources and also have promoted the use of environment friendly technology like Electric Vehicles and use of Hydrogen. Hydrogen being a carbon-free fuel, can be considered as one of key sources of clean energy for the future. This Fuel can be produced by steam reforming of natural gas or electrolysis of water from the sources like biomass, nuclear power and Renewable sources. It is imperative to note that it is not the production of hydrogen that is challenging, but the production of green hydrogen. The usage of Green Hydrogen will assist India to achieve its targets under the Paris Agreement and also reduce the dependency on import of fossil fuels. As per the report of Council of Energy, Environment and Water, the demand of green hydrogen in India can be around 1 million tonnes by 2030.

This article predominantly resonates the scope and future of green hydrogen in India.

Types of Hydrogen

1. Brown Hydrogen: This hydrogen is produced with the help of coal and massive amount of CO₂ is released to air.

¹ Author is a student at Karnataka State Law University's Law School, India

2. Grey Hydrogen: This hydrogen is produced with help of Natural gas and the emission is released to air.
3. Blue Hydrogen: This Hydrogen is produced by steam methane reforming with CCS and very less emission is released to air.
4. Green Hydrogen: This Hydrogen is produced by electrolysis of renewable sources and the emission is close to nil.

II. HOW IS GREEN HYDROGEN PRODUCED?

Hydrogen is abundantly available in atmosphere, but the biggest problem is that it is not in its pure form and can't be used directly. So, some kind of energy is required to break it down and make it fit to use.

The most common technique is splitting water molecule into hydrogen and oxygen, but this requires use of heat and chemicals from fossil fuels or natural gas which emit a lot of greenhouse gases to atmosphere.

But, a cleaner and environment friendly approach can be adopted by splitting water into hydrogen with help of electrolysis. Electrolysis is a process of passing a strong Electrical current through water and splitting it into hydrogen and oxygen molecules. If this electrolysis is done by using electricity from renewable sources like solar or wind then it is called as 'Green Hydrogen' and it no greenhouse gas is emitted and thereby ensuring Ecological Security.

III. BENEFITS OF GREEN HYDROGEN

Green hydrogen is a "versatile energy carrier" and it has diverse range of applications. It is upcoming sustainable source of fuel as it can be transported through pipelines as well as road transport sector like trucks, aviation, shipping, etc. and also it can be stored in storage units². It can be used in industries like steel industry, chemical industry, refineries. Most important application of it is for heating and power generation.

Green Hydrogen can be used with fuel cells to power things electric vehicles and electric appliances. Hydrogen fuel cells are more efficient than engines run by gas or petrol.

IV. GLOBAL SCENARIO

The Globe is moving towards adopting green hydrogen as sustainable source of fuel. The US

² : IRENA (2020), *Green Hydrogen: A guide to policy making*, International Renewable Energy Agency, Abu Dhabi

President Biden has promised to produce green hydrogen which eliminates use of fossil fuel. So, the Department of Energy has put \$100 Million into R&D of Hydrogen and fuel cells.

The European Union is investing \$430 billion in production and R&D of Green Hydrogen to achieve its target of its Green Deal by 2030³.

Saudi Arabia is constructing a \$500 billion-dollar new city in the Desert on Red Sea called Neom. The energy product which will be used to power the city will be pure Green Hydrogen. So, a plant of capacity 4 GW from wind and solar is set up on the deserts and many more in the process of installation⁴.

In Japan, one of world's largest green hydrogen plant is installed near Fukushima. This plant will be used to power fuel cells for automobiles and stationary sites.

Australia also has proposed to build Asian Renewable Energy Hub in Pilbara that will use 1,743 wind turbines and 30 sq. miles of solar panels to run 26 GW Electrolysis factory to produce Green Hydrogen.⁵

V. INDIAN SCENARIO

India is committed to rapid expansion of the Hydrogen economy, ensuring the cost-effective deployment of low carbon hydrogen technologies across the transport sector, industry and power sector by 2030. Hydrogen demand can be increased by 5 times by 2050. Currently around 5Mt per annum is required mostly by industries of refiners and fertilizers, but the demand will be 28Mt per annum and around 80% will be produced by renewable sources.⁶

Delhi became the first state in India to run the buses with Hydrogen – enriched CNG. Likewise, several companies like Indian Oil Corporation and NTPC are working with regards to run more hydrogen-based buses in India.

India has a huge potential for Green Hydrogen due its favourable geographic conditions and presence of natural elements in enormous quantity. India aims to meet its commitment of Paris Agreement to achieve 40% of its total Electricity to be generated by Renewable Energy. So, India has launched various National Policies like National Solar Mission, Solar Wind Hybrid Policy, etc., to boost the production of Electricity through Renewable Source of Energy and thereby providing a way to boost production of Green Hydrogen in India.

³ Renee Cho, *Why do we need Green Hydrogen*, Columbia Climate School (May 20, 2021, 16.22), <https://news.climate.columbia.edu/2021/01/07/need-green-hydrogen/>.

⁴ Jim Robbins, *Green Hydrogen: Could it be key to a Carbon-Free Economy?*, Yale Environment 360 (May 20, 2021, 17.24), <https://e360.yale.edu/features/green-hydrogen-could-it-be-key-to-a-carbon-free-economy>.

⁵ *Id.*

⁶ Hall, W., Spencer, T., Renjith, G., and Dayal, S. 2020. *The Potential Role of Hydrogen in India: A pathway for scaling-up low carbon hydrogen across the economy*. New Delhi: The Energy and Resources Institute (TERI).

In the Union Budget of 2021-2022, the Central Government announced the launch of National Hydrogen Energy Mission (NHM) which aims at utilisation of hydrogen as a energy source.

Key features of National Hydrogen Energy Mission:

- To focus on the generation of Hydrogen from Renewable sources of Energy.
- To link India's growing renewable capacity with the Hydrogen Economy.
- To help India achieve its goal of production of 175 GW of Electricity through Renewable Energy, the Union Budget of 2021-2022 has allocate Rs. 1500 Crores for Renewable Energy development and NHM.

It will be very interesting to look out for future policies and the steps that will be taken by the Government to promote and boost the production of Green Hydrogen.

VI. CHALLENGES AND OPPORTUNITIES OF GREEN HYDROGEN IN INDIA

The Indian Government should formulate a comprehensive policy and Law with regards to Green Hydrogen and make it mandatory to blend a percentage of green hydrogen in existing industrial and automobile fuels. The Policy should provide a friendly environment for the investors and provide them with incentives.

Enormous Financing is prerequisite to set up required infrastructure that consists of hydrogen delivery network, storage and transport network and the refuelling stations. The Production of green hydrogen at one place and transporting it to commercial places for its usage demands huge capital investment.

The fuels cells are fuel-efficient than internal combustion engines, however requires infrastructural development.

Another important challenge will be safety protocol and caution with regards to storage and transport of green hydrogen as it is highly flammable and has low ignition trigger. Likewise, the Green Hydrogen being very light in its weight, it increases the risk of its leakage. So, proper monitoring and regular maintenance of storage and transport units will be mandatory.

At present, the cost of producing hydrogen with help of Renewable sources is more than producing with fossil fuels. So, the biggest challenge will be to cut down the price that will attract the investors to invest in production of green hydrogen.

There should be excess of electricity produced from renewable sources to avoid hinderance in production of hydrogen. So, the target of 450GW of Renewable Energy by 2030 should be

boosted rapidly to meet the hydrogen production needs of the country.

VII. CONCLUSION

Over the years, the hydrogen has remained to be the key source of various industries like refineries and fertilizers. The boosting of green hydrogen will integrate multiple industrial sectors and be a long-term goal which will help in decarbonising the planet.

India soon will join its hands with other nations across the globe to launch the National Hydrogen Energy Mission. The global target of production of Green Hydrogen is 1.45million tonnes by 2030.

If the Challenges in India are tackled in a systematic and efficient manner, then India can be a Green Hydrogen Hub as it possesses huge potential for Renewable energy. It will also help in achieving the targets under Paris Agreement and ensuring clean and pollution free environment. So, Green Hydrogen is definitely the sustainable fuel of future.
