

# 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 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. "COMMA House" for HEMS Operating Experiments

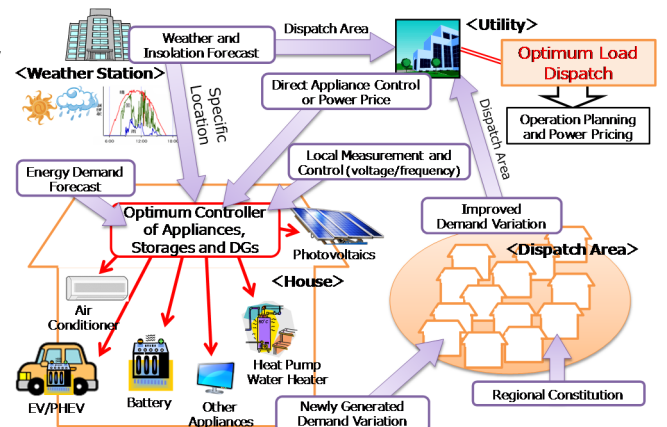


Fig. Autonomic Cooperative Energy Management System Including Renewable Energy Resources and Sophisticated Batteries

### 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.

### Estimation of Energy Demand Considering Population Decline and Aging

Population decline and aging in a community will also affect its energy demand in long-term. Considering these problems are needed to discuss town planning as "smart city" and "community energy management", since the change of energy demand will cause the proper selection of energy supply system. We are estimating future energy demand for household, commercial, and transport sectors in harmonized way based on people flow, which is traditionally estimated by each sector.

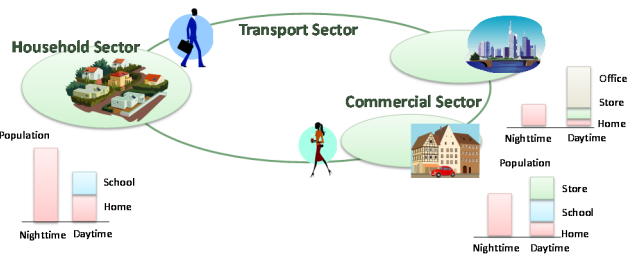


Fig. Estimation of Energy Demand based on People Flow

### Residential energy model with electric vehicle and photovoltaic system

To realize the low-carbon society massive introduction of photovoltaic power generation (PV) has been expected over the medium and long term in Japan.

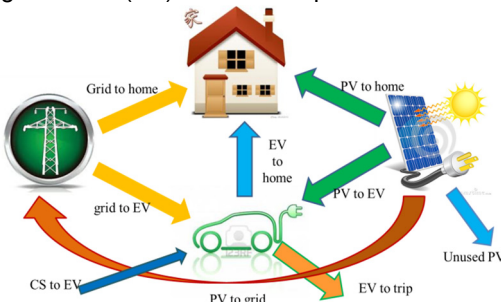


Fig. Power flow of PV-EV linkage model

However, the problem of reverse power flow by the mass introduction of PV has been an issue of concern in power network operation. As a countermeasure for reverse power flow problem, the method of increasing the self-consumption by using

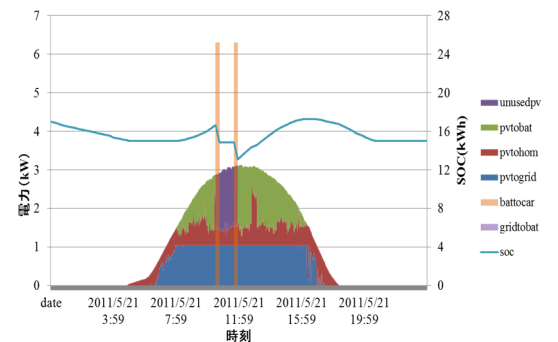


Fig. Power supply and demand balance on a sunny day

the electric vehicle (EV) as a storage battery for PV has attracted attention.

Assuming a household consisting of EV and PV System, we made a PV-EV linkage model to optimize the power supply and demand at the household, taking into account PV generation, EV usage patterns and electricity demand at the household. We study the reduction effect of reverse power flow due to PV by using EV batteries.