

## New India and Hydrogen World

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### Road map

To achieve net zero emission by 2070, enter in to the hydrogen world is what India is looking for. Recently, the hydrogen production in India is from methane reforming. This produces significant carbon dioxide emissions. Though carbon capture and storage technology (CCS) can reduce such emissions but still in India it is in under developing stage. Mission of Indian government is to mitigate climate targets and making India a green hydrogen hub. The term “Green Hydrogen” is very famous now days in India. Here are some facts and future trends of India towards Green Hydrogen [1-5].



**Figure:** “Future of India towards net zero emission”.

### History & Present [6-9]

- In 1776, British scientist Henry Cavendish was firstly identified hydrogen by reacting zinc metal with HCl.
- In 1800, William Nicolson and Anthony Carlisle decomposed H<sub>2</sub>O in to Hydrogen by electrolysis.
- In 2021, NTPC Renewable Energy Ltd., India setup a fuelling station at Leh Ladakh, which is India’s first green hydrogen fuelling station. The company’s aim to produce green hydrogen by using electricity which produces from renewable energy.

### Hydrogen Economy [10-16]

Hydrogen economy involves two terms 1) hydrogen as a fuel and 2) Hydrogen in fuel cells. Transfer from fossil fuel to green hydrogen is useful for decarbonization economic sectors. Where hydrogen can have benefits from vehicular emission, shipping, aviation heating and utility sectors. A best alternative of fossil fuel is hydrogen fuel, is because it only produces water vapor as a byproduct instead of hazardous greenhouse gases unlike from fossil fuels.

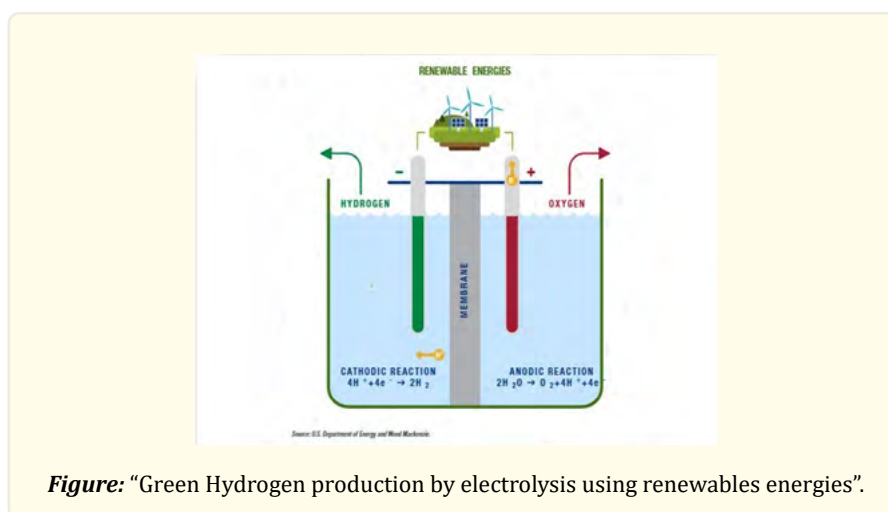
### Future Steps [17-21]

To mitigate the need of climate targets and 2070 commitment, India needs more advanced hydrogen production methodology along with carbon capture and storage system (CCS) facilities. This can be more easily and less time consuming through involvement of renewable energy sources. Hence, economical and easily viable sources of hydrogen can reach to every citizen of India.

The goal to reach 450 GW of renewable energy generation is the drive to achieve global hub of green hydrogen manufacturing. The main focus goal of Indian government is to bring down the cost of green hydrogen to 1\$/ kg by 2030.

### Challenges to produce hydrogen [22-28]

- 1) Infrastructure development issue to adopt large scale hydrogen production.
- 2) To produce or extract green hydrogen is one of the difficult tasks. The lightest element in the world is hydrocarbons and water. Hence, extracting hydrogen from water requires lots of effort and energy as water molecule is stable. Most well known process to produce green hydrogen is electrolysis from renewable sources.
- 3) The other method to produce brown hydrogen is burning of coal oil, black hydrogen from bituminous tar and grey hydrogen from methane or natural gas.



**Figure:** “Green Hydrogen production by electrolysis using renewables energies”.

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