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China Hydrogen Gas Storage Market Assessment, By State [Physical-based (Gas, Liquid, Others) and Material-based (Chemical Hydrogen, Adsorbent, Interstitial Hydride, Others)], By Storage Type [Pressurized Composite Vessels, Fiber Reinforced Composite Vessels, Cryo-Compressed Vessels, Others], By Technology [Geological Based, Compression, Liquefaction, Material Based, Others], By End-user [Energy & Industry (Nuclear Plant, Power Grids, Others), Mobility (Shipment, Heavy Transport, Others), Space Exploration, Others], By Region, Opportunities and Forecast, 2016-2030F

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Abstracts

China's Hydrogen Gas Storage Market was valued at USD 759.3 million in 2022, expected to reach USD 1651.5 million in 2030 with a CAGR of 10.2% for the forecast period between 2023 and 2030.

The hydrogen gas sector in China contributes majorly to the clean energy economy. The future of hydrogen energy in China contributes to the country’s energy network by implementing hydrogen gas as a fuel and feedstock in various industrial processes, fuel cell vehicles, for synthetic hydrocarbon fuels for shipping and aviation. In March 2022, the government entities China’s National Development and Reform Committee (NDRC) and National Energy Administration recognized the importance of clean hydrogen and developed a plan to evolve hydrogen energy for 2021-2035.

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China is currently the largest producer of hydrogen, with an annual production of 33 million tons. Still, the operating technologies are unveiled to produce gray hydrogen from coal gasification and as byproducts of the chemical processes. Under the authorized emission target by 2025, annual hydrogen production from renewable sources should reach between 100,000 to 200,000 tons. China has initiated its solar and wind power-to-gas (P2G) projects where utilizing renewable energy hydrogen is produced via electrolysis of water. By February 2022, China had over 120 renewable hydrogen projects under operation. A Chinese power company named China Southern Power Grid (CSG) has commissioned a new hydrogen energy development project to solve the problem of storing hydrogen in solid form under normal ambient conditions. Thus, these developments and initiation towards cleaner energy are expected to drive the demand for the hydrogen gas storage market.

Liquid Organic Carriers Technology Gaining Traction

Liquid Organic Carriers (LOHC) technology is gaining importance across industries to store hydrogen gas by eradicating the cost of liquefaction or gas compression. The LOHC technology is based on the chemical bonding of hydrogen to liquid organic carriers (LOHC), which are generally heterocyclic compounds or aromatic hydrocarbons. In contrast to conventional chemical hydrogen storage, LOHC reactions occur reversibly. Exothermic hydrogenation reactions accompany the loading of hydrogen, and the discharge is followed by endothermic dehydrogenation. The LOHC process comprises several advantages over the other traditional processes. Under ambient temperature and pressure, hydrogen storage is feasible, making it easy to handle. The produced carrier molecule is cycled between the loaded (LOHC+) state and unloaded (LOHC-) state, which is already converted into a chemically stable molecule, which leads to minor loss during long-term storage and far-distance transportation. Loaded LOHC+ can be transported to the respective application locations using standard chemical tanks. In 2014, the China University of Geosciences (Wuhan) partnered with Hynertech to develop a novel technology to store and transport hydrogen using LOHC technology, one of the widely used technologies for hydrogen gas storage.

Storage and Transport Infrastructure

The hydrogen sector of China is still in the pilot stage of development, where they need advanced technologies for storage and transport, which creates various difficulties and challenges. Compared to gray or blue hydrogen sources produced from coal synthesis and petrochemical processes, the storage cost system of renewable-based hydrogen is

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high. Modified tanks and storage vessels equipped with trailers configured to withstand high pressure are commonly used for storing and transporting hydrogen gas. Tube trailers with Gen IV steel containers withstanding 70 megapascals pressure are frequently being deployed, China is still using Gen III type with a pressure handling capacity of 35 megapascals.

Along with compressed hydrogen handling, Chinese technology also needs to improve in liquid hydrogen storage as their liquid storage is only limited to the aerospace and defense sectors. Salt cavern storage, considered a massive underground alternative, is also unavailable in China. They are currently investing in building caverns as an option for their industries. The prevailing technology constraints in storing hydrogen which could plummet the China market. This constraint has led to the development of hydrogen midstream value chain, which has led the researchers to invest more in innovation and R&D, exploring the multiple-stage storage alternatives, mainly aiming to improve the high-pressure gaseous storage and developing liquid hydrogen storage for various applications.

Impact of COVID-19

The impulsion of China to meet the goal of green development, clean hydrogen was substantially necessary, but the outbreak of COVID-19 and geopolitical tension has exacerbated hydrogen production. China’s energy sector primarily relies on fossil fuels, but they are continuously putting efforts to enhance the usage of renewable energy sources such as solar, wind, hydrogen, etc. The disruptions in the supply chain and reduced technology advancement during the pandemic have led to the temporary shutdown of various facilities to produce and store green hydrogen. But to cope and recover from the prevalence of the outbreak, China has put considerable investments in renewable-based hydrogen production. China Hydrogen Alliance (CHA) has stated optimistically that green hydrogen production could reach 100 million tons by 2060. China is continuously building technologies to expand hydrogen industrial zones, which already laid down several projects such as the Beijing-Tianjin-Hebei economy zone, Yangtze River Delta, and Pearl River Delta.

Impact of Russia-Ukraine War

The invasion of Russia Ukraine has slowed down the economy, and Western oil companies and Russia’s traditional buyers have backed out, which forced Russia to establish a network to bridge the gap. In 2021, China spent around USD 52.1 billion on imports of Russian oil and various energy resources, drastically increasing to USD 81.3

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billion in 2022. The production of hydrogen from coal gasification in China is around 70% which, according to the International Energy Agency, has a lifecycle emissions intensity of 22-26 kg carbon-dioxide equivalent per kg of hydrogen. The current cost of green hydrogen in China using Chinese electrolyzers is USD 3.22/kg compared to USD 5.28/kg for grey hydrogen. Thus, the war between Russia and Ukraine is expected to hamper the hydrogen gas storage market due to the impact on imports and export between these countries.

Key Players Landscape and Outlook

Energy companies in China are putting their efforts towards clean energy goals and are building strategies to circumvent the dependency on fossil fuels. In July 2020, Linde and CNOOC Energy Technology & Services, a subsidiary of China National Offshore Oil Corporation (CNOOC), signed a memorandum pact to develop and explore the potential of the hydrogen energy industry in China. The companies using their advanced technology are investing in hydrogen production and filling facilities and significantly improving storage and mobility. Linde, with their expertise in the hydrogen industry, which has the most significant liquid hydrogen capacity and distribution network, will provide their services to CNOOC. They will build a high-purity hydrogen storage cavern, as Linde is leading in this domain, along with a proper pipeline network to meet supply.

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