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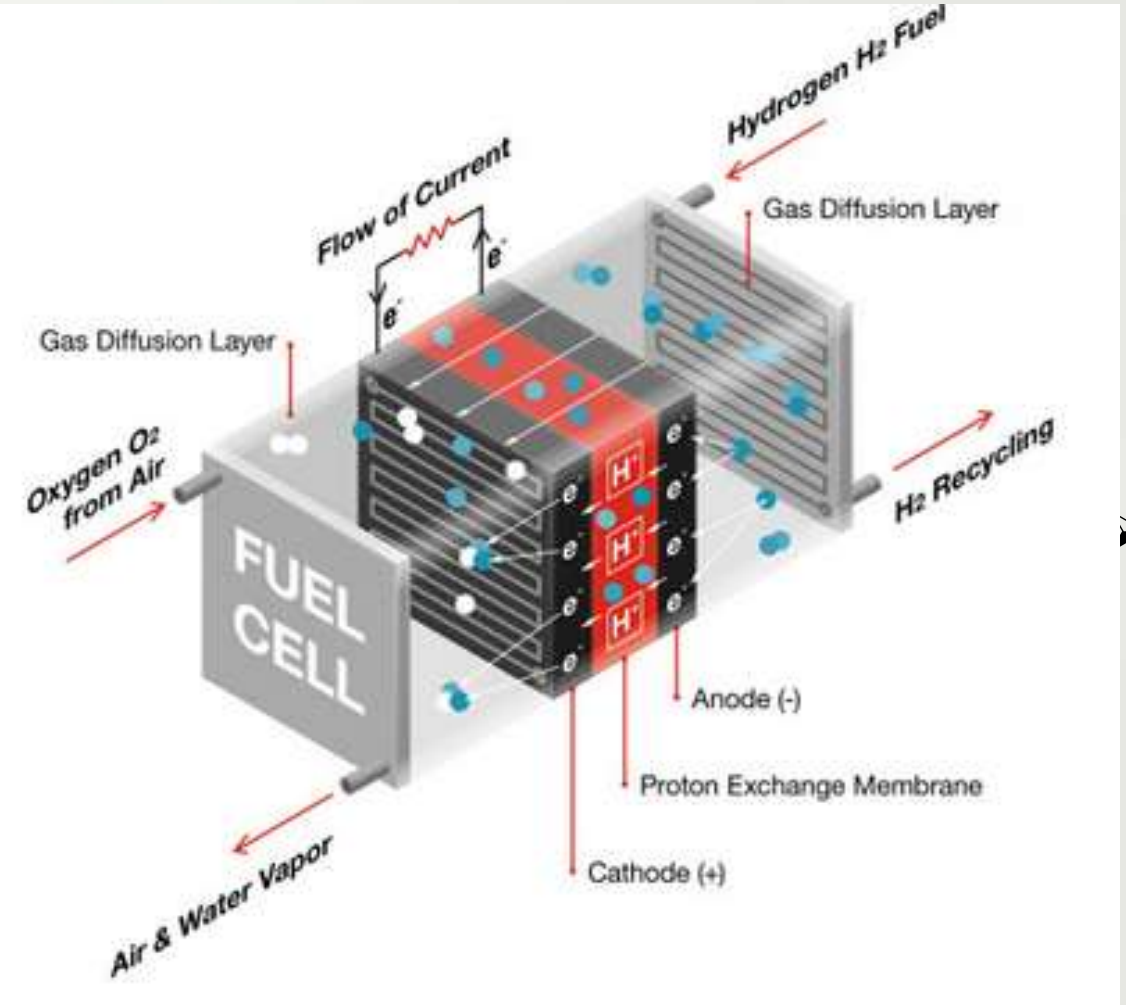
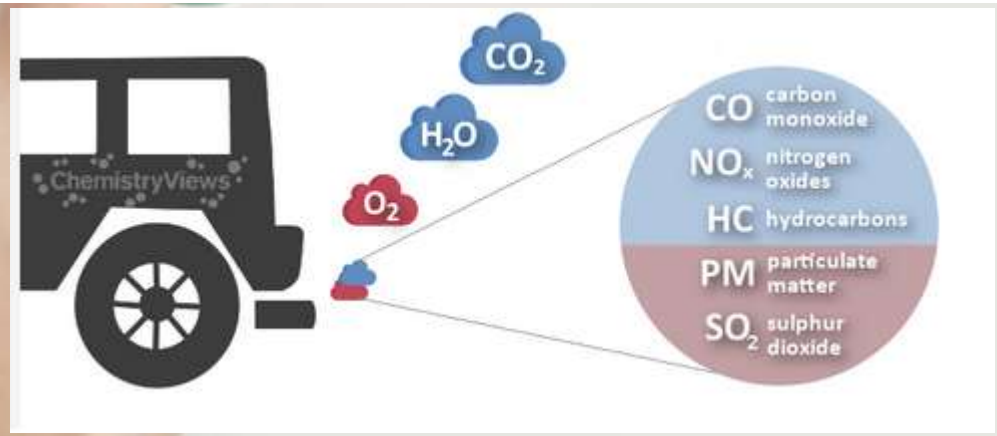
International Conference on Green Hydrogen (ICGH-2023)

Why in News?

- The three-day International Conference on Green Hydrogen (ICGH-2023) was organized in New Delhi.
- The conference aims to establish a Green Hydrogen ecosystem and foster a systemic approach to global decarbonisation goals.





Hydrogen Energy (H2)

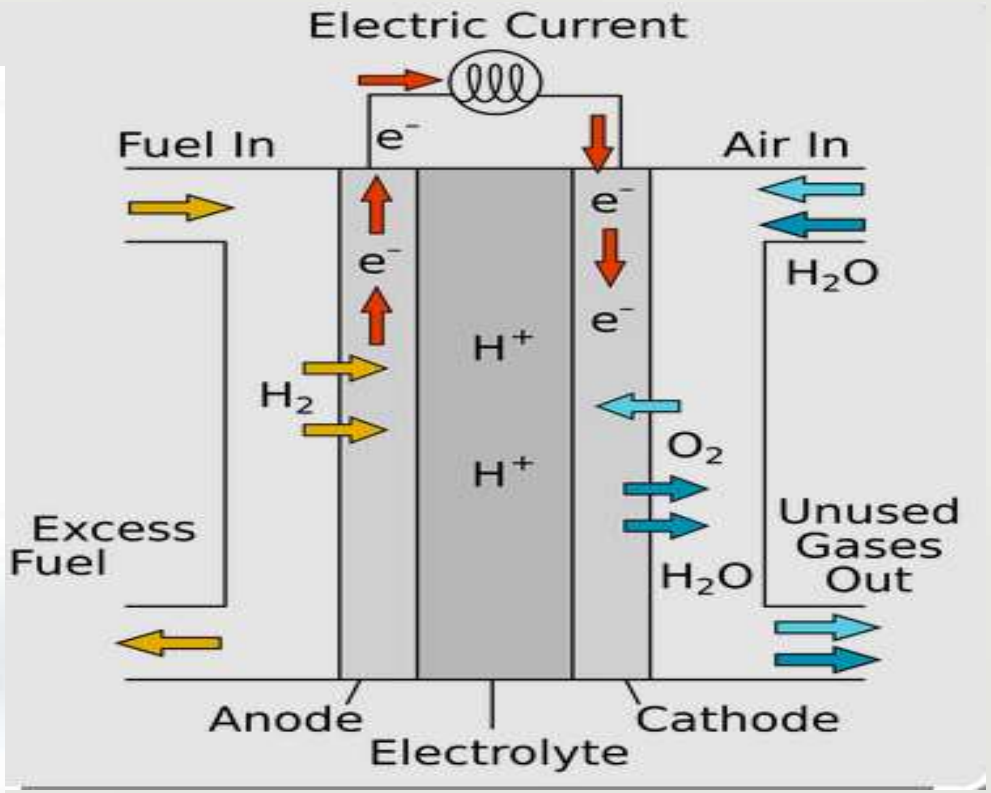
- Many scientists believe that the fuel for the future is hydrogen gas.
- When hydrogen gas burns in the air or in fuel cells, it combines with oxygen gas to produce non-polluting water vapour
- fuel cells directly convert hydrogen into electricity.

Application of hydrogen: Fuel cell

Hydrogen fuel cell systems are used for generating electricity, in vehicular applications (Fuel cell cars, buses, etc.) and portable devices (Laptops, phones, etc.)

fuel cell is a device that generates electricity by a chemical reaction.

Only water vapour and heat are emissions from fuel cell.



Types of hydrogen

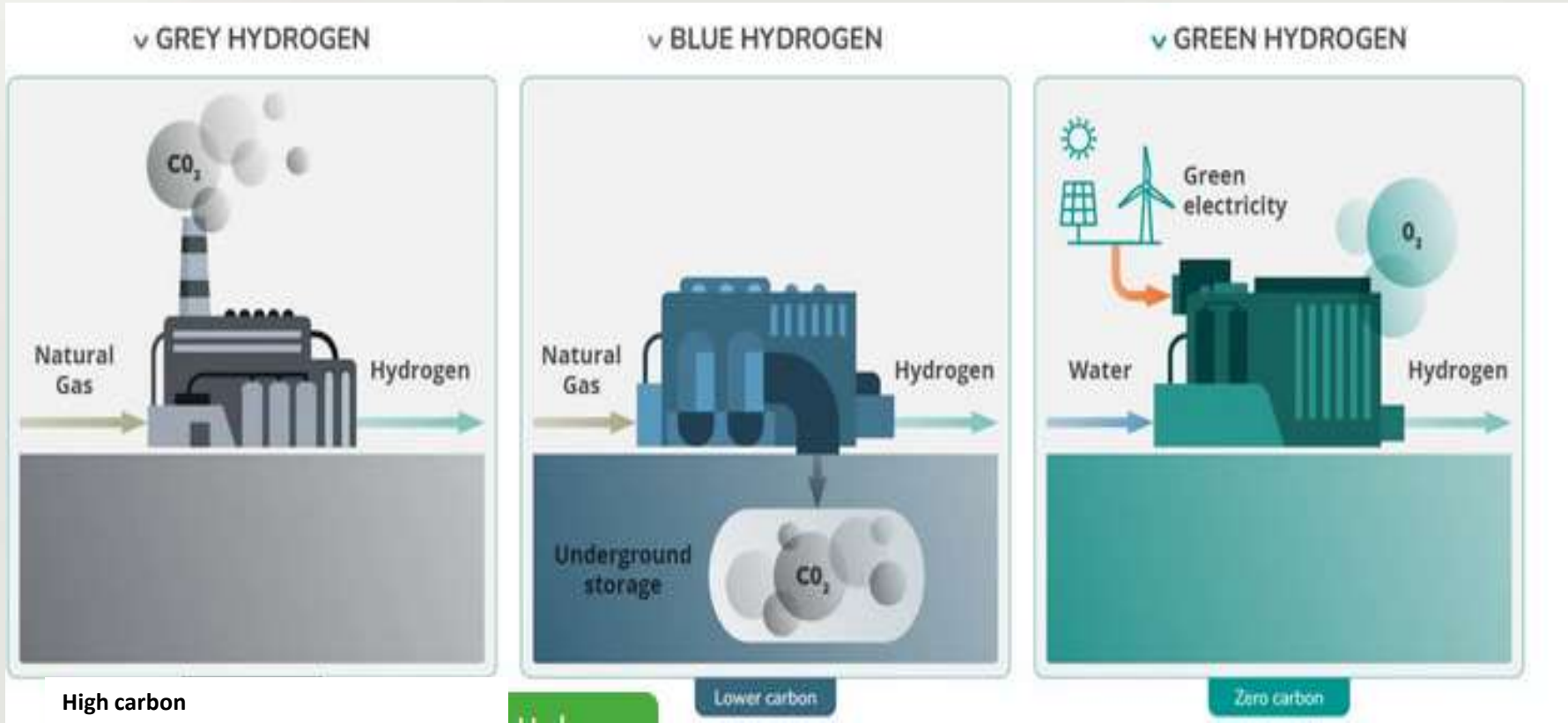
Grey hydrogen: Hydrogen derived using fossil fuels is called as grey hydrogen.

Blue hydrogen: It is derived from natural gas through the process of steam methane reforming (SMR).

SMR mixes natural gas with very hot steam, where hydrogen and carbon monoxide.

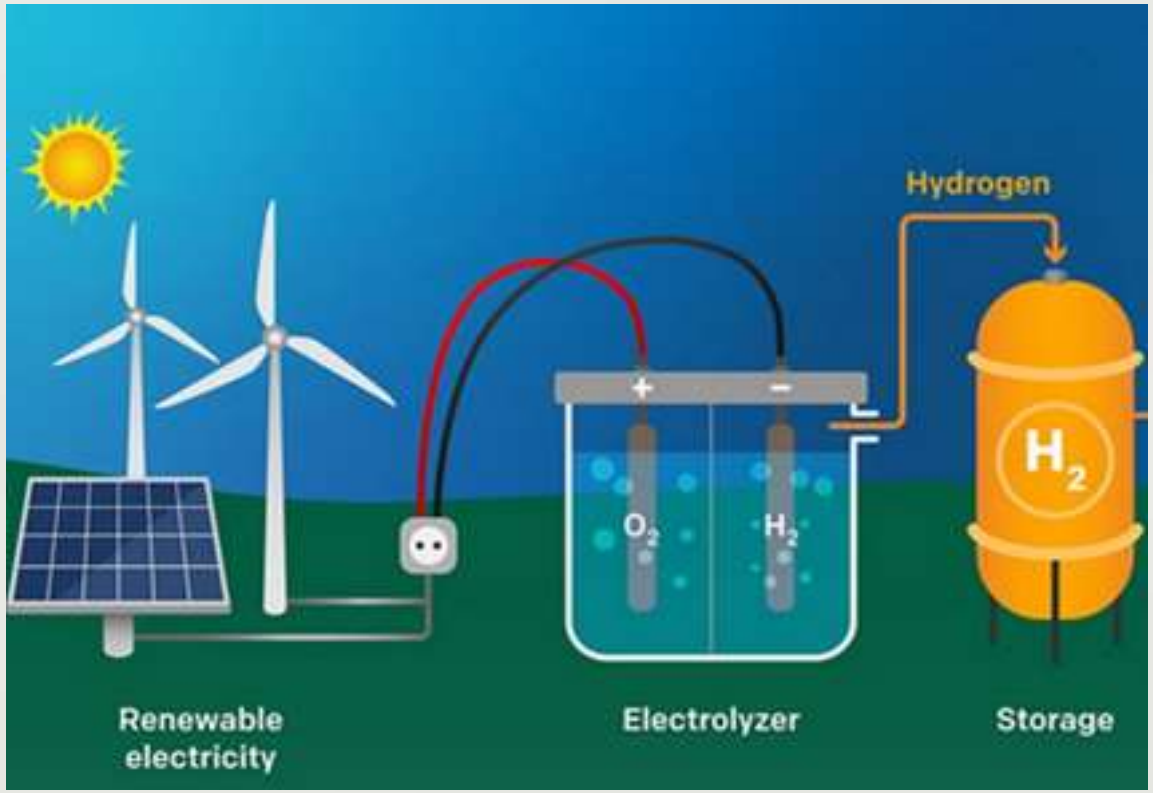
$$(1)\ CH_4+H_2O\rightarrow CO+3H_2$$
$$(2)\ CO+H_2O\rightarrow CO_2+H_2$$

Green hydrogen: It is derived by electrolysis of water



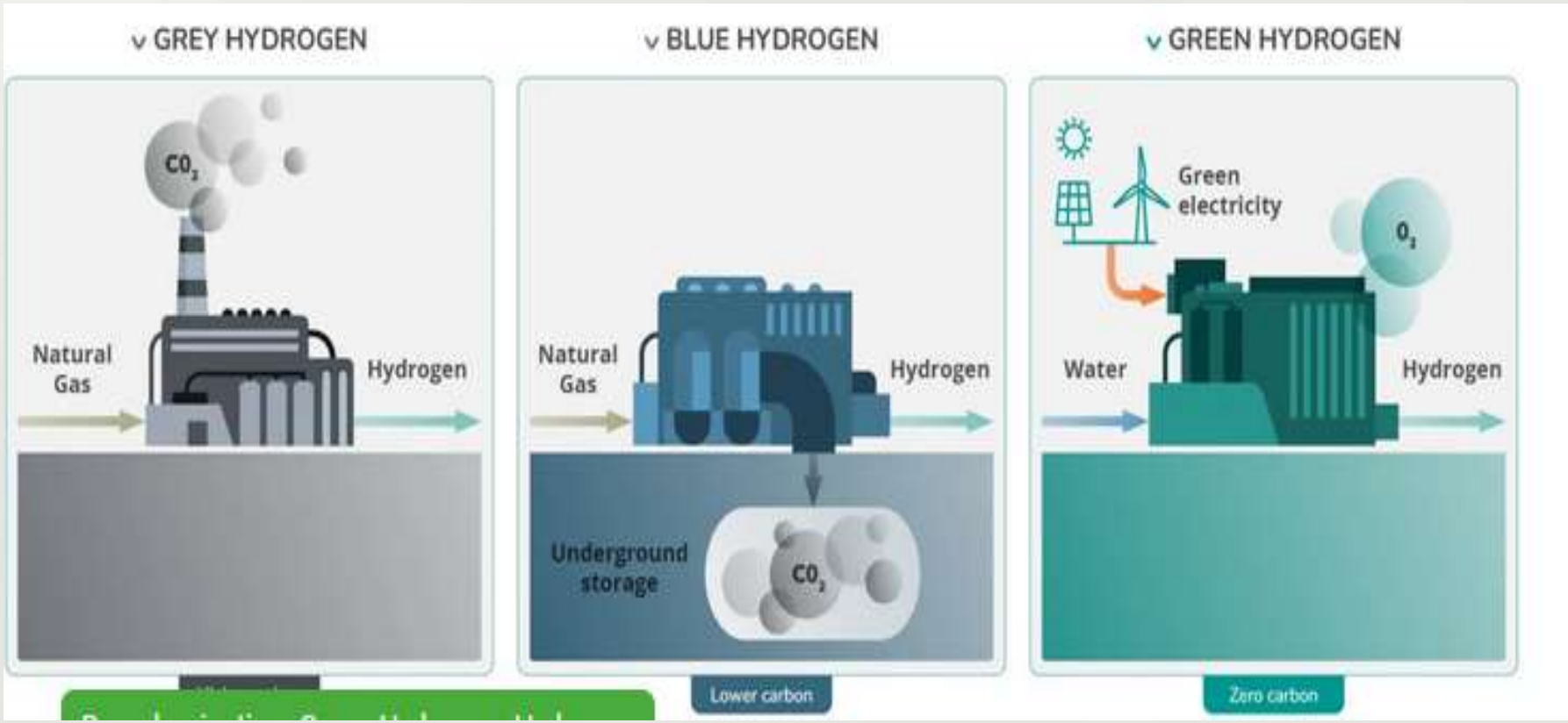
Green Hydrogen

- Green hydrogen is a form of renewable energy that is produced by splitting water molecules into hydrogen and oxygen using electricity
- If electricity comes from renewable sources such as solar, wind, hydro or Biomass, then the hydrogen thus produced is referred to as green hydrogen.

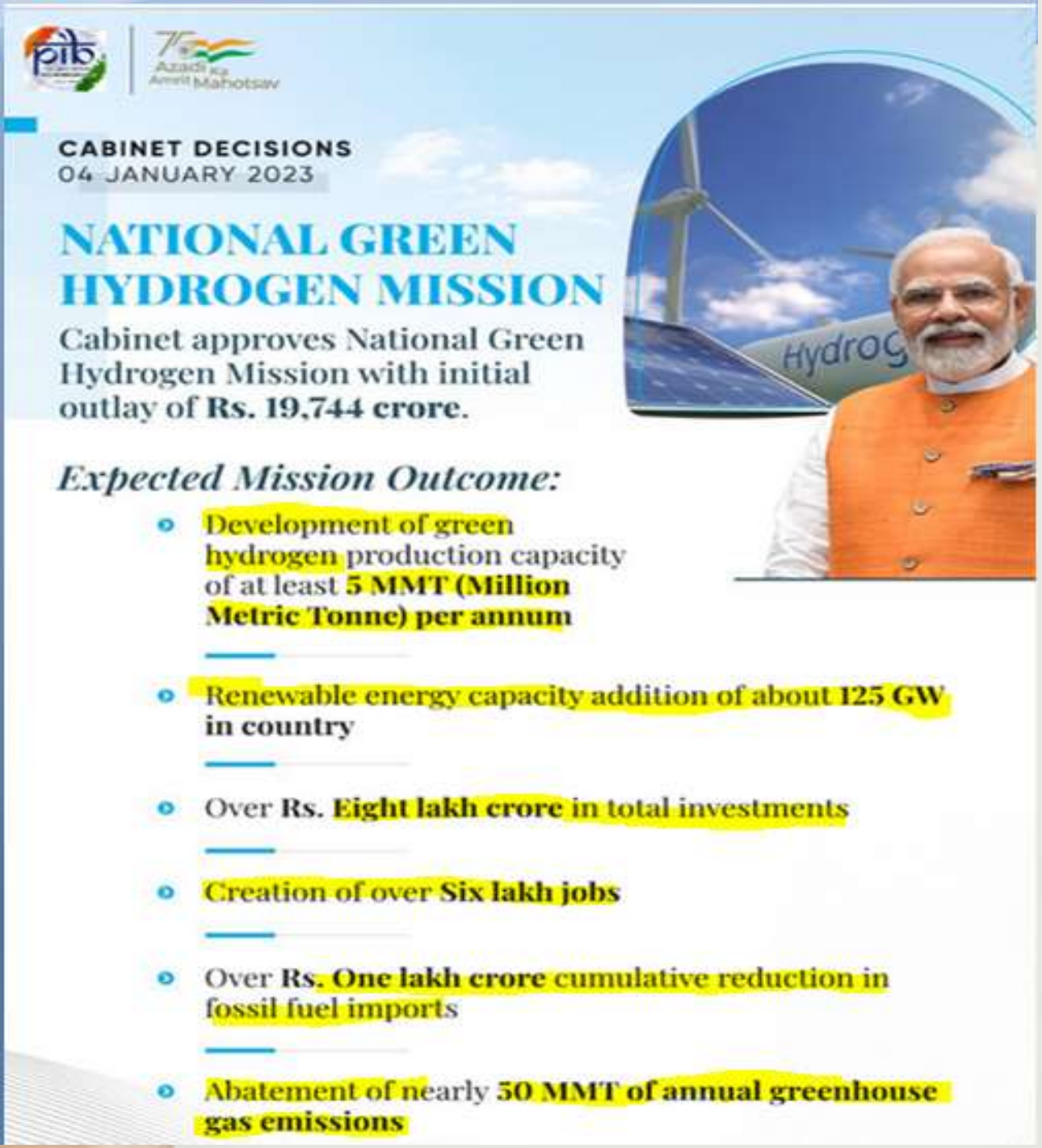


Significance of green hydrogen

- Green hydrogen is the **only type of hydrogen** that is **produced in a climate-neutral manner**, making it **critical to reach net zero emissions by 2050.**
- It has the **potential to decarbonise various sectors** such as **transport, industry, power and buildings**, and **contribute to the global efforts to mitigate climate change.**

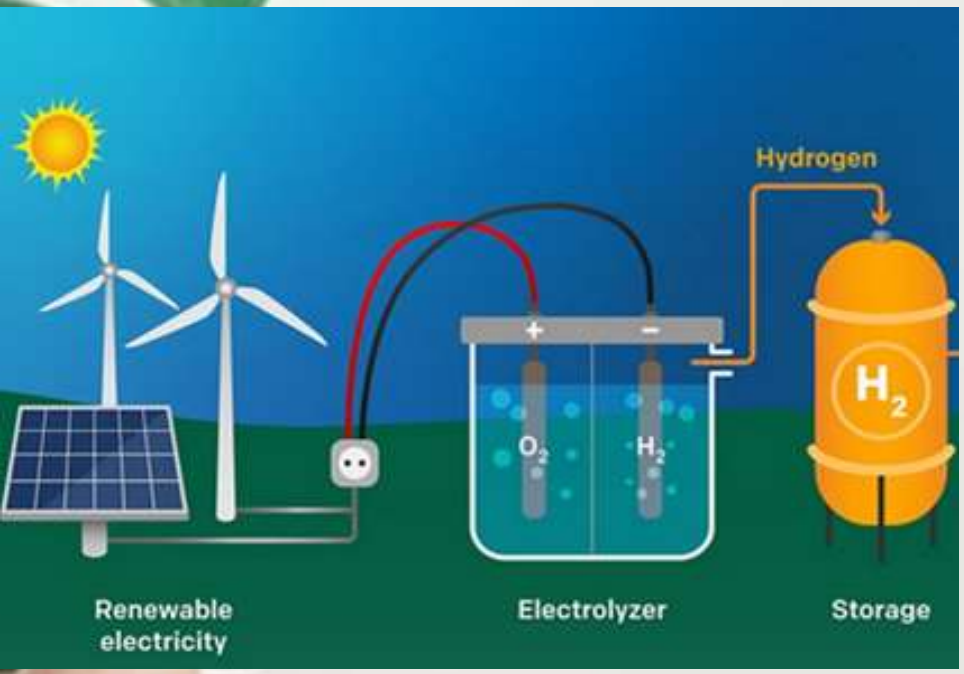


Status of Green Hydrogen in India



NATIONAL GREEN HYDROGEN MISSION

About NATIONAL GREEN HYDROGEN MISSION



- It is a program to incentivise the commercial production of green hydrogen and make India a net exporter of the fuel.

Sub Schemes:

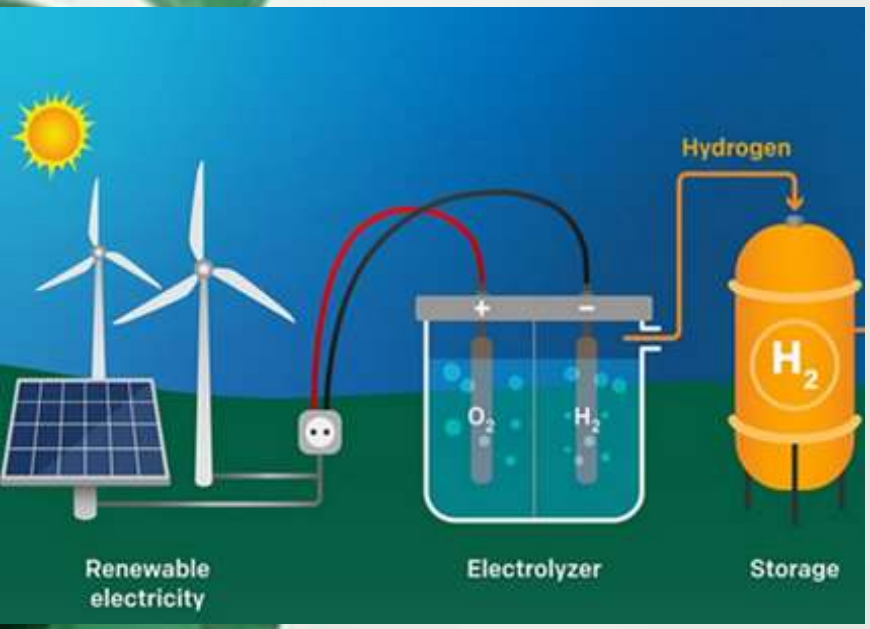
1. Strategic Interventions for Green Hydrogen Transition Programme (SIGHT):
   - It will fund the domestic manufacturing of electrolysers and produce green hydrogen.

2. Green Hydrogen Hubs:
   - States and regions capable of supporting large scale production and/or utilization of hydrogen will be identified and developed as Green Hydrogen Hubs.

Current Production:

- Green hydrogen currently accounts for less than 1% of global hydrogen production due to it being expensive to produce.

- A kilogram of black hydrogen costs USD 0.9-1.5 to produce
- while grey hydrogen costs USD 1.7-2.3 and
- blue hydrogen can cost anywhere from USD 1.3-3.6.
- However, green hydrogen costs USD 3.5-5.5 per kg, according to a 2020 analysis by the Council for Energy, Environment and Water.

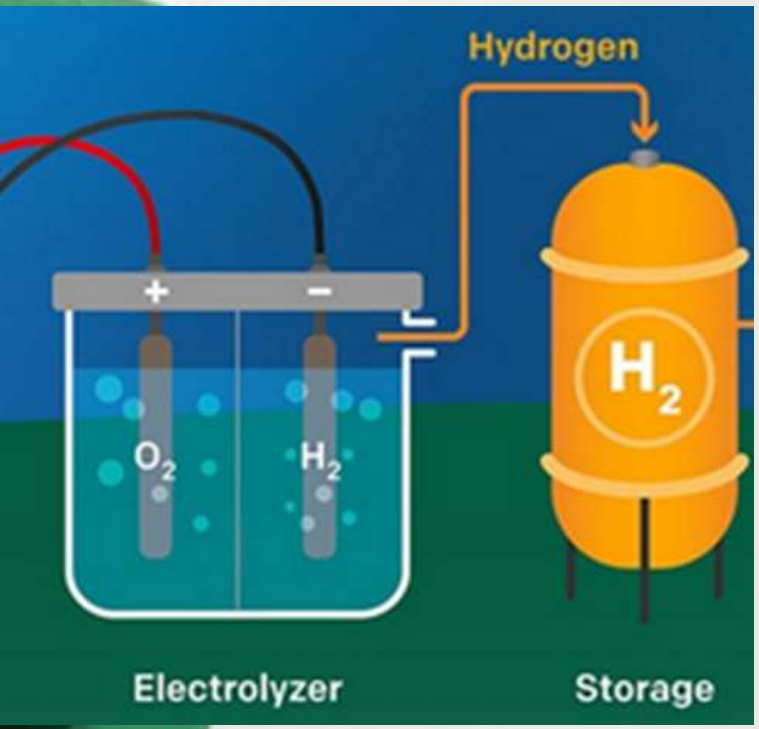


- **What are the Challenges for Green hydrogen**

- **In Nascent Stages Globally:**
  - **Green hydrogen development is still in the nascent stages globally and while India can take the lead in being a major producer, but it doesn't have the necessary infrastructure yet to execute all these intermediary steps.**

High Production Costs: Green hydrogen production involves electrolysis of water using renewable energy sources. However, the cost of renewable energy infrastructure and electrolysers remains relatively high, making green hydrogen production costlier compared to fossil fuel-based alternatives.

Limited Renewable Energy Capacity: The intermittent nature of solar and wind power requires substantial investments in energy storage infrastructure to ensure uninterrupted power supply for electrolysis.



- **Water Availability**: Green hydrogen production **requires a significant amount of water for the electrolysis process**. In regions with limited water resources or facing water scarcity, ensuring sustainable water supply for large-scale green hydrogen production can be challenging.

- **Storage:** Hydrogen is also **hard to store**, for storage it **requires compression to 700 times** atmospheric pressure, **refrigeration to -253 degree Celsius.**

- As well is more **explosive.**

Material	Energy per kilogram ($MJ\,kg^{-1}$)
Hydrogen (liquid)	143
Hydrogen (compressed, 700 bar)	143
Hydrogen (ambient pressure)	143
Methane (ambient pressure)	55.6
Natural gas (liquid)	53.6
Natural gas (compressed, 250 bar)	53.6
Natural gas	53.6
LPG propane	49.6
LPG butane	49.1
Gasoline (petrol)	46.4
Biodiesel oil	42.2
Diesel	45.4

Advantages of hydrogen-based energy:

- **High energy density**: Hydrogen has the highest energy per mass of any fuel, it is 120 MJ/kg, almost three times more than diesel or gasoline.
- **Reduced imports:** helps to reduce crude oil import and its use as feedstock for ammonia production reduces India's fertilizer imports.
- **India is the world's third largest consumer of oil,** for which country has to depend heavily on oil imports.
- **Non-polluting & decarbonising:** The use of hydrogen can reduce the CO2 related emissions significantly
- **Abundance**: Hydrogen can be produced locally from numerous sources like methane, gasoline, biomass, coal or water.

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