

**Technical Development for Smart Grid Project at Mitsubishi Electric Corp**

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The energy policy are greatly affected by social, environmental and technical issues, such as the potentiality of natural resources, public perception of nuclear energy, strategy for global warming, and technical difficulties. A massive increase of installations of photovoltaic, wind generation and other renewable energy sources is promoted by governments and agencies as an alternative to fossil fuels around the world. The Japanese government policy for carbon emission reduction is based on the increasing of generation capacity for photovoltaic to 28GW by 2020 and 53GW by 2030.

Even if renewable energy sources are expected to contribute to the emission reduction, there may be some technical difficulties to integrate a large amount of renewable sources to the existing electric power system. Difficulties and challenges associated with the renewable energy sources are mainly related to the location of the sources and to the unstable output of the generation. Regarding the Japanese power system, three main problems are expected: the first is the impact of photovoltaic production on the voltage regulation in the low voltage distribution network; the second is the utilization or control of the possible excess of power from renewable energy sources in some periods of the year; the third is the impact of renewable sources output fluctuation on the frequency and the correlated costs of ancillary services.

Mitsubishi Electric Corp. is constructing a test facility to promote the research and development of smart grid technologies, which could contribute to the stable and efficient supply of electricity. The facility is composed of 4MW size of photovoltaic system, synchronous generators, which could simulate hydro pump-storage system, storage devices such as Nas and Lithium-ion batteries. These devices are integrated in a test transmission system with voltage regulator devices such as SVC and SVR. Furthermore, a digital simulator for power system analysis is inter-tied with the transmission facilities through a BTB device.

In this facility, many technical developments for powers system dispatch and control such as advanced EMS/SCADA, DAS and AMI, will be tested and the effectiveness of algorithms and functionalities will be proved.

This paper presents the in-house facility at Mitsubishi Electric Corp. which is now under construction to promote the research and development of smart grid technologies. The future electricity supply system could be simulated and analysed on the facility. In addition, several technical developments for large scale integration of renewable resources are discussed.