China's national demonstration project for compressed air energy storage achieved milestone in industrial operation

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On May 26, 2022, the world's first nonsupplemental combustion compressed air energy storage power plant (Figure 1), Jintan Salt-cavern Compressed Air Energy Storage National Demonstration Project, was officially launched! At 10:00 AM, the plant was successfully connected to the grid and operated stably, marking the completion of the construction of the first national demonstration project of compressed air energy storage in China in accordance with the commercial power station standards. After the successful completion of the continuous full-load energy storage–power generation test, it was officially put into operation to become a milestone in the development of new energy storage technologies in China.

Fig. 1 Aerial panorama of Jintan Salt-cavern Compressed Air Energy Storage National Demonstration Project.

Compressed air energy storage in salt caverns is a large-scale energy storage technology that has developed rapidly in recent years. In the national demonstration plant, a salt cavern formed by water-soluble salt mining is used to store mass compressed air during low power demands and release it to generate electricity when power consumption peaks. Therefore, this technology can achieve peak shaving and valley filling, thereby improving power grid regulation capability. Thus, it serves as a key technology for building a new generation power system.

This project is the only national demonstration project and the first commercial power station project in the field of compressed air energy storage in China. It was jointly developed by Tsinghua University, China National Salt Group, and China Huaneng Group, who were responsible for the main body design, construction, and operation and maintenance, respectively. The first phase of charging and discharging installed power is 60 MW, whereas the generation capacity is 300 MWh. The long-term construction scale is 1000 MW. The salt cave is approximately 1000 m deep with a volume of 220,000 m^3 with a maximum pressure state of 140 atm. Presently, the power plant can not only use the peak-to-valley difference to achieve peak regulation, i.e., air compressed for 8 h to generate electricity for 5 h, but can also be used as a backup power station for the Jiangsu power grid.

Presently, existing commercial compressed air energy storage power plants in the world are all fossil fuel-based, relying on natural gas and leading to secondary carbon emission. As the first nonsupplemental combustion compressed air energy storage power plant, this project achieves zero carbon emissions while the energy storage efficiency is approximately 5% higher than that of the current highest efficiency of the existing fossil fuel-based commercial plant, e.g., the efficiency of the McIntosh Power Station in the United States, which is approximately 55%.

This project was approved by the Department of Energy in 2017, and construction started in 2020. The Department of Electrical Engineering of Tsinghua University is the technology developer and provider. Shengwei Mei, a professor at Tsinghua University and the vice president of Qinghai University, is the principal scientist of this project. Xiaodai Xue, an associate researcher at Tsinghua University, served as the chief engineer of this project. The first set of core equipment, such as high-temperature cen-

trifugal compressors, high-capacity heat exchangers, and high-power air turbines, were developed and verified. Additionally, this project established a standard in the field of compressed air energy storage. This project has achieved a zero breakthrough in the commercial operation of compressed air energy storage technology in China and will become a benchmark for new energy storage.

After this project is put into operation, it will continue to optimize operations, focusing on three major goals: compressed air energy storage technology tests, standard creation, and engineering and commercial operation demonstration. It will continue to build a new energy storage industry benchmark. Meanwhile, the project team will accelerate the second phase of the project and provide new energy storage solutions for constructing new power systems dominated by new energy.

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Declaration of competing interest

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