OGIMOTO LAB.

[Energy Integration and a Smart Sustainable Society]

Collaborative Research Center for Energy Engineering

http://www.ogimotolab.iis.u-tokyo.ac.jp/

Department of Electrical Engineering and Information Systems

Energy System Integration

Energy system, which is a critical infrastructure to support social and economic activities, is currently facing new challenges to achieve security, economy, and reduction of environmental burden such as carbon emission for sustainability. Energy system requires transition to holistic optimization involving centralized and decentralized resources through integration of newer forms supply, i.e. photovoltaic (PV), wind power, and other renewables, as well as novel demand devices including electric vehicles, heat pump water heaters, and energy storages.

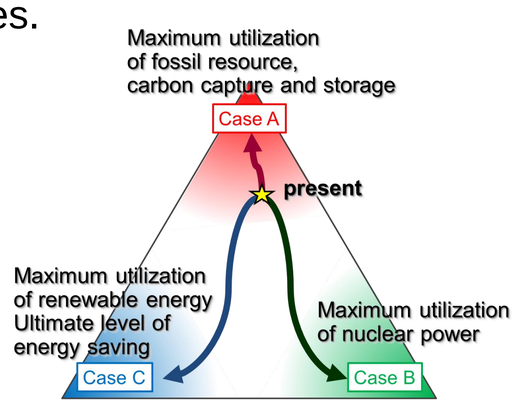
The upcoming energy system is requiring decentralized management for the integration of demand into demand-supply balancing in an energy system so as to accommodate renewable generation characterized by constantly fluctuating output and newer types of electrical loads. The decentralized energy management will assure flexibility in operation and system configuration as well as enhanced robustness against risk factors.

Energy System of the Next Generation

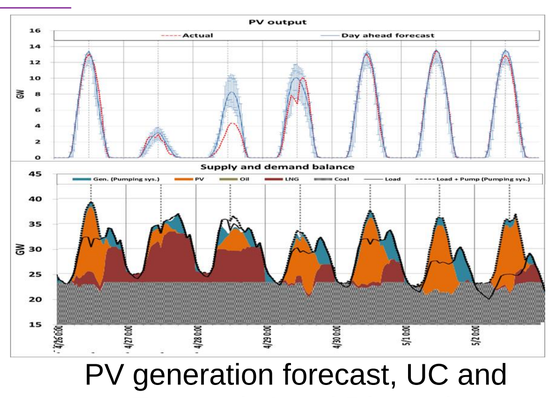
Establishing long term view with firm technical and socio-economic basis

Long term view covering technological innovation, socio-economic trend, and institution is crucial for studying energy issues. Our energy system integration research, aiming at the optimum energy system, covers the following areas using technology assessment, simulation, optimization, scenario planning, strategic study and other techniques.

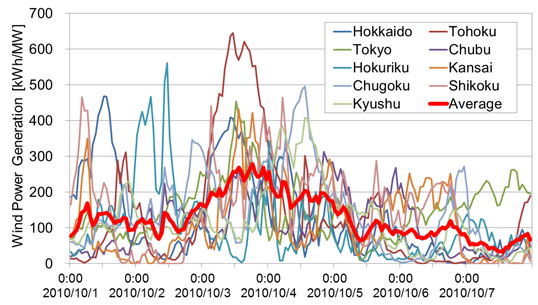
- Energy strategy
- Dynamic analysis and assessment of energy supply and demand
- Analysis of variation and generation forecast of renewable energy generation
- Unit commitment and load dispatch simulation



Three pathways of energy system evolution



PV generation forecast, UC and Economic Load Dispatch



Variation of Wind Power Generation

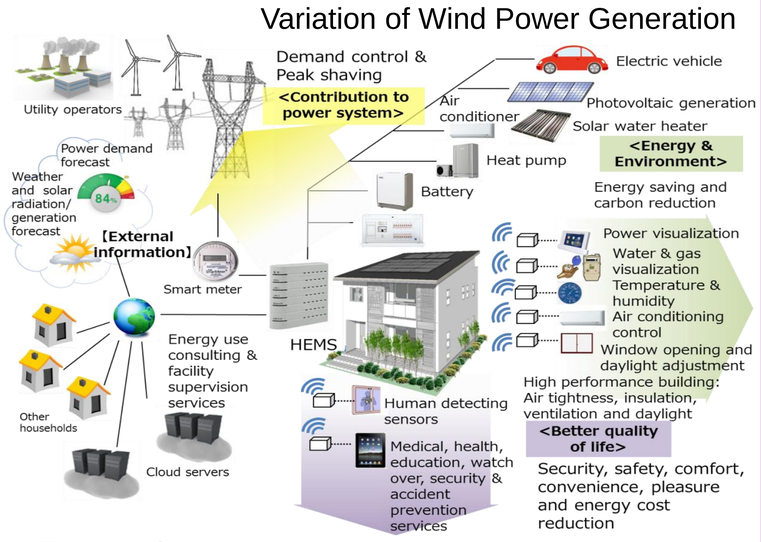
Distributed Energy System

Developing smart grid tightly integrated with overall energy system

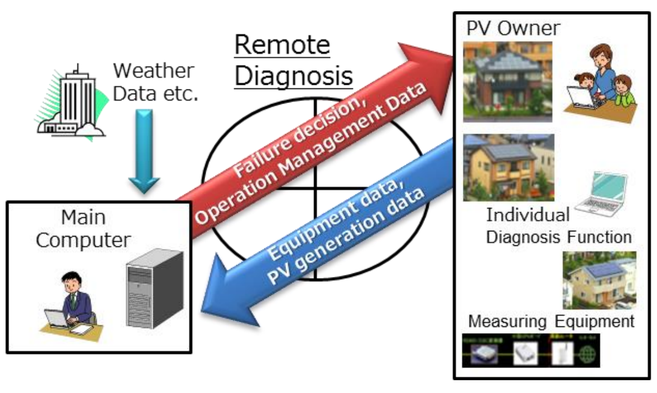
The high penetration of fluctuating generation from PV and wind would lead to difficulty of supply-demand imbalance within a whole power system. Stabilization of the overall system requires active harmonization between the centralized power system including transmission/distribution system and distributed energy systems/resources including energy storage.

Our goal of the following research areas aims at the three axes of values, which are not only "energy and asset management for energy efficiency, economy and environment" but "contribution to overall energy/power system operation optimization" while enhancing "quality of life of living and working".

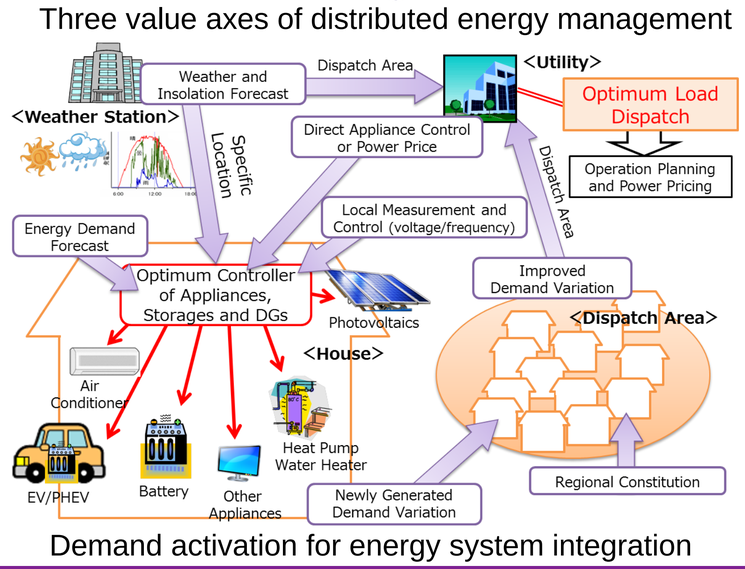
- Optimum operation scheduling of domestic energy use
- Distributed energy management, simulation and verification at COMMA House
- Asset management applied to distributed energy systems
- ICT technologies such as IoT and iDR



Three value axes of distributed energy management



Remote asset management of distributed systems



Demand activation for energy system integration