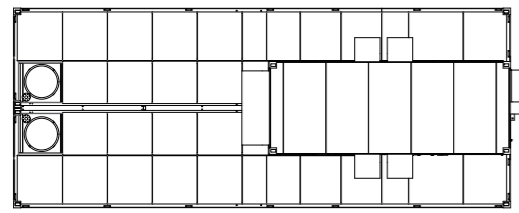


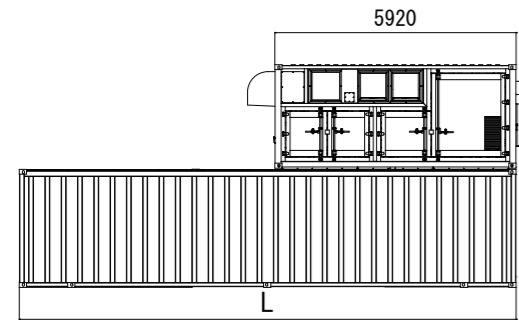
Module Outline

(Size:mm)

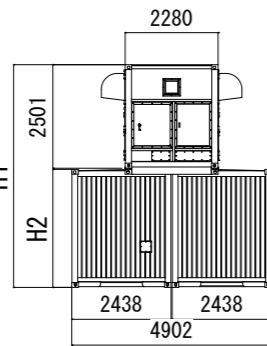


Top View

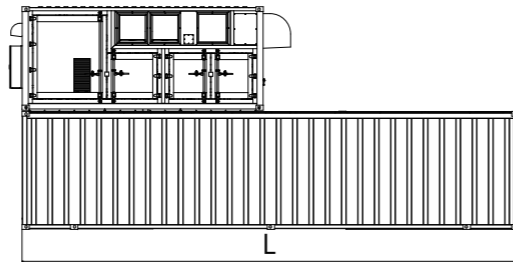
Output x Duration	334kW _{AC} 4h	334kW _{AC} 6h	250kW _{AC} 8h
Tank Type	30ft	40ft	
L	9125	12192	
H1	5120	5425	
H2	2591	2896	



Front View

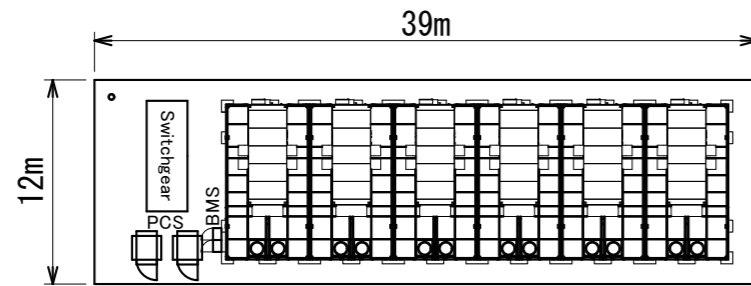


Side View

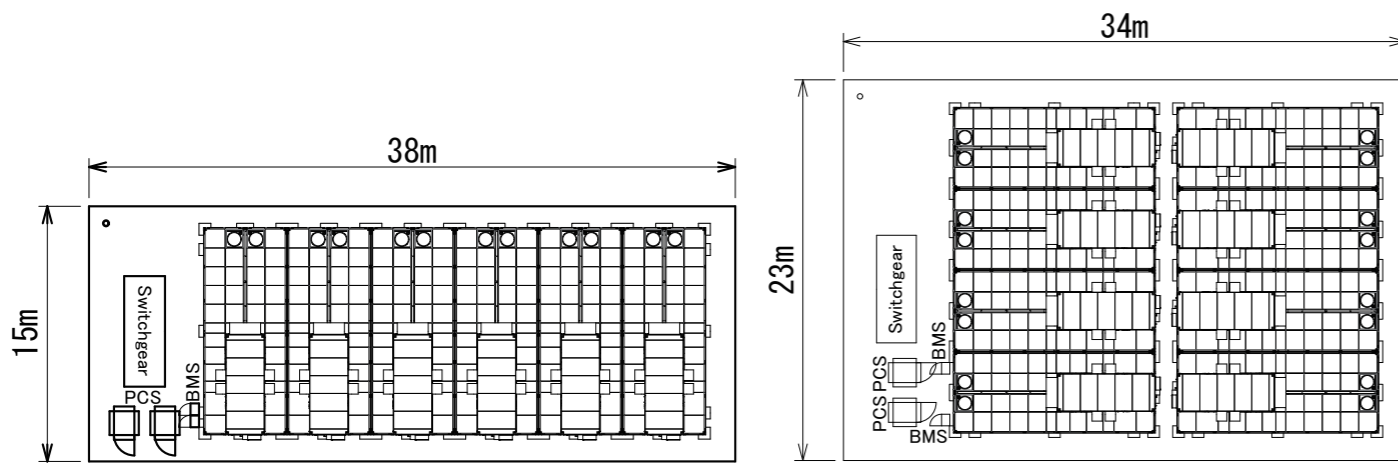


Rear View

System Layout Footprint Examples



2MW x 4h (8MWh)



2MW x 6h (12MWh)

2MW x 8h (16MWh)

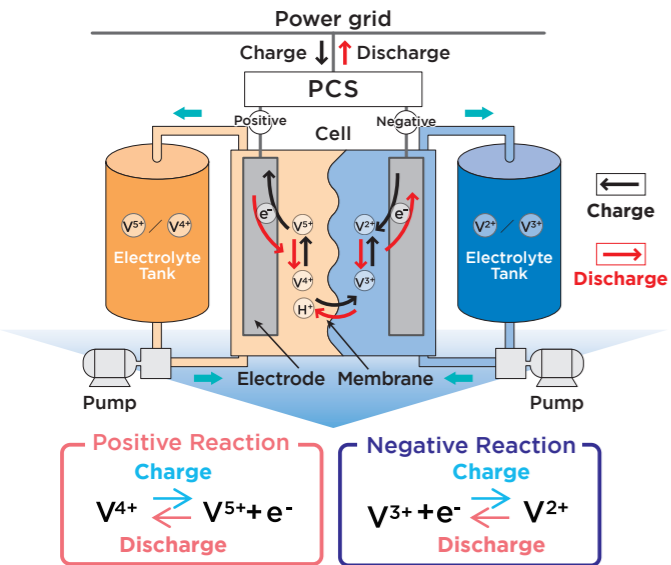
Redox Flow Battery

— Long Duration Energy Storage (LDES) —



Principle

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



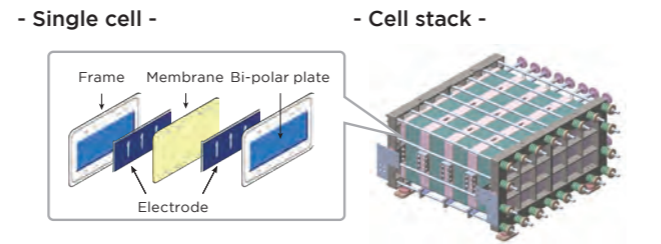
- The battery reactions are associated with only the changes in the valences of vanadium ions
- The valence changes do not deteriorate the electrolyte; the electrolyte can be used semi-permanently and reused

Features

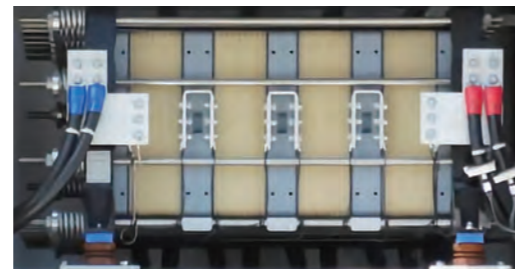
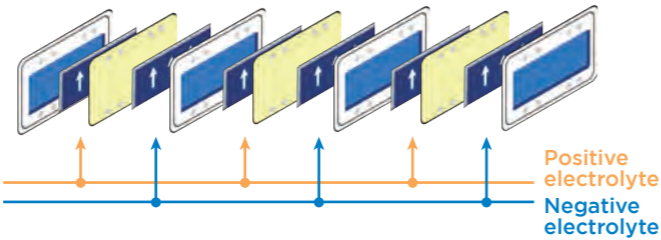
- Fire Safety**
The electrolyte is non-flammable and all other components are made from flame-retardant materials.
- Long Life, 30-Year Operational Lifespan**
Designed for long-term reliability with minimal degradation of electrolyte and electrodes. It can be operated for 30 years regardless of the operation pattern.
- Eco-Friendly**
The electrolyte can be reused, and 99% of system materials can be recycled. Proven under the certification system of Ministry of Environment in Japan.
- Superior Life Cycle Cost**
With no need for cell or electrolyte replacement and minimal waste at Decommissioning, The system achieves low life-cycle costs in long-duration configurations.

Configuration

Single cell & Cell stack

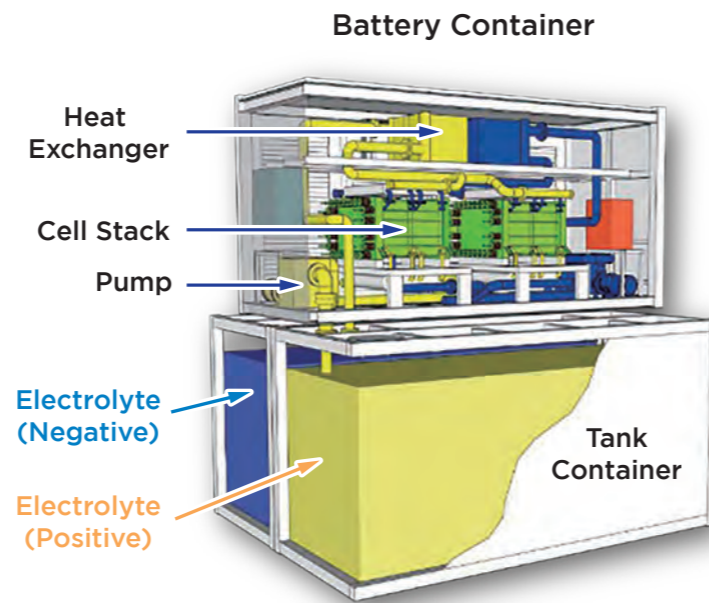


Cell stacking



cell stack

Container



15% Increase in Energy Density*

15% By newly developing a membrane and implementing individual state of charge (SoC) management for the positive and negative electrodes, the energy density (the amount of energy that can be stored per cubic meter of electrolyte) has been increased by 15%. (*Compared to Generation 3)

30% Cost Reduction*

30% A 30% reduction in costs was achieved through enhancing the power output of cell stacks, reducing electrolyte volume by increasing energy density, and improving manufacturing processes. (*Compared to Generation 3)

30-Year Operational Lifespan

30-Yr By applying newly developed long-life materials and appropriate maintenance, the system can be used for up to 30 years.



The V40-type Redox Flow Battery (12MWh (2MW Output, 6-hour duration))

The V40-type Redox Flow Battery has achieved significant improvements in output and energy density through enhancements in its components, enabling cost reduction and space saving. Additionally, by adopting long-life materials, the battery operates for up to 30 years.

Leveraging features such as safety, flame resistance, and environmental friendliness, this battery is well-suited for grid-scale energy storage and Long Duration Energy Storage (LDES). It will contribute to a wide range of applications including microgrids and backup power for public facilities in emergencies, as well as power supply for offices and factories aiming for 100% renewable energy (RE100).

Output x Hours	1MW×4h	1MW×6h	1MW×8h
System Type*	V4X-4000	V4X-6000	V4X-8000
Storage Capacity	4 MWh _{AC}	6 MWh _{AC}	8 MWh _{AC}
System Output	1 MW _{AC}		
Module Images			
Tank Type	30 ft	40 ft	
Module Capacity	1334 kWh _{AC}	2000 kWh _{AC}	
Module Power	334 kW _{AC}	334 kW _{AC}	250 kW _{AC}
Module Weight	140 t	210 t	210 t
Number of Modules	3 units	3 units	4 units

* X is filled with the initial letter of the applicable standard.
 Duration is expandable to more than 10 hours.

Hokkaido Electric Power Network Project

- Customer: Hokkaido Electric Power Network, Inc.
- Location: Minami-Hayakita Substation
Hokkaido, Japan
- Power and Energy: 17MWx3h (51MWh)
- Application: Enhancing grid control for new 162MW wind turbines (e.g. Frequency regulation, Renewable generation smoothing)
- Operating Term: 21 years
- Start of Operation: Apr. 2022



Large Scale Flow Battery Demonstration for Grid Control with Hokkaido Electric Power Network (METI Project)

- Customer: Hokkaido Electric Power Network, Inc.
- Location: Minami-Hayakita Substation
Hokkaido, Japan
- Power and Energy: 15MWx4h (60MWh)
- Objective: Urgent demonstration project of a large scale power storage system, subsidized by the Ministry of Economy, Trade and Industry
- Application: Frequency regulation, Renewable generation smoothing
- Demonstration Term: 2013 to 2018 (Ongoing operation)
- Start of Operation: Dec. 2015 (Commercial operation since 2019)



Floor 1: Tank, Pump and PCS



Floor 2: Cell stack and heat exchanger

San Diego Gas & Electric Project

- Customer: San Diego Gas & Electric (SDG&E)
- Location: San Diego, California, US
- Power and Energy: 500kWx8h (4MWh)
- Application: Microgrid, Electricity wholesale market
- Start of Operation: Sep. 2024



Flow Battery Pilot Project for Grid Applications in California (NEDO Project)

- Customer: San Diego Gas & Electric (SDG&E)
- Location: San Diego, California, US
- Power and Energy: 2MWx4h (8MWh)
- Application: Microgrid, Peak shaving, Renewable firming
- Term: 2015 to 2021 (Ongoing operation)
- Start of Operation: Mar. 2017 (Commercial operation since 2022)
- First Flow Battery in the US with a UL-certified cell stack (UL 1973)
- First Flow Battery operational in the California Independent System Operator (CAISO) markets since December 2018
- Market participation in both energy and ancillary services (AS).
- Operation with 0-100% usable SoC and unlimited cycle life.
- First Flow Battery engaged in a microgrid operation on actual power distribution line independent of external grids in December 2021



(Taiwan) Industrial Technology Research Institute (ITRI) Project

- Customer: Industrial Technology Research Institute (ITRI)
- Location: Tainan, Taiwan
- Power and Energy: 1,000kWx3h (3,000kWh)
- Start of Operation: Nov. 2024



(Australia) Energy Queensland Project

- Customer: Energy Queensland Limited
- Location: Brisbane, Queensland, Australia
- Power and Energy: 250kWx3h (750kWh)
- Start of Operation: Sep. 2024



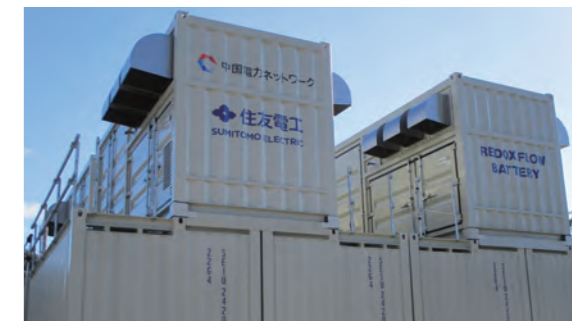
(Belgium) John Cockerill Project

- Customer: John Cockerill
- Location: Seraing, Belgium
- Power and Energy: 500kWx3.4h (1,700kWh)
- Start of Operation: Oct. 2018



Chugoku Electric Power Project

- Customer: Chugoku Electric Power Transmission & Distribution Co., Inc.
- Location: Ama-cho, Oki-gun, Shimane, Japan
- Power and Energy: 4,000kWx3.125h (12,500kWh)
- Start of Operation: 2026 (partially)



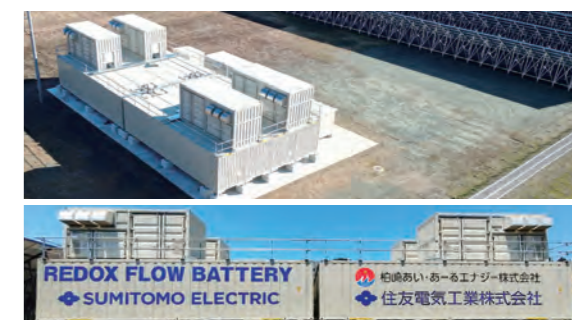
Minami Kyushu City Project

- Customer: Mitaden Co., Ltd.
- Location: Minami Kyushu, Kagoshima, Japan
- Power and Energy: 250kWx4.5h (1,125kWh)
- Start of Operation: Apr. 2025



Kashiwazaki City Project

- Customer: Kashiwazaki IR Energy Co., Ltd.
- Location: Kashiwazaki, Niigata, Japan
- Power and Energy: 1,000kWx8h (8,000kWh) x 3
- Start of Operation: Feb. 2026 Completion / Mar. 2025 Completion / Sep. 2024 COD



NIPPON P.S Project

- Customer: NIPPON P.S Co., Ltd.
- Location: Tsuruga, Fukui, Japan
- Power and Energy: 250kWx3h (750kWh)
- Start of Operation: Jan. 2023

