Secondary Battery Utilization Technology

Background and Objective

The secondary battery energy storage technology is a key for supply of low carbon electric power, and electrification of house demands and transportation fields, which are very effective against problems caused by global warming.

One of the aims in this project is to propose a utilization method of the heat pump type water heater and secondary battery energy storage hybrid system (HP and BES hybrid system) installed in residential house for electrification of house demand field. And for diffusion of electric and plug-in hybrid vehicles (EV and PHV), we proposed guidelines for the installation of outlet plugs for normal chargers, and study the optimization of the charging infrastructure by the traffic simulator. We researched and studied the transition of the diffusion policies and impact on the markets of EV and PHV to improve the electrification of transportation field.

Main results

1. Development of HP and BES hybrid system installed into residential houses

The prototype of HP hybrid BES system [Q08018] was connected with PV as shown in Fig. 1. We evaluated the energy consumption efficiency of this system, and studied an operation method for absorption of excess energy generated by PV for stabilization of distribution lines. We then evaluated the CO_2 emission reduction effects by high efficient residential energy systems with analysis of the property of hot water demands and the improvement of the CO_2 emission factor of the bulk power system. The HP type water heater system can decrease more than gas boilers and FC co-generation system [Q09019].

2. Facility guideline for outlet plug of standard charger for EV and PHV

Prior to the serious diffusion of EV and PHV, guidelines to be considered, such as ensuring safety, to install outlet plugs of normal charger are summarized for five installation sites; individual house, apartment house, business building, commercial store and parking lot. Recommendations of normal chargers installed indoors and outdoors are proposed on the basis of requirements of JEAC 8001 which are the electrical engineering regulation for customers in Japan (Fig. 3) [M09006].

3. Development of Traffic Simulator for Analysis on Charging Infrastructure of EV

Traffic simulation for a model city of population of two million was carried out to analyze the relationship between EV performance, traffic situation, and the requirements of the charging infrastructure for EV diffusion. The required number of the charging infrastructure was estimated, in case of improvement of the EV performance and provision of normal charge infrastructure [L09009].

4. Transition of the diffusion policies and their impact on the electric vehicle market in Japan

The objective of this research was to review transition of the diffusion policies and plans and their impact on EVs in Japan. The targets on the number of EVs were never achieved because of EV characteristics, such as their short mileage per charge and high price. Although car-sharing services and rent-a-car business were introduced to resolve these issues, targeted user's lifestyles and trip patterns were not matched with those services. [Y09015].

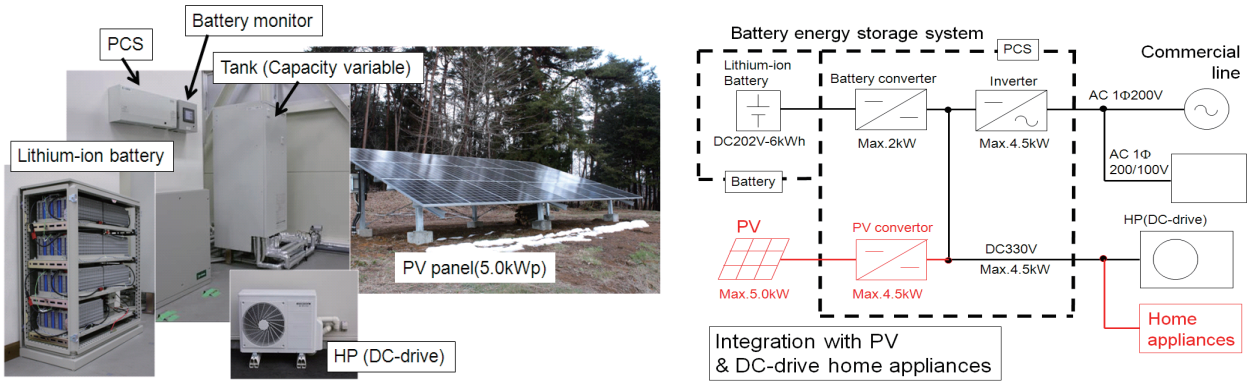

Fig.1 Plot type battery energy storage system integrated with heat pump water heater for residential use connected with PV (left: components, right: system diagram), for validation of energy efficiency improvement under the simulated conditions with daily heat-water demand pattern in a house, and propose of operation method for absorption of excess energy generated by PV.

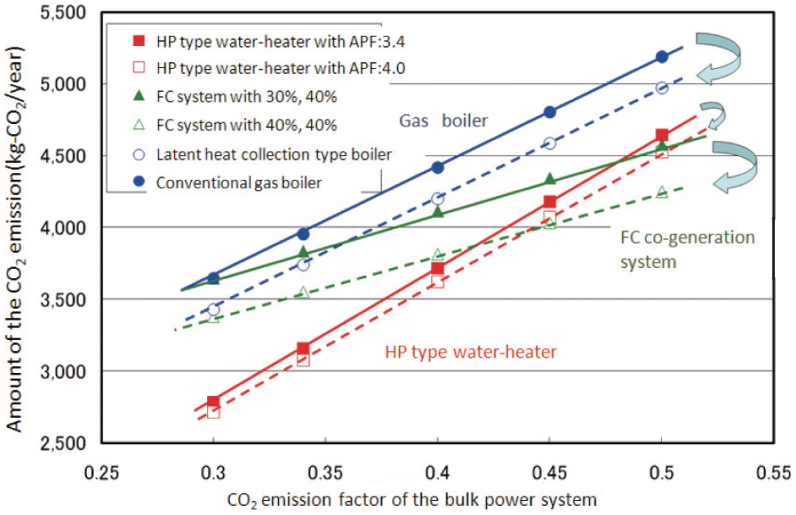

Fig. 2 Comparison of CO_2 emissions from residential houses installed with high efficiency water-heater systems with consideration given to residential demands.

The amounts of CO_2 emission from the residential houses were calculated by simulation with electricity and hot water demand patterns in a year. HP type water-heater systems can decrease CO_2 emission more than gas boilers and FC co-generation systems with improvement of the CO_2 emission factor of the bulk power system. The HP type systems can decrease the amount of CO_2 emission more than FC co-generation systems in less than 0.4 kg-CO_2/kWh of the CO_2 emission factor of the bulk power system.

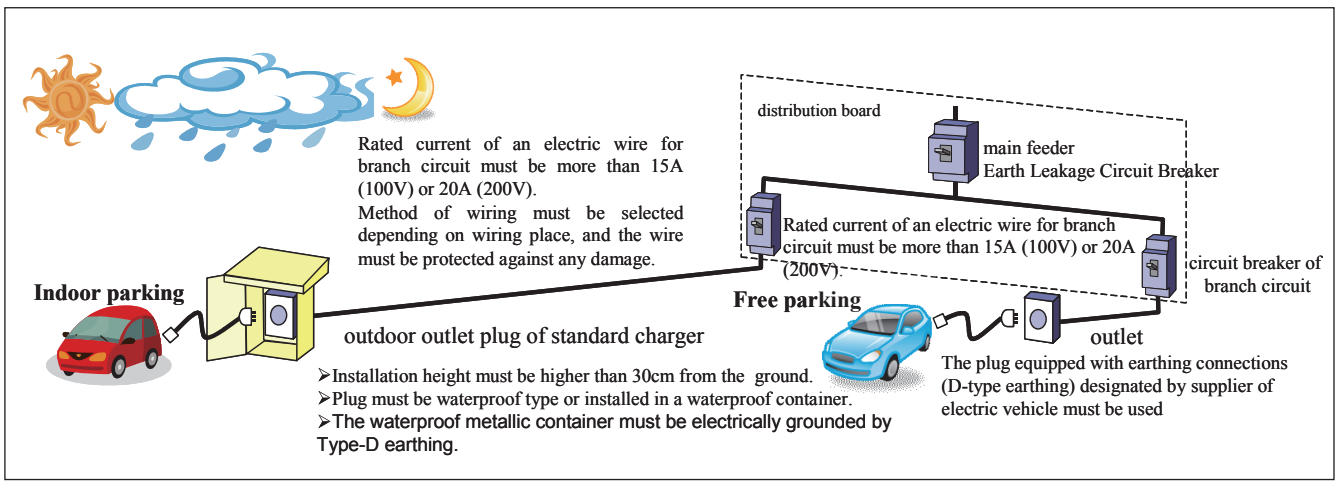

Fig.3 Example of installation of standard charger

Recommendations for indoor and outdoor standard chargers on the basis of JEAC