

EXPLORATION AND PRACTICE OF ENERGY STORAGE TECHNOLOGY IN SHANGHAI

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Energy storage system technology plays an important role in smart grid. Analyzing from the view of existing status and problems faced by the Shanghai grid, the article puts forward the necessity of applying energy storage technology in a large urban grid and the achievements in the key technologies in the Shanghai grid. As a comprehensive demonstration base for the pilot project of the smart grid in Expo 2010 by the State Grid (SGCC), the Shanghai Caoxi Energy Conversion Exhibit Station is also introduced in detail.

By the end of 2009, Shanghai Municipal Electric Power Company (SMEPC) possessed 16.5766 gigawatts (GW) in generation capacity and 101.5547-GVA transformer capacity in 815 substations between 35 kilovolts (kV) and 500 kV, with the annual power generation of 78.270 terawatt hours (TWh) and annual power sales of 91.760 TWh (see Figure 1).

As a grid operator of a typical mega-metropolis, SMEPC encounters three primary challenges:

- Soaring load, large peak-valley difference, and high pressure in grid construction and peak load regulating;
- Rapid development of renewable energy; and
- Stricter requirements imposed on electricity quality.

The core technology of energy storage is a front-edge technology with strategic influences and is in urgent need for the power grid development. State Grid Corporation of China (SGCC) has set up special projects for major scientific and technical innovation of energy conversion and assigned SMEPC a project of Development and Application of Stationary Battery Storage System for Large Urban Grids.



Fig. 1. Distribution of energy storage systems in the Shanghai grid.

After three years of hard work, a series of substantial achievements has been made.

- Research and development of the Battery Energy Storage System (BESS)

On May 28, 2007, a base for the research of NAS battery was set up jointly by SMEPC and the Shanghai Institute of Ceramics, Chinese Academy of Sciences, complying with the principle of “entity-mode operation, project-oriented management and industrialization preparation,” and mainly committed to the research on NAS batteries, cell modules, stationary batteries, and its monitoring system. In May 2010, the 100-kilowatt (kW) NAS BESS was put into grid-connected operation.

- Demonstration of the BESS

To demonstrate the achievements made by SGCC in energy storage in a large urban grid and in electric vehicle energy supply, SMEPC has embarked on building Caoxi Energy Conversion Comprehensive Demonstration Base since the end of 2009, which is one of the nine comprehensive demonstration projects of the smart grid for the Shanghai Expo by SGCC.

An energy storage station, which is the first connected to the utility grid for demonstrative operation in the country, is built in the base with different kinds of energy storage subsystems amounting to 300 kW and remote-monitoring energy storage subsystems totaling 110 kW, in which the mode of distributed storage, concentrated monitoring, and unified dispatch is realized through a management system.

The goals of demonstrating the hundred-kilowatt-class energy storage system over the duration of the Shanghai Expo have been achieved by SMEPC. Next, the company will ultimately aim at popularizing the application of megawatt-class energy storage systems in the urban grid to obtain the independent intellectual property rights of the stationary BESS for large urban grids and make positive contributions to the development of domestic energy storage technology and the promotion of large energy storage stationary batteries.