

MODULE 4

FIVE STAGES OF THE HYDROGEN SUPPLY CHAIN

Hydrogen, as a pivotal element in the future sustainable energy economy, necessitates a holistic approach to its availability. It is insufficient merely to produce it; an effective supply chain must be established to guarantee its safe and economical transport from source to end user. This process encompasses several interconnected stages that collectively form an efficient logistics system, facilitating the widespread utilization of hydrogen across industry, transportation, and energy sectors.

PRODUCTION

This stage marks the inception of the entire chain, wherein hydrogen is generated from diverse raw materials. The most preferred method is water electrolysis utilizing renewable energy sources, resulting in what is known as green hydrogen—entirely ecological. Hydrogen can also be produced from natural gas (grey or blue hydrogen if CO₂ capture is employed), biomass, or through other processes; however, green hydrogen represents the future of a sustainable economy.

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STORAGE

Once produced, hydrogen necessitates suitable storage to guarantee a consistent supply and stability. It can be stored as a compressed gas in specialized pressure tanks, which is presently the most widely employed method. An alternative is liquefied hydrogen, which demands extremely low temperatures (known as cryogenics). Additionally, innovative solutions are being explored, such as storage in metal hydrides (in a solid state) or in expansive underground salt caverns.

2

TRANSPORT

The transport phase is tasked with transferring hydrogen from production or storage sites to distribution points or directly to major consumers. Presently, tanker trucks that transport compressed or liquefied hydrogen are predominantly utilized. In the future, specialized hydrogen pipelines, or the adaptation of existing gas pipelines, will be pivotal in facilitating the most efficient and cost-effective transport of substantial quantities over extended distances.

3

DISTRIBUTION

Distribution represents the phase in which hydrogen is conveyed from transport hubs to smaller, local recipients or final points of sale. This encompasses the establishment and management of a network of hydrogen fueling stations for vehicles, along with smaller pipelines or cylinder deliveries to industrial sectors. A robust distribution network is crucial for ensuring that hydrogen becomes widespread and accessible to a diverse array of users.

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FINAL CONSUMER

The final stage involves the actual utilization of hydrogen. This occurs in various industries, where it functions as a raw material (for instance, in the production of ammonia or green steel) or as a clean fuel. In transportation, it powers electric vehicles equipped with fuel cells. Hydrogen is also essential to the energy sector, where it is employed to generate electricity and heat, in addition to serving as an energy storage solution that stabilizes the grid. In the future, it may be utilized for heating buildings or as a fuel for ships and airplanes.

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