World's largest flow battery energy storage station connected to grid

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Dalian Flow Battery Energy Storage Peak-shaving Power Station. Credit: DICP

The 100 MW Dalian Flow Battery Energy Storage Peak-shaving Power Station, with the largest power and capacity in the world so far, was connected to the grid in Dalian, China, on September 29, and it will be put into operation in mid-October.

This energy storage project is supported technically by Prof. Li

Xianfeng's group from the Dalian Institute of Chemical Physics (DICP) of the Chinese Academy of Sciences. And the system was built and integrated by Rongke Power Co. Ltd.

The Dalian Flow Battery Energy Storage Peak-shaving Power Station was approved by the Chinese National Energy Administration in April 2016. As the first national, large-scale chemical energy storage demonstration project approved, it will eventually produce 200 megawatts (MW)/800 megawatt-hours (MWh) of electricity.

The first phase of the on-grid power station project is 100 MW/400 MWh. Based on China's average daily life electricity consumption of 2 kWh per capita, the power station can meet the daily electricity demand of 200,000 residents, thus reducing the pressure on the power supply during peak periods and improving power supply reliability in the southern region of Dalian.

Energy storage technology can help power systems achieve the strain and response capability needed after large-scale access to the power grid. It is also particularly important in facilitating the use of renewable energy, which is key to helping China achieve its carbon peak and carbon neutrality goals but is not always accessible due to variations in wind and sunlight, etc.

System debugging. Credit: DICP

The Dalian Flow Battery Energy Storage Peak-shaving Power Station, which is based on vanadium flow battery energy storage technology developed by DICP, will serve as the city's "power bank" and play the role of "peak cutting and valley filling" across the power system, thus helping Dalian make use of renewable energy, such as wind and solar energy.

These renewable energy sources will be used to charge the station's batteries during the grid load valley period by converting electrical energy into battery-stored chemical energy. Later, at peak grid load, the stored chemical energy will be converted back into electrical energy and transmitted to users.

The station's energy storage technology uses vanadium ions of various

valence states. Electrical energy and chemical energy are converted back and forth through redox reactions of these ions in the positive and negative electrolytes, thus realizing large-scale storage and the release of electrical energy.

Power module. Credit: DICP

Electrolyte tanks. Credit: DICP

This technology is promising in large-scale energy storage applications because of its excellent safety, good reliability, large output power and storage capacity, long life, good cost-performance, use of recyclable electrolytes, and environmental friendliness.

Additionally, this technology can work with conventional thermal power, nuclear power, and other power sources, providing peak regulation and frequency regulation for the power system as well as improving its flexibility.

The Dalian Flow Battery Energy Storage Peak-shaving Power Station

will improve the renewable energy grid connection ratio, balance the stability of the power grid, and improve the reliability of the power grid, thus serving as a model for electricity peak-shaving and renewable energy grid management in China.

Provided by Chinese Academy of Sciences