RKP

CASE STUDY

DALIAN CONCURRENT

ENERGY STORAGE STATION

World's first 100 MW-class vanadium flow battery system project



100 MW
POWER

400 MWh
CAPACITY

4 h
DURATION

DOWNTOWN DALIAN, LIAONING, CHINA

Commissioned: 2022

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Project Overview

The Dalian ConCurrent Energy Storage Station is the world's first 100 MW-class vanadium flow battery energy storage system and the largest energy storage system located in an urban city center globally. The station was delivered by RKP and commissioned in December 2022.

This project is a National Energy Administration-approved demonstration project — China's first national-level large-scale chemical energy storage demonstration. It is strategically located in downtown Dalian, surrounded by critical infrastructure including a coal power plant, petrol station, residential areas, schools, and hospitals, making safety and reliability paramount requirements.

The station is designed and operated as critical urban grid infrastructure. It transforms Dalian's southern power grid from a C-shaped (radial) configuration into an O-shaped (ring) configuration, fundamentally improving power supply reliability for the region.

WORLD FIRST
100 MW-class VFB system

98.8%
Average availability in 2025

350 MW
Thermal unit black-started

4 HOURS
Continuous emergency supply

WHY IT MATTERS

Dalian ConCurrent Station demonstrates that long-duration VFB storage can operate safely beside dense urban communities while strengthening grid topology, restoration capability and critical-load resilience.

Key project information

Core configuration, delivery and lifecycle parameters

Project Name	Dalian ConCurrent Energy Storage Station (Phase I)
Location	Dalian, Liaoning Province, China (Downtown Area)
Power / Capacity	100 MW / 400 MWh (4-hour duration)
Configuration	716 electrolyte tanks, 358 battery containers, 179 PCS units, 3,024 stacks (31.5 kW each)
Technology	Vanadium Flow Battery (VFB) — RKP Proprietary
Developer	Dalian Clean Energy Group Co., Ltd.
Owner / Operator	Project SPV established by Dalian Clean Energy Group.
Technology Provider	RKP
EPC Contractors	Dalian ConCurrent Energy Storage Station Co., Ltd.
Commissioning Date	Grid connection: May 2022; Full commercial operation: October 2022
Design Life	~25 years

Key Functions and Benefits

Six operating roles delivered by the long-duration VFB system

Grid Stability

Provides voltage and frequency support to strengthen the regional grid, transforming the southern Dalian grid from a C-shaped to O-shaped (ring) configuration.

Peak Shaving

Charges during off-peak hours (or when renewable output is high) and discharges during peak demand, reducing strain on the transmission network.

Frequency Regulation

Rapid-response capability to maintain grid frequency within statutory limits.

Renewable Integration

Enhances the grid's capacity to absorb wind and solar generation, reducing curtailment in Liaoning Province.

Black Start

In June 2024, the station successfully completed the world's first black start test of a city-grid large-capacity thermal power unit (Huaneng Dalian 350 MW coal-fired unit) using a battery energy storage system, verifying VFB has stronger capability for grid restoration than other battery technologies.

Emergency Backup Power

Provides up to 4 hours of continuous power supply for critical facilities (hospitals, emergency services) during grid outages.

Auxiliary Power Supply

Supports auxiliary loads for regional power plants.

Operational Performance

Reliability, dispatch flexibility and restoration capability demonstrated in operation

98.8% Average system availability

operation from January to Dec 2025

Winter Grid Balancing Peak Shaving During the Heating Season

Frequent peak-shaving dispatch during the winter heating season.

Summer Peak Support Rapid Response to High Electricity Demand

Enhanced dispatch during periods of high summer electricity demand.

Flexible Power Dispatch Wide Operating Range

Stable partial-load operation across a wide 20–100 MW range.

World-First Black Start A Landmark Achievement in New-Type Energy Storage

Successfully completed the world's first black start of a large-capacity thermal power unit using new-type energy storage in June 2024.

Revenue Model

The project operates under the following revenue structures:

01 Fixed Capacity Charge

Receives fixed capacity-based compensation under provincial grid procurement arrangements, providing a stable and predictable baseline revenue

02 Grid Services

Direct dispatch by Liaoning Provincial grid operator for peaking, frequency regulation, and grid support services

03 Electricity Spot Market

Active participation in spot trading; demonstrated profitable arbitrage

04 Ancillary Services

Compensation for black start capability, emergency backup, and system security services



100 MW / 400 MWh URBAN VANADIUM FLOW BATTERY INFRASTRUCTURE



A global reference for urban grid resilience

Safety, reliability, black start and commercial flexibility validated in one operating asset

Why this project matters globally

The project demonstrates how long-duration VFB storage can support dense urban networks, sensitive sites and critical infrastructure while operating across multiple dispatch and revenue functions.

Urban Safety Profile 01

Located in a city center surrounded by communities, petrol stations, schools, and hospitals, the project demonstrates that VFB technology can be deployed in sensitive environments. The water-based, non-flammable electrolyte eliminates thermal runaway risk, which is relevant to utilities, substations, industrial facilities, and community-adjacent sites worldwide.

Grid Reliability Enhancement 02

The project's role in transforming grid topology from a C-shaped radial configuration to an O-shaped ring configuration demonstrates how large-scale storage can materially improve regional power supply reliability — relevant to regional, weak-grid, and network-constrained locations.

Black Start Proven Capability 03

The successful black start of a 350 MW thermal unit validates VFB technology for grid restoration, a capability of strategic importance for islanded networks, remote communities, mining operations, and critical infrastructure.

Proven Availability 04

The 98.8% system availability rate demonstrates the reliability and maturity of RKP's VFB technology for mission-critical grid applications.

Commercial & Operational Transferability 05

The Dalian ConCurrent station combines capacity-based compensation, electricity spot-market arbitrage, and ancillary or system-security services.
While market arrangements differ by jurisdiction, the reference demonstrates RKP's ability to operate a VFB asset across multiple dispatch and revenue functions, supporting revenue stacking and long-term asset utilization.

READY TO BUILD YOUR NEXT LONG-DURATION STORAGE PROJECT?

Let's discuss the right duration, system architecture and commercial pathway for your project.

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SCAN TO CONTACT

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Safe | Durable | Scalable | Built for long-duration value