Autonomous Energy Management System Enabling the Maximum Penetration of Renewable Energy

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[Abstract]

Key Words　Renewable energy, Generation forecast, Energy management, Demand-supply balance, Power system

We propose the autonomous Home Energy Management System (HEMS) which realizes the activation of demand to control the supply-demand balance and collaborates with a centralized energy management in the whole power system. HEMS contributes to retention of the quality of energy service in residential buildings and to the large penetration of renewable energy such as photovoltaics into power systems. The building appliances, distributed energy generations, and energy storage systems are operated in a cooperative way with a central energy management system by HEMS in consideration of the renewable energy generation forecasted with the smoothing effect.

  The sub-theme 1, renewable energy generation forecast, established an insolation forecast model by multiple regression method and methodology for prediction error evaluation via the smoothing effect. The sub-theme 2, distributed autonomous energy management, started to measure electricity consumptions by minute and gas consumptions by 5 minutes for 50 families in apartment housings and prepared the analysis models. The sub-theme 3, cooperative control of distributed/central energy management, evaluated two types of the demand technology control to stabilize the system voltage and frequency. The sub-theme 4, energy demand-supply balance and planning, began to analyze issues and countermeasures, and established a total scheme of distributed autonomous energy management.