

MODULE 3

GREEN HYDROGEN CYCLE

Green hydrogen refers to hydrogen generated through the electrolysis of water, utilizing energy derived solely from renewable sources, such as solar or wind power. This renders the entire hydrogen production process nearly emission-free and ensures it does not contribute to greenhouse gas emissions, thereby serving as a crucial component of the energy transition towards climate neutrality.

USE

PRODUCTION
FROM RENEWABLE
ENERGY SOURCES

TRANSPORT

STORAGE

Production from renewable energy sources

They utilize electricity sourced entirely from renewable resources to dissociate water molecules (H_2O) into pure hydrogen (H_2) and oxygen (O_2). This renders the process entirely emission-free, producing no harmful substances in the atmosphere. The source of energy is what defines the "green" character of hydrogen.

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Storage

Once produced, hydrogen must be stored appropriately to ensure a stable supply and flexibility in its applications. It can be stored in various forms, most commonly as a compressed gas at high pressure in specialized, durable tanks. An alternative method involves condensing hydrogen into a liquid state at extremely low temperatures (-253°C) within cryogenic tanks. Additionally, there are promising technologies for storing hydrogen in solid materials, such as metal hydrides, or in underground caverns.

Transport

For green hydrogen to effectively reach its recipients, efficient transport is essential. For long distances and substantial quantities, pipeline transport may prove to be the most economical option, frequently utilizing existing gas infrastructure modified for hydrogen. For shorter distances and smaller recipients, hydrogen is transported in specialized tanks (either as compressed gas or liquid) via trucks or rail cars. The advancement of efficient transport methods is crucial for the widespread adoption of the hydrogen economy.

Use

Green hydrogen, recognized as a versatile and clean energy carrier, plays a significant role across various sectors, facilitating their decarbonization. In transportation, it powers electric vehicles equipped with fuel cells, including cars, buses, and trains, emitting solely water vapor. In the industrial sector, it serves as a raw material for ammonia production (fertilizers) and green steel, in addition to functioning as a high-temperature fuel. Furthermore, hydrogen is increasingly utilized in the energy sector for electricity and heat generation, contributing to grid stability amid fluctuations in renewable energy sources.