2UCD401162

Article
PCS100 ESS - ABB and Prudent Energy working together to provide grid stability

Prudent Energy, together with ABB, have provided countless grid stabilization solutions to the renewable energy industry. From Slovakia to China, ABB and Prudent Energy are applying technological "know how" to provide the opportunity to store energy from the electricity grid and return it when required. This offers a range of options to strengthen and enhance the performance, quality and reliability of smart electricity grids.

To maintain efficient transmission and distribution, the active and reactive power balance in a system needs to be controlled. Inadequate active and reactive power management can result in high network losses, equipment overloading, unacceptable voltage levels, voltage instability and even outages. ABB and Prudent Energy have provided a turnkey solution incorporating ABB's 100 kW PCS100 ESS, PLC (programmable logic controller) system, transformer and circuit breaker with Prudent Energy's specialized VRB battery to a pioneering microgrid customer in Slovakia. Prudent Energy is the designer, manufacturer and integrator of the patented Vanadium Redox Battery (VRB®) Energy Storage System – a long-life, environmentally friendly "flow battery" system. Prudent's technology integrates smoothly with ABB's PCS100 ESS as it works by charging the VRB battery and regulating the power flow by discharging power to the grid when wind and solar energy output varies, and during unstable events, such as extreme weather conditions. After many tests, ABB's power protection team in China provided a new solution for Prudent's VRB battery to solve the problem of initial charge. The end result was an improved solution based on past projects with Prudent using their VRB battery system, which is smaller sized, lower cost and easier to operate.

The complete solution of ABB's PCS100 ESS paired with Prudent's VRB Energy Storage System

China's energy demand is growing rapidly and renewable sources are a key part of the country's new energy strategy. To gain more knowledge and test the available technology in certain areas, China State Grid (SGCC) initiated the "Golden sun demonstration project" in Zhangbai county, Hebai province. The project involves 100 MW windpower, 50 MW solar and 20 MVA energy storage systems, split into smaller slices and supplied by different technologies and manufacturers. This is to allow SGCC evaluation and the benchmarking of the different concepts and technologies and also to test system performance for different applications.

Prudent Energy and ABB delivered a 2 MVA Energy Storage System based on Prudent's VRB Vanadium Redoxflow battery and ABB's PCS100 ESS power converter technology integrated with transformer, switchgear and control (PLC). The system will be used for multiple application tasks like smoothing renewable energy output, peak shaving and frequency regulation. At that time it was also the first Megawatt class installation in China for ABB and Prudent Energy.

Prudent's VRB is an energy battery offering supply over many hours and therefore perfectly suited for smoothing or shifting renewable generation.

ABB's 2 MW PCS100 ESS that will help complete the energy storage function with Prudent Energy

ABB's PCS100 ESS and Prudent's VRB Energy Storage System that has been installed on Jeju Island located in between Korea and Japan

ABB team in China L-R: Leo-Yan Zhang, Pan Gao, Fanshi Kong, DeDi Li, Hongzhang Sun, Luping Qi, Bettey-Yuhua Lu, Amanda-Wei Li and Guang Bai

Wind and solar energy are sustainable, clean sources of energy that have the potential to make a significant contribution to today's economy. About 16 percent of global final energy consumption comes from renewable resources. While many renewable energy projects are large-scale, renewable technologies are also suited to rural and remote areas, such as islands, where energy is often crucial in human development. ABB have provided a 100 kW PCS100 ESS to Prudent Energy to work in conjunction with their VRB battery system. This solution has been installed in a laboratory on Jeju Island, which contains wind turbines and solar cells.

In 2006 Korea established the "Energy Basic Law" which created a suite of incentive and support programs to encourage a shift towards a more sustainable energy generation base. These programs included such things as the building of 100,000 green homes, special financing tools and tax models for local governments utilizing green technology, and mandatory use of renewable energy in new public buildings.

Jeju Island, situated on the southern tip of Korean Peninsula, is the biggest island in Korea. The regional government is keen to utilize a high percentage of renewable power generation for the island. A number of projects for wind and solar farms are underway or already in operation. The focus is to create an infrastructure that is capable of supplying the island, even with the HVDC link to the mainland disconnected. A number of institutes are working on this strategy. With a high portion of renewable energy, grid stabilization and energy smoothing support is vital. This is a typical application for energy storage systems. ABB's PCS100 ESS converter technology is able to establish a grid on its own, similiar to a synchronous generator, therefore allowing renewable energy to connect to the grid. This puts the PCS100 ESS in a good position to be considered as one of the core technologies. Together with Prudent's VRB, a small demonstration and test system was installed at the island's laboratory to investigate the best power system topology and control strategies. The project is significant to ABB, as it is the first battery energy storage system in Korea. This combined solution has helped Prudent's VRB battery achieve stable storage and release according to the grid's requirement. For the grid, PCS100 ESS is like a synchronous generator, but it is more flexible to operate and faster to respond to grid instability. It supports the voltage even if the grid power is off, and has black start capability. Black start capability means you can start the system without the grid, purely from the battery.

Therefore, the PCS100 ESS is providing the overall system with the capacity for storage or release of 200 kWh of energy to help grid stabilization on the island. The PCS100 also provides a pre-charge before the system connects to the grid for use.

In this application it was desirable to keep sections of load supplied, so the PCS100 ESS system can also be set to operate in island mode where the system disconnects from the main grid but continues to supply local loads. When the grid returns, the systems will automatically resynchronize and return to grid connect mode. Based on the success of the Indonesian and State Grid Corporation of China projects, Prudent trusted ABB's advanced technology and the excellent service that is offered globally. ABB's PCS100 ESS has the added advantage of providing grid code compliance – vital in today's wind and solar market. ABB accomplished the Factory Acceptance Test, and delivered the solution to Prudent Energy on time.

For further information please visit:
www.abb.com/energystorageandgridstabilization