Storage Battery Systems That Reuse EV Batteries

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With the spread of electric vehicles (EV) in recent years, a system for safely and effectively utilizing batteries used in EVs is being established.

On the other hand, storage battery systems for utility customers were used to reduce the contract demand by cutting the peak of power consumption to save energy costs. If the results of the virtual power plant (VPP) demonstration project of the Ministry of Economy, Trade and Industry, which started in FY2016 and planned to continue until FY2020, are systematized, utility customers can acquire income besides the limit on the maximum power consumption, and the effect of investment-return will be higher.

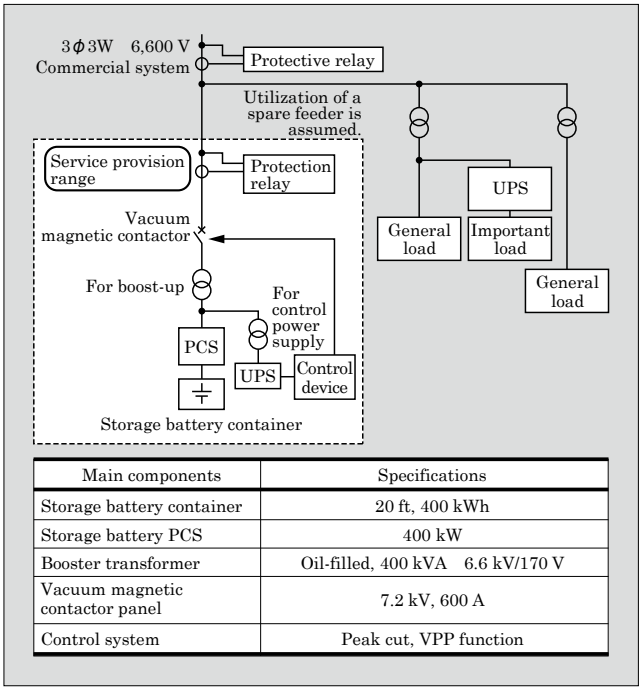
This system is a storage battery system for utility customers equipped with used EV storage batteries that has functions for supporting peak cut, VPP, and business continuity plans (BCPs). Figure 1 shows the appearance.

1. System Configuration

This system has been created by combining a 20-feet container that stores the used storage batteries provided by 4R Energy Corporation by twice the loading efficiency of the conventional one with Fuji Electric's power conditioning systems (PCSs) and control systems. Figure 2 shows the system configuration and the specifications of main components.

Conventionally, storage battery systems were proposed according to each customer's request. Fuji Electric has developed a standard package with Sumitomo Corporation and Japan Benex Corporation to reduce the costs. The system can be customized according to the customer's request.

Fig.1 Used EV storage battery system



Main components	Specifications
Storage battery container	20 ft, 400 kWh
Storage battery PCS	400 kW
Booster transformer	Oil-filled, 400 kVA 6.6 kV/170 V
Vacuum magnetic contactor panel	7.2 kV, 600 A
Control system	Peak cut, VPP function

Fig.2 System configuration and specifications of main components

2. Space-Saving Design

The storage battery packs will be used in the state they were mounted on EVs to utilize the safety technology of automobile parts. A storage battery container with great safety and mounting density has been co-developed by making full use of the high loading technology for containers. As shown in Fig. 3, the conventional 20-feet container stores 12 packs (approximately 200 kWh), where as the new model stores 24 packs (approximately 400 kWh).

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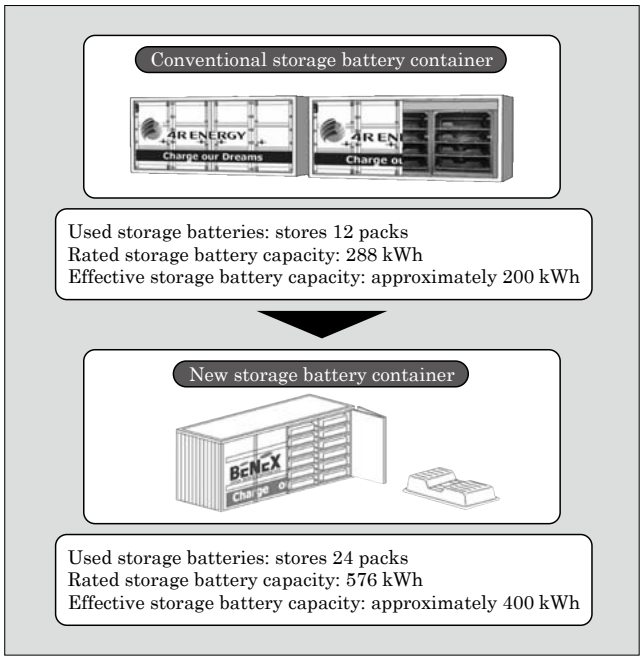

Fig.3 Mounting design of storage battery container

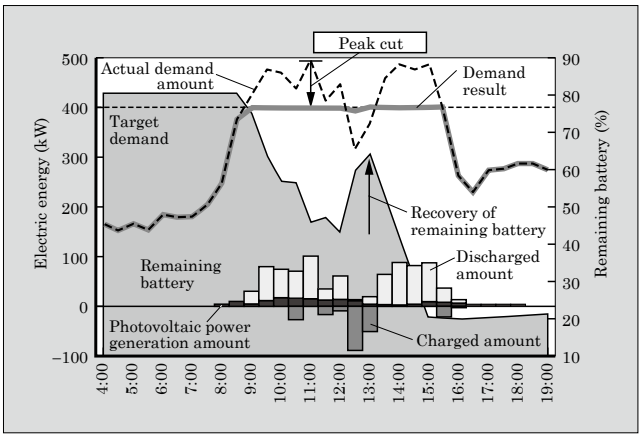

Fig.4 Example of peak-cut operation

3. Functions

The following refers to the overview of the system functions.

(1) Peak cut and peak shift

Using the electric power storage system and peak cut and peak shift operations helps reduce the contract demand, basic charge, and electricity rate. Certain cost reduction effect is expected although it depends on how customers use power. Figure 4 shows an example of peak cut operation.

(2) BCP

The system can be used as a backup power supply that is necessary for stable and continuous business operation. Specifically, when the commercial power fails, the linkage switch of the commercial power is released, the storage battery PCS is switched to the self-support operation and activated to supply power.

(3) VPP Function

Figure 5 shows the basic configuration diagram of VPP. As shown in the figure, VPP is a technology for bundling resources of utility customers (equipment such as an ESS) and controlling them like one power plant as an adjustment power of the power system. By this technique, storage batteries charge and discharge according to the signals from the higher level system. Thanks to VPP, compensation can be expected in the future.

Fuji Electric is participating in the VPP demonstration project of the Kansai Electric Power Group, and this system incorporates the function that supports this demonstration project. Therefore, the utility customers purchasing the system can participate in the VPP demonstration project and can apply for subsidies to reduce the initial costs.

(4) Effective Utilization of Renewable Energy

As shown in Fig. 6, the solar power generation for self-consumption may be surplus in a low-demand time zone on weekends. Renewable energy can effectively be utilized by charging this surplus power in storage

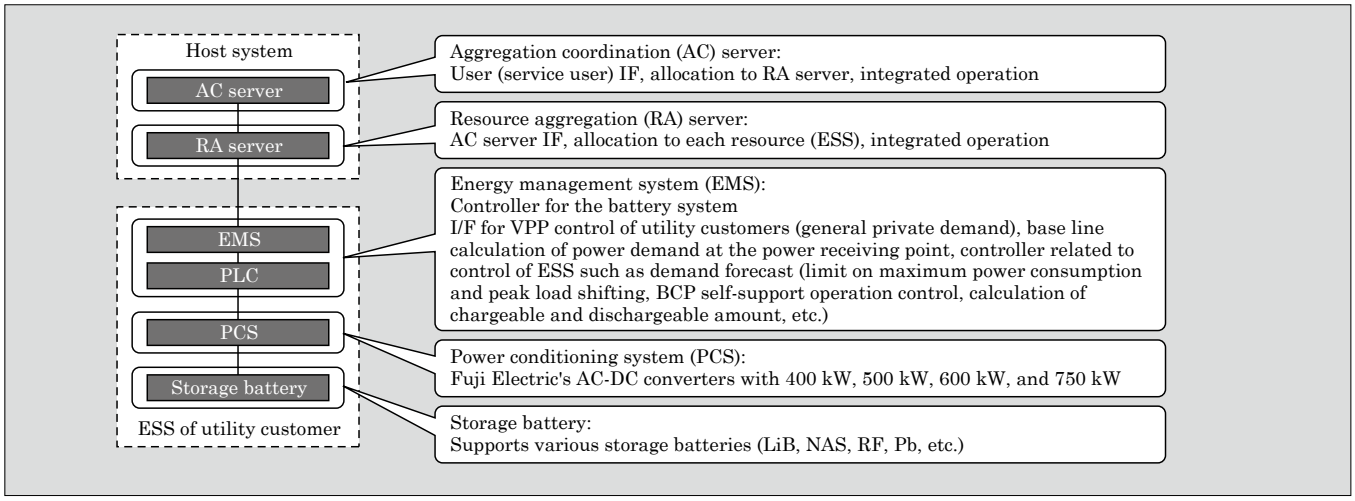

Fig.5 Basic configuration diagram of VPP

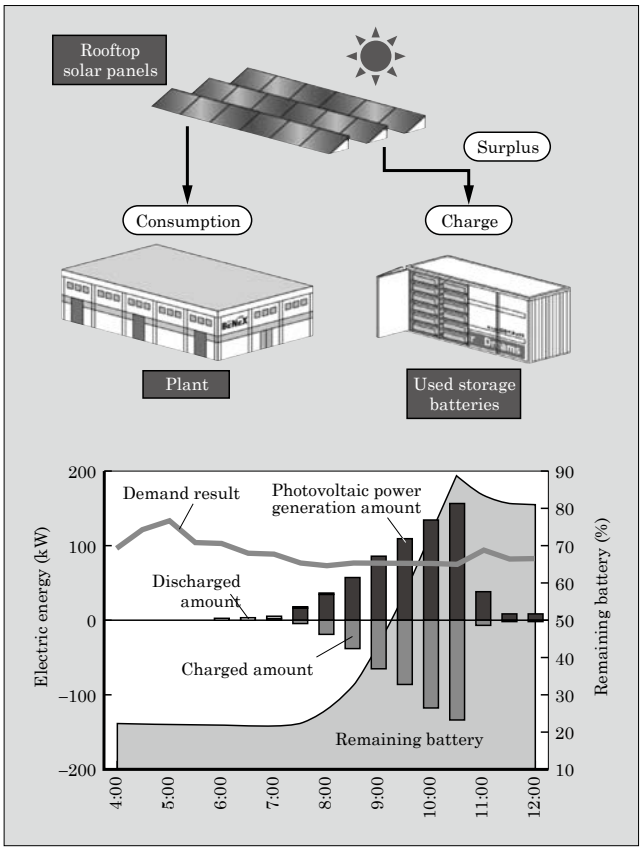

Fig.6 Example of effective utilization of renewable energy

batteries and discharging it in a time zone with high demand.

4. Human Machine Interface

The control system is equipped with the touch panel on the front panel whose screens are used for the operation and maintenance of the storage battery system using the screens. Thus, visibility and operability are greatly improved, and the system allows intuitive operation without depending on the instruction manual. Figure 7 shows an example of a system monitoring screen that allows power system state monitoring and remotely opening and closing high voltage switches, and Fig. 8 a demand monitoring screen that can monitor the actual load per 30-minute demand and charge and discharge of storage batteries.

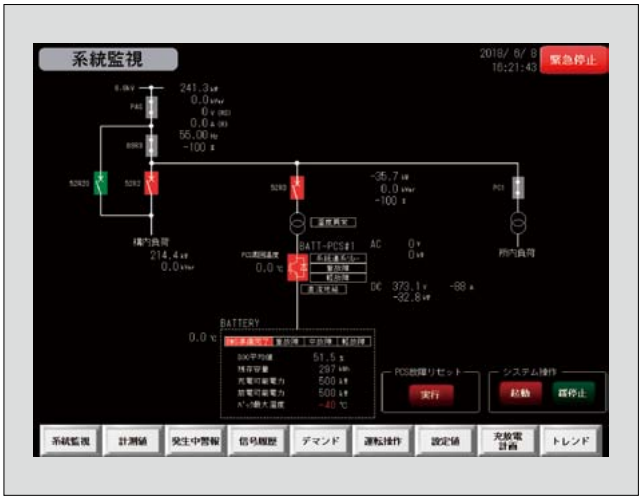

Fig.7 Example of system monitoring screen

Fig.8 Example of demand monitoring screen

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