4. Optimum Energy Application Technology: Contributing to More Comfortable Living

(1) Customer energy utilization support: FY 2006 - FY 2008

[Objectives]

To support the development of new power demands while promoting the efficient use of energy as required by society in the face of the progressive liberalization of the electricity market and harsher competition between energy suppliers.

[Principal Results]

- The indoor thermal environment design tool for homes was improved to enable the simultaneous calculation of the thermal comfort and air-conditioning load of all rooms for practical application of the tool.
- The load survey system for ESCOs to which the non-intrusive monitoring system developed by the CRIEPI was applied was introduced to a commercial building for the first time and its valid performance was confirmed.
- A tool was developed to find the combination of heat pump and hot water tank which meets installation space restrictions and offers the lowest total cost (sum of the installation cost and operating cost) for the purpose of facilitating the wide user of heat pump type water heaters.

(2) Assessment of the system operation performance of new Eco-cute model: FY 2006 - FY 2008

[Objectives]

To establish a performance assessment method and to conduct the assessment of the system operation performance to assist

the development and commercialisation of a new Eco-cute model with high efficiency, compact design and applicability to cold regions.

[Principal Results]

- A new performance assessment method in consideration of user convenience was developed for a new Eco-cute model (Table 1).
- A new "heat-pump performance assessment test facility" was designed, fabricated and installed and the performance assessment of the new Eco-cute model was conducted.

Table 1 Performance Assessment Items for Eco-Cute

Development Theme	Performance (Hot Water Capacity, Power Consumption Level and Performance Coefficient)	Functions and Capacity to be Secured
Compact Design	· Unit performance (rated (intermediate season), summer, winter and defrosting) · Annual system efficiency of equipment with general region	· Continual hot water supply capacity · Maximum hot water supply capacity · System performance on intermittent hot water supply pattern
Cold Region Application	· Unit performance (rated (intermediate season), summer, winter, defrosting in winter and hot water supply in winter in cold regions) · Annual system efficiency of equipment with cold region specifications · Annual system efficiency of multi-functional equipment with cold region specifications	· Continual hot water supply capacity · Maximum hot water supply capacity · Capacity of operation in cold ambience in winter in cold regions · Integrity at the time of power failure in cold regions · Integrity in cold regions

(3) Development of high performance inverter for customer appliances: FY 2006 - FY 2008

[Objectives]

To develop and demonstrate a next generation inverter incorporating a SiC semiconductor device in order to respond to customer demands for high performance (low loss and compact design) and low cost electronic power equipment.

[Principal Results]

- Based on quantitative examination of the cost-benefit performance of a SiC diode, the target was selected for the demonstrative development of an inverter incorporating a SiC diode to be fabricated in FY 2007 and the specifications of this inverter were decided.
- In connection with a simulation programme for the efficient design of an inverter circuit, a basic analytical algorithm and a semiconductor device model were developed and their performance to analyse the dynamic characteristics of the inverter was verified.

(4) Establishment of SiC semiconductor technology for customer equipment: FY 2006 - FY 2008

[Objectives]

To lead the technological development of a large capacity SiC semiconductor in Japan with a view to contributing to the innovation and energy saving of power technologies by means of using an ultra-low loss SiC semiconductor power converter.

[Principal Results]

- For the development of an element technology for a large capacity SiC power semiconductor, a high speed epitaxial growth technique of more than 50 ?m/hr, which is the highest level in the world, was developed to produce practical 4 inch diameter substrates.
- The highly accurate detection of crystal faults by photo luminescence and X-ray topography was demonstrated as a technological development result to produce low fault elements. In addition, the successful detection of crystal faults generated in the formation process of the ion injection layer was achieved to produce such elements.