

IWAFUNE LAB.

[Sustainable Energy Demand and Supply System]

Collaborative Research Center for Energy Engineering

<http://www.iwafunelab.iis.u-tokyo.ac.jp/index.html>

Sustainable Energy Demand and Supply System

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Our research goal is exploring what kind of energy system has low environmental impact (in terms of carbon dioxide emissions or energy consumption) and how we can realize the system. The goal is simple, but we should consider wide-ranging constraints of the economy, the amount of resources, the international competition and political problems, the human preference, the uncertainty



Fig. "COMMA House" for HEMS Operating Experiments

over the future, the rigidity of existing systems, etc.

Interdisciplinary research is needed in order to properly assess those factors, not only engineering, but economics, social sciences. The following three topics of recent research in our laboratory.

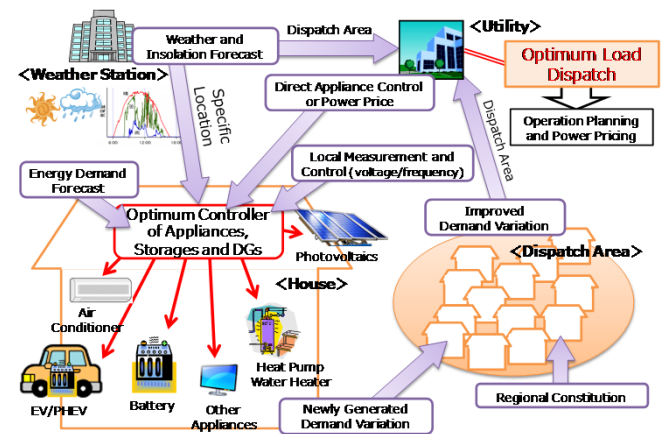


Fig. Autonomic Cooperative Energy Management System Including Renewable Energy Resources and Sophisticated Batteries

Autonomic Cooperative Energy Management System

We assumed the system for balancing supply and demand where centralized energy management treating a whole power system and decentralized energy management treating one building operate cooperatively.

Development of Evaluation Model of Area Energy Management

- Developing a city energy model of Area Energy Management System, including district heating and cooling, stationary battery, and aggregation of demand response
- Evaluating reduction of energy consumption, environmental load, economical balance of the system, and non-energy benefit such as residents' willingness to pay for energy self-supply

Controllability of Air-Conditioning in Residential Sector

In the conventional electric power system, utilities must supply required electricity to consumers for maintaining power demand and supply. Keeping the demand and supply balance by this way will become very difficult when renewable energy resources are introduced in bulk. To realize more efficient system, consumers must cooperate with suppliers.

In this study, the demand of air-conditioning in house is focused as demand which can be controlled. The pattern of electricity consumption can be changed by control of air-conditioner while the comfort inside the house is maintained.

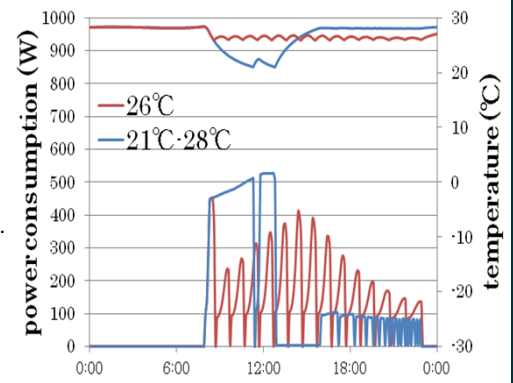


Fig. Electricity consumption and temperature in two settings of air-conditioner

Evaluation of Battery Operation Based on the Analysis of Smoothing Effect of Residential Electricity Consumption Using Measured Data

Residential electricity consumption pattern differs depending on family structure, home appliance, life style and etc. Therefore, electricity consumption that is fluctuating severely is smoothed out when aggregated with electricity consumption of other households. We are aiming to clarify the roles of HEMS and CEMS by using measured data to analyze the smoothing effect, and evaluate/optimize battery operation.

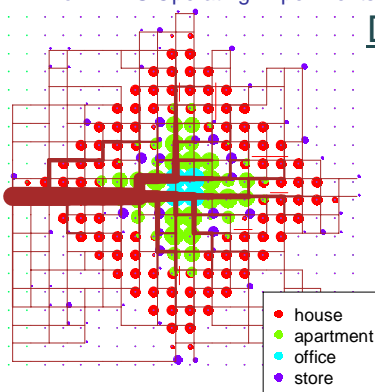


Fig. Building distribution and energy infrastructure in a modeled city

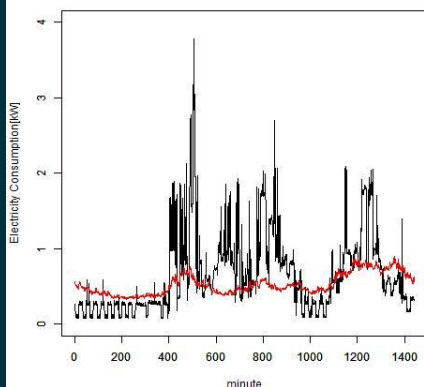


Fig. Electricity consumption of 1 household(Black) and average electricity consumption of 40 households (Red)