Delivered 8-Hour Capacity Redox Flow Battery System to a Municipal-Established Local Power Utility

1. Outline

For the first time for a local power utility established by a municipality, a redox flow battery system (hereinafter referred to as RF battery) was delivered to Kashiwazaki Ideal & Realistic Energy Co., Ltd.* (hereinafter referred to as Kashiwazaki IR) located in Kashiwazaki City, Niigata Prefecture. As the introduction of renewable energy expands, it is expected that the introduction of long-duration energy storage (hereinafter referred to as LDES) with a capacity of 6 hours or more will accelerate in the future. This installation is an example of an LDES connected directly to the power grid.

2. Background

2-1 Grid-scale energy storage

With the increasing share of variable decarbonized energy sources like photovoltaic (PV) and wind power generation in the grid, the need for demand-supply balancing is increasing. Since 2024, the procurement of adjustment power has been fully liberalized, and the supply of adjustment power using large-scale stationary batteries is attracting attention as a business. As legislation is in progress, the introduction of stationary battery systems connected directly to the power grid has begun.

2-2 Long duration energy storage

As the adoption of PV progresses, the price of electricity in the market tends to drop during sunny daylight hours (e.g., 0.01 yen/kWh), while the price tends to spike in the morning and evening. As the integration of renewable energy is expected to increase further, the duration of price drops and spikes is expected to increase, which is leading to a growing focus on LDES technologies. As a result, the demand for long-duration storage in stationary batteries is expected to grow.

3. Equipment Introduction

In light of the above background, Kashiwazaki IR, local power utility established by the municipality and relying on PV power generation, has introduced long-duration energy storage batteries to utilize surplus renewable energy and stabilize electricity procurement prices.

3-1 RF battery

RF batteries are a type of energy storage system that utilize an electrolyte as the active material, undergoing oxidation-reduction reactions within the cells to charge and discharge. Features of RF batteries include:

- Long lifespan and low degradation
- High safety (non-hazardous materials)
- Environmentally friendly (high reuse and recycling rates)

These features make RF batteries well-suited for large-scale stationary energy storage. Figure 1 shows the principle of the RF battery.

As shown in Table 1, the battery modules consist of three containers. The upper container houses the cell stacks and other machinery responsible for the charge and discharge reactions, while the lower two containers store the electrolyte. By increasing the size of the tank containers, the storage capacity of the electrolyte can be enhanced, thereby increasing the energy storage capacity. In this project, 40-foot (approximately 12 m) tank containers have been used to achieve an 8-hour capacity.

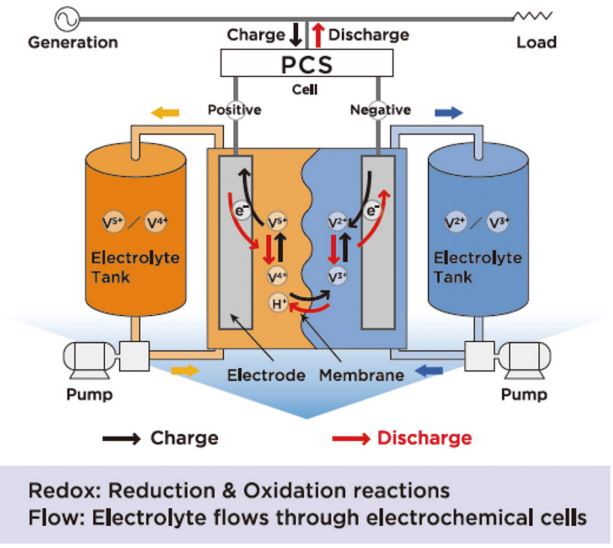
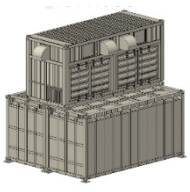
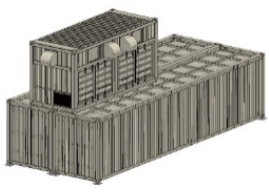


Fig. 1. Principle of RF battery

Table 1. RF battery module types

	4-hour type	8-hour type
Rated Power	AC 250 kW	AC 250 kW
Energy Capacity	AC 1,000 kWh	AC 2,000 kWh
Appearance		

3-2 Delivery destination

Kashiwazaki IR, the delivery destination, is a locally established municipal power utility, which is invested in by eight private companies and Kashiwazaki City. The company is promoting the use of renewable energy to achieve the goal of a “Decarbonized Town,” based on the “Regional Energy Vision” advocated by Kashiwazaki City.

3-3 Use application

The purpose of the battery operation are as follows:

1. Promotion of renewable energy utilization
2. Reduction and stabilization of procurement prices from the wholesale electricity market

A schematic diagram of the battery operation is shown in Fig. 2. When the output from the decarbonized power sources owned by the company exceeds the demand (resulting in surplus electricity), the battery is charged. During times of reduced generation, the stored energy is provided to customers, thereby increasing the utilization rate of renewable energy. Additionally, during times of low prices in a wholesale market, the Japan Electric Power Exchange (JEPX), the battery is charged (purchased energy), and during price spikes, the stored energy is discharged (supplying to customers and selling to the market) to avoid the risk of sudden price surges.

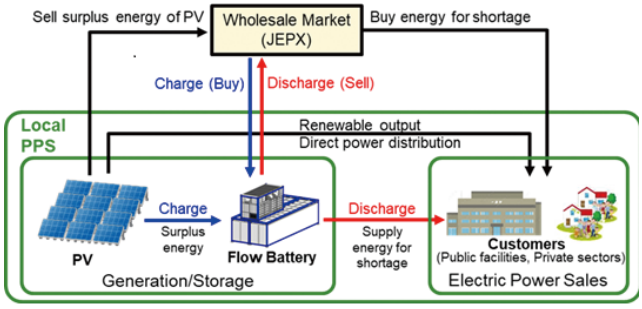


Fig. 2. Operational concept

3-4 Specification

In this project, four 8-hour type capacity modules are used, configuring the system as AC 1,000 kW/8,000 kWh. Figure 3 shows the system layout, Table 2 provides the system specifications, and Photo 1 shows the external view of the RF battery system.

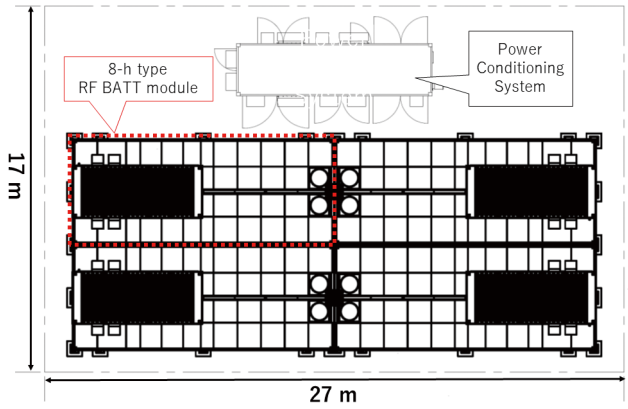


Fig. 3. RF battery system layout

Table 2. Specification of the system

Specifications	
Rated Power	AC 1,000 kW
Energy Capacity	AC 8,000 kWh
Grid Connection	6,600 V 50 Hz
Number of modules	4 units

Photo 1. External view of RF battery

*Kashiwazaki Ideal & Realistic Energy Co., Ltd.
https://kashiwazaki.de-power.co.jp/company/ (Japanese version only)