

Optimum Energy Utilization Technology – Contributing to More Comfortable and Enriched Life –

Brief Overview

We promoted researches on effective energy utilization technology supporting rich life and industry considering conformability and environment influence.

For low-loss SiC power semiconductor devices, through collaboration research, we developed production technology of epitaxial layers with quality and size (diameter of 3 inches) adaptable to supply to the commercial market for industrial uses. This opened a path to development and production of SiC power devices and converters.

Aiming at demonstration of “solitary aged people watching system” developed by CRIEPI, we started one-year demonstration test in Komae City. This system is intended to watch daily living conditions through analysis and prediction of use situation of electricity from electric current fluctuation generating from home appliance ON/OFF switching.

For next generation electricity grid technology started in FY 2008, as one of measures to alleviate reverse power flow to upper systems due to mass introduction of photovoltaic power generation (PV), we developed the optimum operation method for heat pump water heaters and batteries considering uncertainty of weather and hot water demand realizing consumption of PV-generated energy within consumers as far as possible.

Achievements by Research Theme

End use technology

- Customer energy utilization support
 - Started the demonstration test at Komae City of “solitary aged people monitoring system” developed by CRIEPI.
 - Developed data conversion method to protect privacy contained in customer’s load pattern. [R08006]
 - Clarified relation between energy saving effect and convenience (waiting time) caused by reducing the number of operating elevators. [R08004]
- Evaluation of system operational performance of new Eco-cute model
 - Reflected the most advanced Eco-cute type performance evaluation test results conducted for total 100 days for establishment of the national residential energy saving standards.
- Inverter with SiC device
 - Clarified limits of efficiency increase and compactification for several kW class inverters combined with conventional Si devices (Fig. 1) [R08027]
 - Developed new all SiC inverter circuits using SiC-JFET devices.
- SiC power semiconductor
 - Developed production technology of 3-inch diameter high-quality SiC epitaxial layers through collaboration research and supplied the epitaxial layers to the industry and national projects.
 - Promoted development of a technology to obtain high-quality epitaxial layers for fabrication of large capacity SiC devices and clarified a defect control method to reduce conduction loss of the high-voltage SiC device.
- Compact secondary battery utilization
 - Completed an assessment test facility of electric power storage system combined with heat pump component for complete electrical housing. [Q08018]

Next generation electricity grid technology

- Demand and supply integrated operation and control
 - Developed a planning method for optimum operation cooperating with demand side appliances and utility distribution system equipment at mass introduction of photovoltaic generation (Fig. 1). [R08025]
 - Developed and demonstrated an islanding detection method of dispersed generators that can ride through system disturbances such as frequency fluctuations. [R08013]
- Assessment of consumer response
 - Studied demand response (DR) value assessment method and extracted DR control measures adaptable to apply to the business consumer.
 - Estimated load reduction potential when applying DR control to offices and retail divisions in the electrical systems. [Y08034]
- Next generation grid communication foundation
 - Developed the basic concept of demand area communication network available for integrated control of demand and supply. [R08014]
 - Assessed time synchronization methods for wide-area control of a power system and fundamental function of the network system realizing low cost versatile control and data acquisition.
- Next generation power distribution components
 - Completed 3,900 A/cm² of critical current density by improving sintering methods of bismuth type super conductor of magnetic-shielded and current-limiting device.
 - Completed 180 kJ of short-circuited energy limit at the super conducting cylinder for magnetic shielded super conducting current limiting device at an actual size (diameter 450 mm).

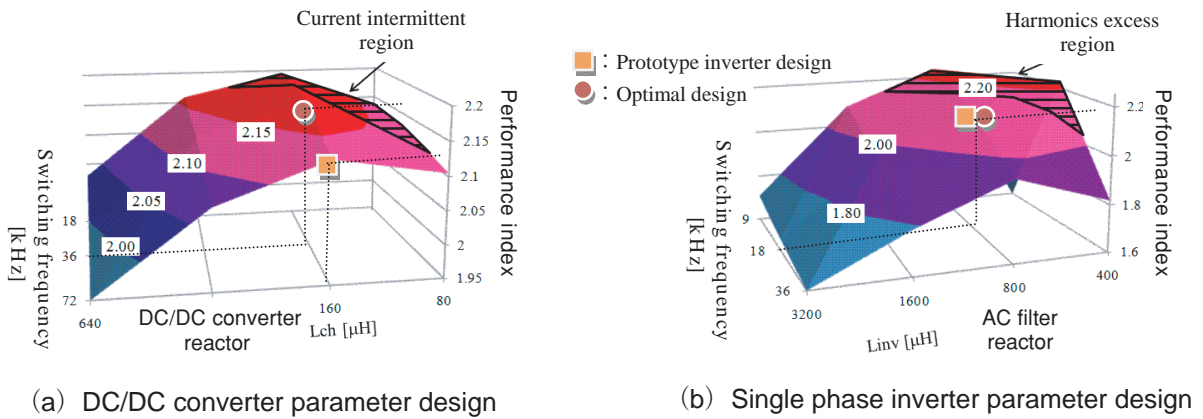


Fig.1 Optimal design of the hybrid inverter parameter considering efficiency and volume

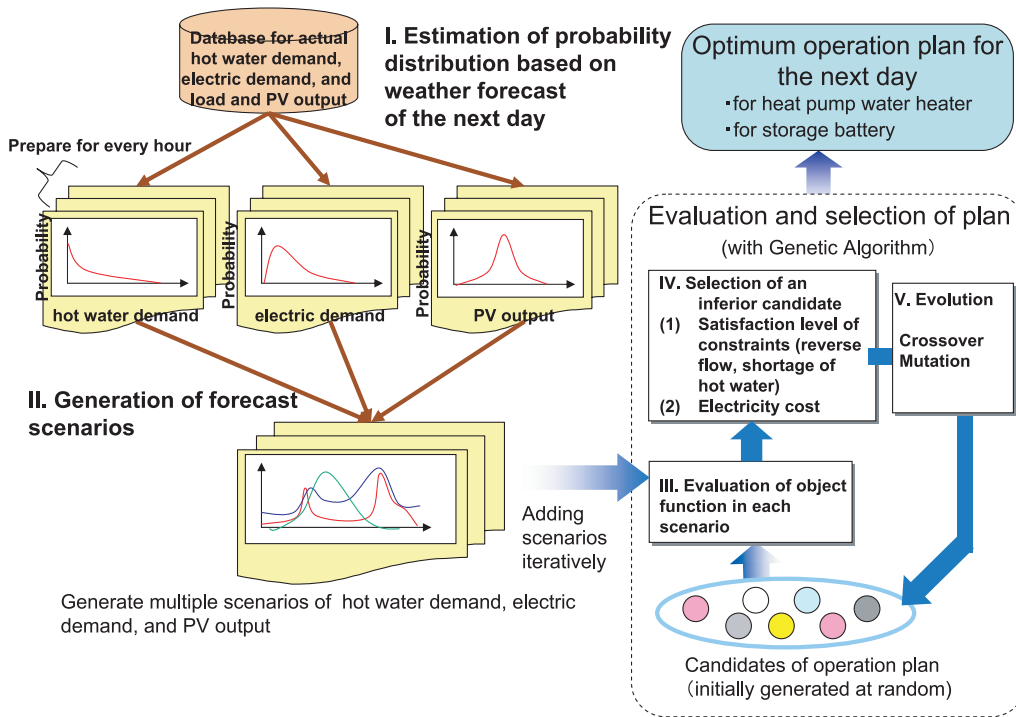


Fig.2 Optimum operation planning method for heat pump water heater and storage battery (considering uncertainty of hot water demand, electric demand, and PV output)