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Hitachi R&D Activities in Smart Grid Demonstration Projects

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Abstract

A great amount of penetration of renewable energy such as wind and solar power is anticipated in the world, backed up by regulations and subsidies of governments such as feed-in tariff. From the viewpoint of power systems operation, the penetration of renewable energy implies that, in the near future, we are obliged to confront the problem of power system instability such as voltage fluctuations and load imbalances because the output of renewable energy depends on the weather which is naturally change-prone and the penetration of renewable energy is currently going forward at a rapid rate. Therefore, power system engineers should make their efforts to develop new technologies and to get prepared for the coming problem of power system instability. I would say that one of the most promising technologies to this problem is smart grid. At the same time, however, it is also evident that smart grid technologies cannot be immediately accepted by everyone because smart grid is a new thing and unfamiliar to most people. Therefore, what we have to do is not only to develop smart grid technologies, but also to implement them to demonstration projects, to open the results of the demonstration projects and show the pros and cons, and finally to convince global citizens of the reliability, affordability and the environmental friendliness of smart grid technologies.

This presentation firstly refers to the mechanism how renewable energy causes power system instability. Secondly, I show Hitachi's key technologies that was demonstrated in three projects: (1) Hokuto Project, in which 400kW PCS (power conditioning system) with automatic tuning function of control parameters, (2) World Expo Micro-grid Project, in which photovoltaic, batteries and fuel cells were used to supply electric energy to the micro-grid in a stable way and the load flow on interconnecting lines between the micro-grid and the distribution network were successfully controlled almost constant, and (3) Rokkasho Project., in which efficient use of multiple photovoltaics and heat pumps was achieved. Finally, I introduce the demonstration projects that Hitachi is carrying out in the world.

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