HARPS Challenges to BIG-PV Power Systems

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This talk presents the outline and several current research topics of the research project "System Theory for Harmonized Power System Control Based on Photovoltaic Power Prediction (HARPS)," supported by the EMS CREST research program of JST (April 2015-March 2020).

According to "Long-term Energy Supply and Demand Outlook" proposed by METI in July 2015, the target in 2030 of the photovoltaic (PV) power installed capacity in Japan is 7% of the total electric energy in the entire Japan, which corresponds to about 64GW. This enables us to reduce CO_2 emission gaining momentum. However, the PV power includes unpredictable large fluctuations. Thus, it is required to develop new control technologies to achieve a stable electric power supply using PV generation forecasts. In addition, there are needs to fundamentally review frameworks of the system structure of the whole power system to achieve the supply and demand balance. Electric power control systems are going to be renewed along with various kinds of new technologies such as Virtual Power Plant and Real-time Market after the deregulation of electricity and the unbundling of electricity generation and transmission.

The main purpose of this research project is to develop a system theory of next generation power system control in order to achieve a harmonized power supply under large penetration of photovoltaic (PV) power systems enabling PV introduction of 102GW, and further towards PV introduction of 330GW. In particular, this project aims to develop a power system control framework and methodology, fully exploiting PV/demand power prediction, and focusing on, in addition to system operation and user layers, functions and properties of a middle layer consisting of various kinds of power aggregators such as demand-response aggregators, electricity-trade balancing groups, and cooperative electric power converters, in other words, the main topics are as follows:

(i) Electric Power System Design: a system design theory composed of supply layer, middle layer, and consumer layer

(ii) Prediction Technology: a PV generation prediction technology adapted to power system control techniques that achieves a stable power supply

(iii) Control Technology: a power system control theory and technology to realize a harmonized stable power supply from the perspectives of fairness and comfort as well as the economics and environmental friendliness, by fully exploiting PV generation predictions.

See http://harps-crest.jpn.org/ for the further details on this project.

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