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Green Hydrogen: Fuelling the Future

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Green Hydrogen: An Overview

Green hydrogen refers to hydrogen generated by electrolyzing water, using renewable energy sources like solar or wind power. Through electrolysis, water is separated into hydrogen and oxygen, and the resulting hydrogen serves as a clean and sustainable fuel.

According to a June 2023 report from Deloitte, the market for green hydrogen is **expected to experience accelerated growth after 2030**. Deloitte forecasts that **from 2030 to 2050, this market will expand by 50%,** reaching an **annual value of USD 1.4 trillion**.

Key Benefits

- **100 % sustainable: It does not release polluting gases** either during combustion or production
- **Versatile: green hydrogen can be converted into electricity or synthetic gas,** serving various purposes in commercial, industrial, or mobility applications

Key Challenges

- **Cost:** Comparatively **more expensive** than hydrogen produced from fossil fuels
- **Infrastructure: Building necessary infrastructure** requires substantial investment
- **Scaling up**: Maintaining a low CAPEX for the installation and production costs compared to other hydrogen production technologies is challenging

Key Players

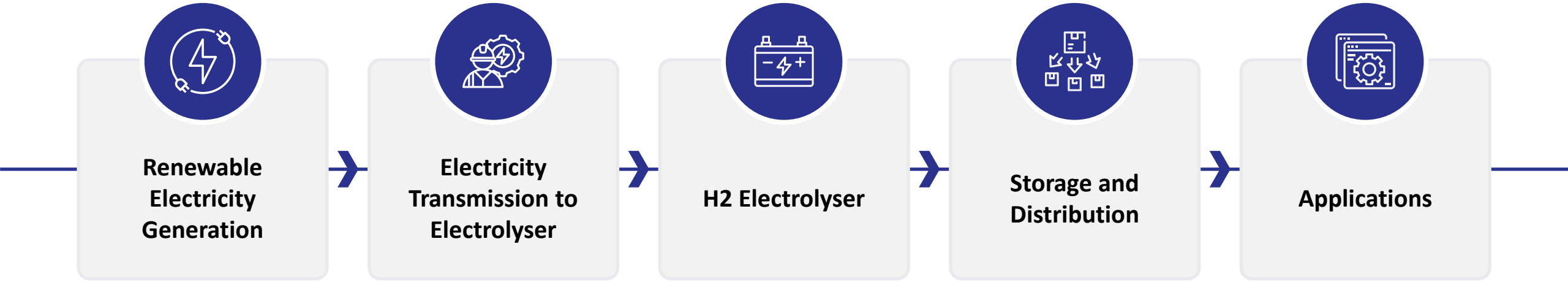
FuelCell Energy, plug, Shell, adani Renewables, Sinopec, Reliance, Bloomenergy, Air Liquide, Making our world more productive Linde, GAIL

Top Green Hydrogen Producer Nations

- **Australia, USA, and Spain** will lead the market by end of 2030
- **Canada, Chile, Egypt, Germany, India, Brazil,** and **Morocco** will follow (based on announced green hydrogen projects and targets around the globe)

Sources: Icons, Key Players, Top Nations, Growth, Benefits and Challenges, energy Storage, Challenge, Benefit

Value Chain of Green Hydrogen



Green Hydrogen Production

In the electrolysis process, renewable electricity splits water into hydrogen and oxygen, utilizing devices like alkaline electrolyzers, PEM electrolyzers, or solid oxide electrolyzers.

Storage & Distribution

The produced hydrogen is compressed and then transported to end-users via pipelines, trucks, or ships, chosen based on operational scale and distance.

Application

It has versatile applications, serving as a fuel source for vehicles and electricity generation in fuel cells. Additionally, it finds utility in heating systems, chemical and fertilizer production, and microgrids, offering energy-efficient solutions.

Sources: Value Chain, Icons, Applications, Link , Link 2, application

Recent Developments (2022 and 2023)

EU

The European Commission laid out its 'REPowerEU' plan in March 2022

- It aims to produce and import 10 million tons of green hydrogen each by 2030

USA

In October 2023, the US Department of Energy (DOE) unveiled an initiative involving an investment of USD 7 Bn

- It aims to establish seven Regional Clean Hydrogen Hubs (H2Hubs) across the nation. This move is aimed at expediting the large-scale rollout of affordable, clean hydrogen

UAE

The UAE government has approved a new national hydrogen strategy in 2023

- It aims to produce 1.4 million tonnes of green hydrogen per year by 2031 and 15 million tonnes by 2050

South Africa

South Africa approved the Green Hydrogen Commercialization strategy in October 2023

- This step aims to position South Africa as a major producer and exporter of green hydrogen

China

China laid down its National Plan for Hydrogen in 2022

- It aims to achieve a green hydrogen output of 100K to 200K tonnes annually by 2025, utilizing renewable feedstock resources, and to deploy a fleet of 50K vehicles powered by hydrogen within the same timeframe

India

India's National Green Hydrogen Mission, was approved in January 2022. It aims to achieve an annual production capacity of 5 million metric tonnes of green hydrogen by 2030

- To reach this goal, USD 2.4 billion has been allocated, with the majority being provided as production subsidies for green hydrogen producers and electrolyzer manufacturers

Sources: Europe, Auction, UAE, India, Incentive, Green Hydrogen Mission, South Africa, USA, China, China Plan

Recent Developments (2023)

- FuelCell Energy & Oando signed **an MoU for large-scale green hydrogen and low-carbon energy production** in Africa in Oct 2023
- It collaborated with Malaysia Marine and Heavy Engineering Holdings Berhad (MHB**) to Deliver Solid Oxide Electrolyser facilities** in Asia, New Zealand, and Australia for large-scale green hydrogen production in Feb 2023

- Plug Power **planned to build a 35-tons-per-day green hydrogen generation** plant at Port of Antwerp-Bruges in Europe. Initial production of green hydrogen is expected in late 2024, and plant commissioning will be in 2025.
- It signed an **agreement with Walmart to help power its lift trucks and deliver green hydrogen using a fleet of liquid transport**

- Bloom Energy Corporation **has declared its involvement in the Nujio'qonik project, a pioneering intercontinental green hydrogen commercialization venture in Canada** with a budget of USD 4.5 billion, by supplying its globally recognized solid oxide electrolyzers (SOEC) in 2023

- Sinopec has finished building the Xinjiang Kuqa Green Hydrogen Pilot Project, **the largest photovoltaic green hydrogen production** initiative in China. Upon reaching full capacity, **it was launched to produce an annual output of 20,000 tons of green hydrogen.**

- Adani New Industries Ltd (ANIL), has committed **USD 2.5 billion to establish an integrated value chain for its green hydrogen project**. This project, with an annual capacity of 1 million tons, is expected to become **operational by the financial year 2027.**

- Reliance Industries is in the **process of building infrastructure for the distribution of green hydrogen,** aiming to facilitate the seamless supply once production starts. The company has set a goal to commence the **production of green hydrogen by 2025.**

Sources: Adani, Reliance, Gail, FuelCell, MHB, Plug, Walmart, BloomEnergy, Sinopec

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