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Advanced Challenge of Kyushu EPCO due to Rapid PV Penetration

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Abstract

In Japan, the introduction of a feed-in tariff system in July 2012 has increased the variable renewable energy (VRE) of which output rapidly fluctuate such as wind or photovoltaic power generation. In Kyushu area, a large number of PV generators have been interconnected on the power grid because of both an inexpensive construction site and high solar radiation intensity. The total capacity of grid-connected PV generators exceeds 7,700MW at the end of January 2018 and another more than 4,000MW capacity of PV will be surely connected to the grid. IEA report described that Kyushu area is defined as Phase 3 level in which electricity supply is characterized by significantly higher levels of uncertainty and variability. The power system flexibility is very important.

We are now upgrading the power grid and system operation technology in cooperation with Transmission Division (TSO) and Distribution Division (DSO); the control system of PV generators and voltage control system for stabilizing distribution system.

Specifically, we introduce a solar radiation amount prediction method utilizing satellite images and grasp the amount of power generation of the changing VRE. And when the supply exceeds the demand after the output of other generators such as thermal power is suppressed, we control the output of VRE with the output control system. This output control system was developed in collaboration with the PCS manufacturers and succeeded in controlling the output of multiple PV power plants of about 400MW in February 2018. Moreover, for effectively utilizing VRE, we installed a large scale battery storage system (output:50MW, storage capacity:300MWh) featured NAS (Sodium-Sulfur) batteries, as a part of “demonstration project to improve power supply-demand balance by the large-scale battery system”.

In addition, we have built a smart grid test facility to develop the advanced distribution systems. The test facility is connected to the commercial line and can simulate real distribution system with loads, storage battery and voltage control units. Utilizing this demonstration test facility, we developed some new type voltage-control equipment such as SVC and STATCOM. After evaluating the effect of the equipment on power quality, we are introducing to actual system.