Harnessing green hydrogen for a low-carbon world: A. K. Tyagi, Founder, Chairman & Managing Director, Nuberg Engineering Limited

India's dual approach of focusing on domestic production and export opportunities positions it as a vital player in global hydrogen economy

By A. K. Tyagi, Founder & CMD, Nuberg Engineering Limited | February 04, 2025

Green hydrogen derived from renewable energy sources such as wind and solar through water electrolysis, holds transformative potential in addressing global climate change. As a clean-burning, zero-emission fuel, green hydrogen emerges as a cornerstone in the transition to a low-carbon future, capable of replacing fossil fuels across heavy industries, transportation, and other energy-intensive sectors. Its role extends beyond just a fuel source, enabling the storage of surplus renewable energy, thus addressing the intermittency challenges associated with wind and solar power.

The applications of green hydrogen are far-reaching, from fuelling vehicles to providing clean energy for homes and serving as a critical feedstock for industrial processes. Particularly promising is its potential to decarbonize sectors like maritime transport and aviation, which are historically reliant on high-emission fuels. As the demand for sustainable solutions grows, green hydrogen's ability to enable the storage and transport of renewable energy over long distances adds to its appeal.

India has emerged as a global contender in this arena, with initiatives such as the National Green Hydrogen Mission charting a bold path forward. This mission reflects a commitment to reducing reliance on fossil fuels, fostering job creation, and catalysing economic growth while targeting a production capacity of 5 million tonnes per annum by 2030. India's dual approach of focusing on domestic production and export opportunities positions it as a vital player in the global hydrogen economy.

Globally, countries like Germany and Japan are also advancing their green hydrogen strategies. Germany emphasizes the need for international collaboration to secure hydrogen supplies while enhancing energy security. Japan focuses on creating robust hydrogen supply chains through international agreements. These nations complement India's efforts, collectively propelling the hydrogen economy to the forefront of the global energy landscape.

The economic and logistical advantages of green hydrogen over direct electricity use are evident. It facilitates the storage of excess renewable energy, ensuring a stable power supply even during low-generation periods. Moreover, green hydrogen offers greater efficiency in transportation over long distances compared to electricity, making it indispensable for regions lacking robust electrical infrastructure. Its adaptability further enables it to decarbonize industries like steel and cement production, which are challenging to electrify directly, while powering fuel cells and serving as a critical feedstock in chemical processes.

Despite its promise, the adoption of green hydrogen faces challenges. High production costs relative to fossil fuels, the need for substantial infrastructure development, and the establishment of uniform safety standards remain significant hurdles. In India, issues such as land availability for renewable projects and the development of electrolyzer manufacturing capabilities pose additional concerns. However, ongoing advancements in technology and policy reforms signal a future where green hydrogen becomes increasingly viable and competitive.

For engineers, the expanding green hydrogen sector presents unprecedented opportunities. The design and optimization of electrolysers, innovative storage solutions, and the development of infrastructure for transportation networks are critical areas requiring engineering expertise. Engineers will also play a pivotal role in integrating hydrogen technologies into existing industrial processes and establishing global safety standards. As the sector grows, the demand for skilled professionals capable of driving this energy transition will soar.

As we look to the future, green hydrogen is poised to become a critical component of the global energy ecosystem. With nations and industries united in their commitment to a sustainable, low-carbon world, green hydrogen represents not just a technological solution but a pathway to a cleaner, greener, and more resilient global economy.

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