

Empowering "Oriental Hydrogen Island" to Create a New Zero-carbon Benchmark

Qingdao Refining & Chemical



PROJECT OVERVIEW

Hydrogen energy, as a clean and zero-carbon energy source, is an important "energy connector" and holds a significant position in the new energy system. It is of great significance for the transformation of energy security and the response to climate change. Under the global response to the carbon neutrality goal, it is receiving increasing attention and has also become an important option for China to promote green transformation and contribute to achieving the "dual carbon" goals.

Facing the "dual carbon" goals and the hydrogen energy industry trend, Qingdao Refining & Chemical has set its sights on the integration path of "hydrogen energy + green electricity" to solve the high-carbon emission problem of traditional refining and chemical enterprises. In 2022, Qingdao Refining & Chemical Company initiated the construction of a hydrogen energy "production, research and processing" demonstration park. The project is located in Huangdao District, Qingdao City. Its main contents include integrated facilities for hydrogen energy production, research and development, and refueling and filling, as well as a supporting photovoltaic green power system. By laying out photovoltaic green power projects, achieve the integrated coupling of hydrogen energy and new energy technologies such as photovoltaic in the park, and build the country's first carbon-neutral hydrogen refueling station. The project achievements include the establishment of the country's first factory-based hydrogen production research project from seawater and the country's first all-seawater environment floating photovoltaic industrial power station. Certified as the first "carbon-neutral" hydrogen refueling station in the country; With an annual production capacity of 2,300 tons of hydrogen for fuel cells, it has become the sole

hydrogen supply center for fuel cells in the Jiaodong region and has been selected for the national "Hydrogen into Every Household" science and technology demonstration project, providing a replicable industrial coupling model for the green and low-carbon transformation of traditional energy enterprises.

COMPANY/ORGANIZATION PROFILE



Sinopec Qingdao Refining & Chemical Co., Ltd. was established in 2004. It is a super-large petrochemical integrated enterprise jointly funded by Sinopec, Shandong Province and Qingdao City, with an annual crude oil processing capacity of 12 million tons. The company is committed to the clean and efficient utilization of energy and its green and low-carbon transformation. In recent years, it has focused on the layout of new energy fields such as hydrogen energy and photovoltaic energy, promoting the transformation of traditional refining and chemical enterprises into comprehensive energy service providers. It has won many national and provincial-level scientific and technological innovation awards.

PROJECT OUTCOME

Energy conservation and emission reduction: The total installed capacity of the supporting water-surface photovoltaic system is 12.9 megawatts, generating 18 million kWh of electricity annually. It can reduce

carbon dioxide emissions by 14,000 tons, which is equivalent to planting 750,000 more trees. In particular, the innovative commissioning of the 7.467-megawatt all-seawater environment floating photovoltaic system has a significant demonstration effect on the large-scale promotion of floating photovoltaic systems in coastal areas, shallow sea regions, and all-seawater environments.

Resource supply: It pioneered the independent construction and operation of public hydrogen refueling stations by domestic petrochemical enterprises, providing effective hydrogen energy support for over a hundred hydrogen-powered buses in Qingdao. At the same time, it solved the problem of no public hydrogen refueling stations at the Qingdao end of the Jiqing Hydrogen Energy Corridor. By July 2025, the cumulative output of hydrogen from fuel cells has exceeded 1,000 tons, supporting the development of the hydrogen energy industry in Qingdao and the Jiaodong region.

Technological breakthrough: The factory-based seawater hydrogen production technology has explored a new solution for coastal areas to consume renewable green electricity and produce green hydrogen, and also provided a new path for the resource utilization of high-salt industrial wastewater.

Industry demonstration: The project was selected as a major demonstration pilot for the hydrogen energy industry in Shandong Province during the 14th Five-Year Plan period. It has completed the country's first factory-based hydrogen production research project from seawater and the country's first all-seawater environment floating photovoltaic industrial power station. It has been certified as the first "carbon-neutral" hydrogen refueling station in the country.

PROJECT HIGHLIGHTS

Main awards

1. Qingdao Municipal People's Government - Qingdao Technological Invention Award
2. China Federation of Industrial Economics - Leading Enterprises in China's industrial Carbon Peaking
3. China Enterprise and Reform and Development Research Society - Outstanding Cases of Implementing the "Dual Carbon Goals" in 2025
4. Top Ten Teams for Technology Transfer of the Working Committee of Qingdao West Coast New Area of the Communist Party of China and the Administration Committee of Qingdao West Coast New Area

PROJECT IMPLEMENTATION

Relying on the policy of the "Hydrogen into Every Household" science and technology demonstration project jointly promoted by the Ministry of Science and Technology of the People's Republic of China and Shandong Province, as well as the development strategy of "Hydrogen Island in the East" of Shandong Province and Qingdao City, Qingdao Refining & Chemical Company follows the transformation and development requirements of Sinopec's "One Base, Two Wings, Three New" and China's largest hydrogen energy company, continuously enhancing its green energy supply capacity and taking hydrogen energy as an important handle for the transformation of the energy structure. Give full play to the advantages in terms of location and resources, target the key technologies of the hydrogen energy industry, strengthen cooperation with multiple fields such as local ports, logistics, automobiles, universities and research institutes, build, supplement and strengthen the industrial chain, accelerate the construction of a hydrogen energy ecosystem covering the entire chain of "production, storage, transportation, refueling and application", and promote the green and low-carbon transformation to enter a new stage.

The project adopts a phased construction strategy: In 2022, the major demonstration and pilot project of the hydrogen energy industry in Shandong Province during the 14th Five-Year Plan and the hydrogen energy

resource base project in Qingdao City will be fully completed and put into use. In 2023, in collaboration with Qingdao Compis, we successfully developed and applied the first large-displacement (2000 Nm³/h) liquid-driven compressor for hydrogen refueling mother stations in China. This effectively solved the technical problem that compressors for hydrogen refueling mother stations in China were difficult to start and stop at any time according to working conditions, achieving an overall energy saving of over 30%. In 2024, the first factory-based seawater hydrogen production research project in China will be completed by combining direct seawater hydrogen production with green electricity for green hydrogen production. This is the first 100-kilowatt-level factory-based seawater hydrogen production project in China to be directly implemented in a petrochemical park and achieve product recovery and application in industrial processes. In 2025, it will be certified by a third-party authoritative institution to obtain the "carbon neutrality" certificate, build the first "carbon neutrality" hydrogen refueling station in China, and at the same time, complete the construction of the country's first floating photovoltaic power station on seawater.

The comparison before and after implementation is significant: from single hydrogen energy production to an integrated model of "production, research and processing", from relying on external energy to self-sufficiency in green electricity, and from traditional energy supply guarantee to zero-carbon park demonstration. The application of virtual hydrogen storage technology has reduced investment and energy consumption by 50%, making it the only hydrogen supply center in the region.

PROJECT IMPACT & SUSTAINABILITY

Through technological innovation and industrial collaboration, Qingdao Refining & Chemical has built China's first "carbon-neutral" hydrogen refueling station throughout its entire life cycle, forming a closed loop of the entire hydrogen energy chain from production to storage, transportation, refueling and application. With a disruptive technological logic, it has restructured the

energy supply system and replaced traditional fossil energy with hydrogen energy. This is not only a policy practice outcome under the "dual carbon" goals. It is also a key node for the hydrogen energy industry to move from technology validation to large-scale application.

Its experience provides a model for the nationwide promotion of zero-carbon hydrogen refueling facilities, accelerating the application of hydrogen energy in transportation, industry and other fields. It is not only a microcosm of the green transformation and upgrading of traditional energy enterprises, but also offers a micro-sample for observing the development of China's hydrogen energy industry.

The green transformation of energy is a future-oriented and long-term strategic task. The accelerated transformation of new technologies will give rise to vigorous "green shoots" in more industrial fields.

China has a large number of new energy innovation carriers and high-level R&D platforms. Relying on these platforms and carriers, seizing the high ground of future energy technology industrialization will surely create greater industrial development potential, simultaneously achieve the advanced optimization of energy structure and industrial structure, and explore a broader green future.

Expert Comments

As a giant petrochemical enterprise, SINOPEC Qingdao Refining & Chemical Co., Ltd. is tackling climate change and advancing low-carbon transition through an integrated "hydrogen energy + green power" pathway. The company has established China's first factory-based seawater hydrogen production research project, a floating industrial photovoltaic power station operating entirely in a seawater environment, and the first "carbon-neutral" hydrogen refueling station. It has created a complete hydrogen energy value chain covering production, storage, transportation, refueling, and utilization, providing support for the development of the hydrogen energy industry in the Jiaodong region. By leveraging technological innovation to overcome emission reduction challenges, the company has successfully explored a new transition pathway for traditional petrochemical enterprises. Its integrated model of hydrogen energy and green power demonstrates strong scalability.

