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Vanadium Redox Flow Battery System

Renewable energy generation is crucial for sustainable development, making energy storage systems essential for stabilizing green energy integration into the grid. Vanadium redox flow battery (VRFB) systems, known for their high safety, 20-year lifespan, and flexible performance, can regulate load, shave peaks, fill valleys, and smooth power output to maintain grid balance and stability. They also contribute to mitigating grid impact and provide black start capabilities.

Pacific Electric Wire & Cable Co., Ltd. (PEWC) has partnered with Sumitomo Electric Industries, Ltd. (SEI) to introduce SEI's VRFB technology. PEWC aims to develop safe, long-lasting energy storage systems for both outdoor and indoor applications, addressing electricity backup and usage needs.

Applications

Grid	Transmission & Distribution	Behind the Meter
Expanding grid integration	Frequency regulation	Frequency regulation
Reducing peak load	Black start capabilities	Black start capabilities
Regulating frequency and voltage	Deferring transmission and distribution investments	Voltage stabilization
Responding to extreme weather emergencies	Voltage stabilization	Emergency weather response
	Emergency weather response	

Benefits

High Safety
Non-flammable electrolyte, no hazard management equipment is required

Long Lifespan
Over 20 years (> 20,000cycles)

Flexible Discharge
Intra-day and multi-day flexibilities

Deep Discharge Capability
100% depth of discharge

Environmental Friendliness
Recyclable and reusable vanadium electrolyte

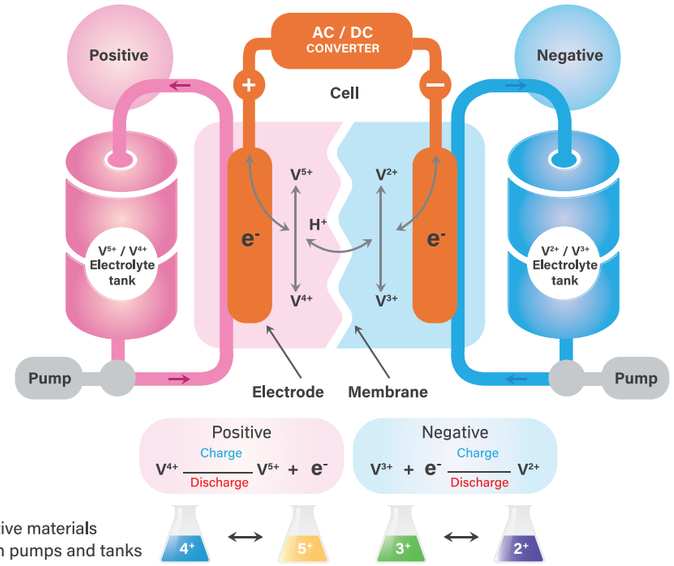
Low Life-Cycle Cost (LOCE)
No battery replacement necessary

Easy Operation & Maintenance:
- Unlimited charging /discharging cycles
- Accurate state-of-charge estimation

Scalable Design
Independent modules for power or capacity expansion, suitable for outdoor and indoor use

Principle

A redox flow battery charges and discharges by circulating vanadium sulfate electrolyte between a tank and battery cells. The stack, composed of multiple cells in series, achieves high voltages.



Redox: Reduction/Oxidation of active materials
Flow: Flowing active materials with pumps and tanks

Fig.1 Schematic structure of VRFB

Structural diagram of the vanadium redox flow battery system

The battery unit includes a cabinet with positive and negative electrodes, a stack, a pump, and a heat exchanger. Integrated with a battery management system (BMS) and a power conversion system (PCS), forming a vanadium redox flow battery (VRFB).

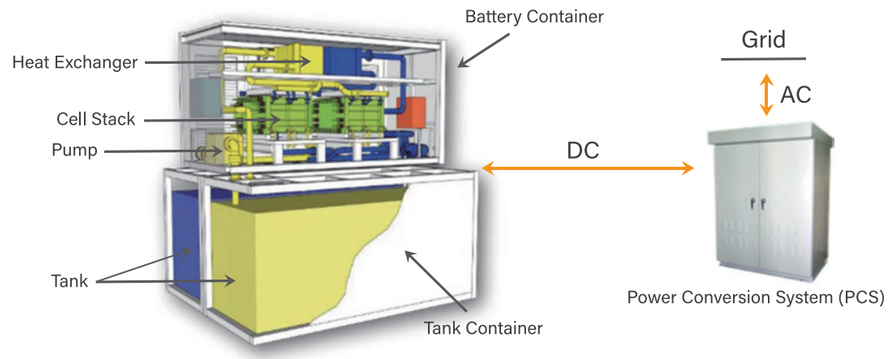
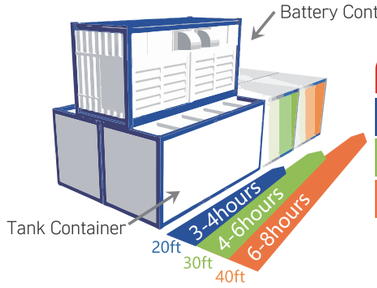
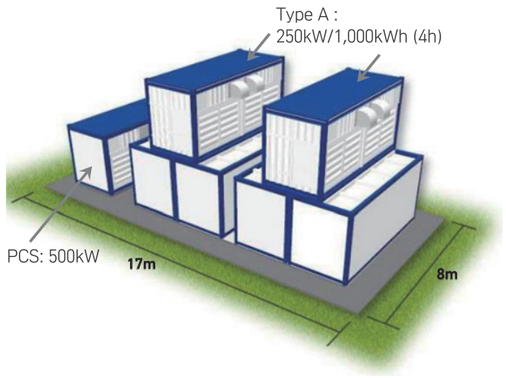


Fig.2 Structural diagram of container type energy storage system

Battery system specifications and space requirements



Type	Output	Hours	Capacity	Dimension (L x W x H)
Type A: 20 feet	250kW	3 - 4hour	750kWh-1,000kWh	6.1m x 4.9m x 6m
Type B: 30 feet	250kW	4 - 6hour	1,000kWh-1,500kWh	9.1m x 4.9m x 6m
Type C: 40 feet	250kW	6 - 8hour	1,500kWh-2,000kWh	12.2m x 4.9m x 6m



Output	Hours	Capacity	L x M
1MW	4hour	4MWh	15m × 17m
1MW	6hour	6MWh	21m × 17m
1MW	8hour	8MWh	27m × 17m
10MW	4hour	40MWh	85m × 27m
10MW	6hour	60MWh	103m × 27m
10MW	8hour	80MWh	131m × 27m

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