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昆宇电源
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Battery Energy Storage System Liquid Cooling Solution with 10-Year Warranty

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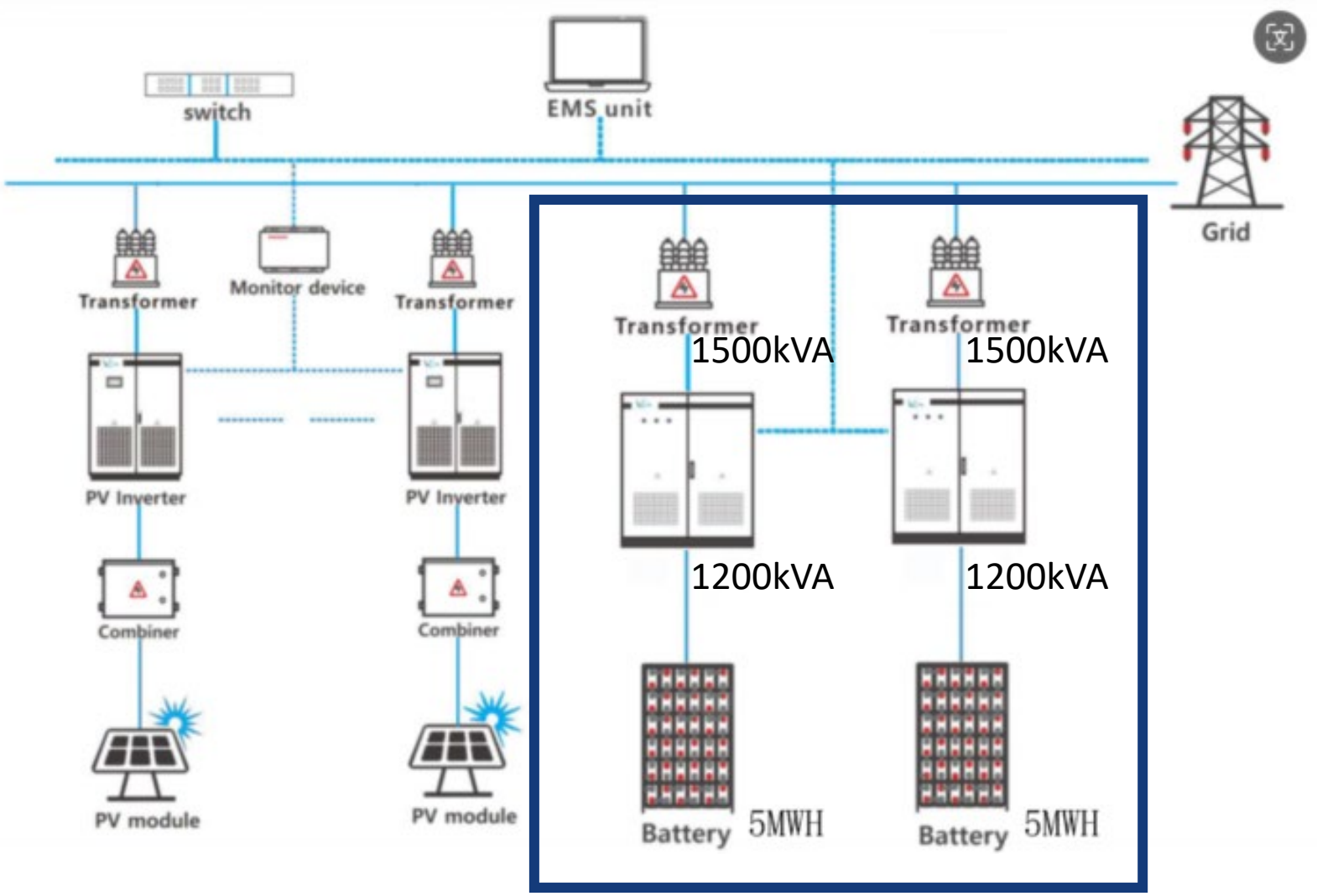
Quotation Sheet LFP Battery (24 July 2024)

Unit Price (USD/FOB China)						
Item	Power（MW）	Energy (MWH)	Unit Price	Quantity (unit)	Amount (USD/FOB China)	Remarks
			USD		USD	
LFP ESS System 1.2MW/5MWh-Liquid Cooling	1.2	5.016	885,469	2	1,770,938	Each system consists of 1 x 5MWh container, 1 x 1.2MW PCS container.
EMS			/	/	/	Optional, will provide if required
1. 10 Year warranty						
2. Quotation is valid for 30 days.						
3. Lead time: Subject to negotiation.						
4. Payment: 100% by T/T in advance.						
5. The quotation is exclusive of spare parts, commissioning costs and cables to client's facilities on site.						

System Overview



Scope of delivery

Project Background Description

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PV:

Battery:10MWh

Peak Load:

Average Load:

% of Inductive Load:

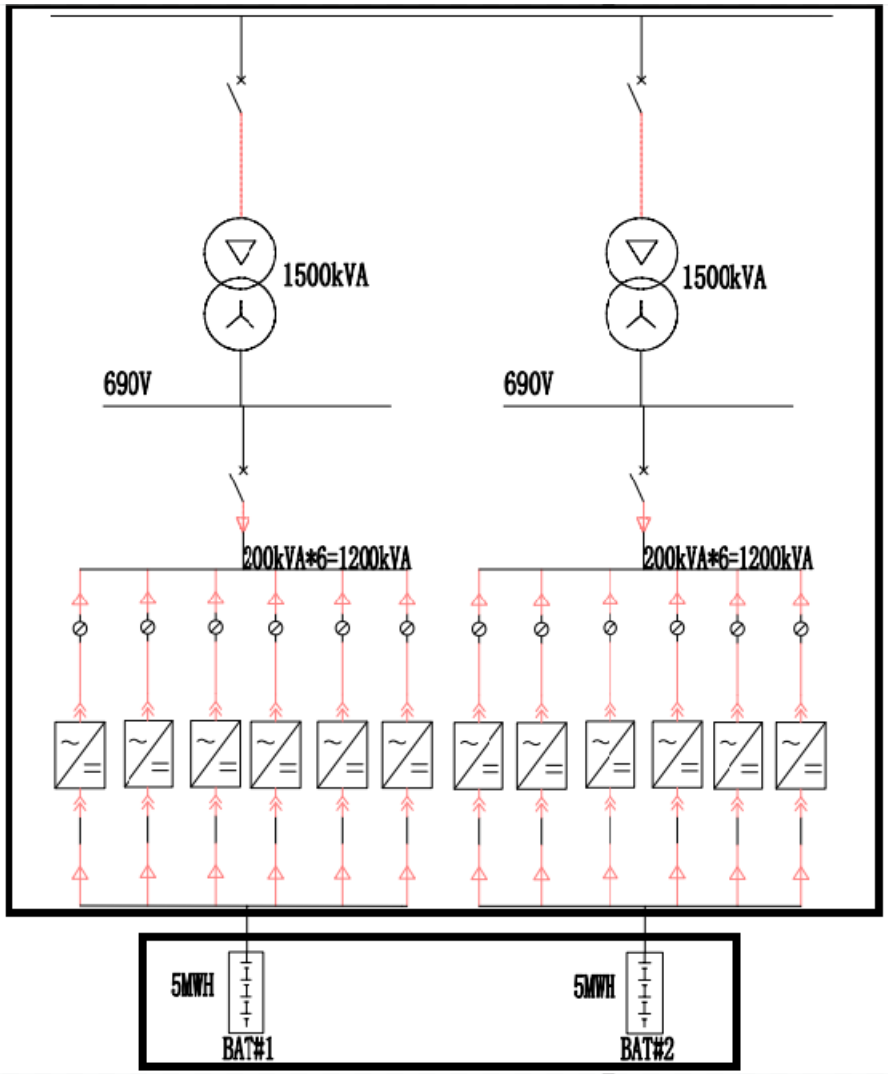
PCS:2400kVA

Transformer:3000kVA

On-Grid

Without DG

Project Overview



Inverter booster integrated system

Battery Energy Storage system

BESS is equipped with two 5MWH battery containers

Each battery container is connected with one 1200kVA PCS, which consists of 6 PCS modules.

In the selection of the transformer, take the power factor of 0.8, so each PCS compartment is equipped with a power of 1500kVA transformer, in total of 2, the total power of the transformer is 3000kVA

Parasol's solution scope:

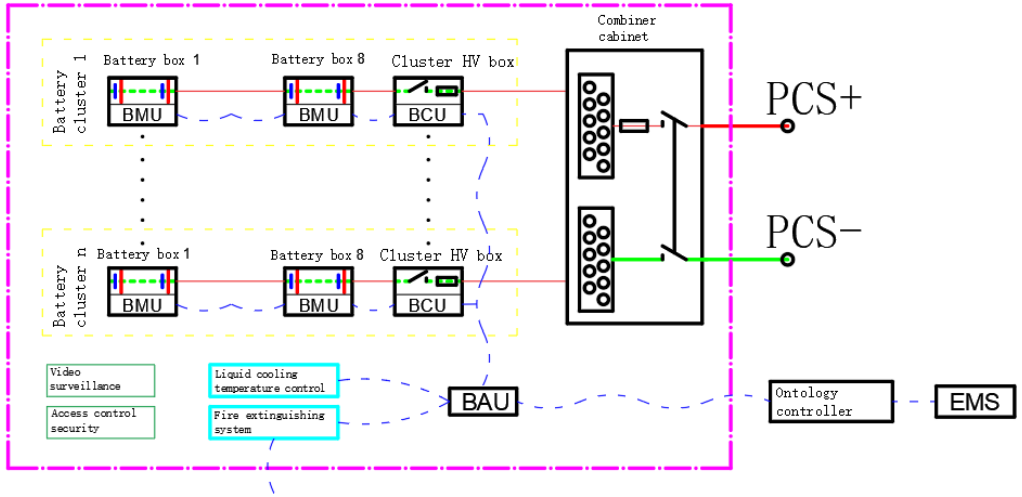
- Battery Energy Storage System:5MWh*2
- Inverter booster integrated system: 2.4MW/3MVA

5.016MWh BESS

LFP BESS includes energy storage lithium battery (including BMS battery management system), liquid cooling temperature control system, security lighting and monitoring system, firefighting system, power distribution system, etc. The designed voltage level of the battery compartment is **1500**, the rated voltage of the battery system is **1331.2VDC**.

This solution requires only simple infrastructure to complete one-stop installation. Only power cables and secondary communication cables need to be connected on-site, which is convenient and fast, reducing engineering difficulty and saving costs.

Topology



5.016MWh BESS

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System Parameters	
Cell	3.2V/314Ah, LFP
System battery configuration	1P52S-8S-12P, 5.016MWh
Battery voltage range	1164.8V ~ 1476.8V (Cell 2.8 ~ 3.55V)
Container Parameters	
Dimension	L6058*W2438*H2896mm
Protection level	IP54
Operating environment temperature range	-30℃ ~ 50℃
Working altitude	≤2000m (>2000m will be customized separately)
Battery thermal management system	liquid cooling
Fire Fighting System	Fire extinguishing system (aerosol), explosion-proof exhaust system and emergency water sprinkler
External system communication interface	Support RS485, Ethernet, CAN
External system communication protocol	Support Modbus RTU, Modbus TCP, IEC104, IEC61850
List of certification standards	UL1973, UL9540, UL9540A, IEC62619, UN38.3

Battery System Solution Overview

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314AhCell -1500Vdc- liquid cooling, 5 MWh LFP ESS DC side solution

Description	Unit Topology Reference Diagram	Rated Voltage (V)	Rated Capacity (Ah)	Stored Energy (kWh)	Combination
Cell		3.2	314	1.0048	
Battery Module (Including BMU)		166.4	314	52.2496	1P52S battery module
Battery Cluster (Including BCU)		1331.2	314	417.9968	1P416S , 8 battery modules and 1 main control box are connected in series to form a battery cluster
Energy Storage Battery Cabinet		1331.2	3768	5015.9616	12 battery clusters installed in a 20-foot-high cabinet container, 5.015MWh battery subsystem

Cell

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314Ah

Nominal Capacity	100 Ah (0.2c@25±3℃)
Rated Capacity	314Ah, 0.2P@25℃
Rated Voltage	3.2V
Charge Cutoff Voltage	3.65V
Discharge Cutoff Voltage	2.5V
AC Internal Resistance (1khz)	≤0.25mΩ
Charging Temperature Range	0~55℃
Discharge Temperature Range	-20~55℃
Rated Charging Current	0.2P (25±2℃)
Rated Discharge Current	0.2P (25±2℃)
Cycle Life	8,000 times (25±2℃, 0.5P/0.5P, 70%EOL)
Cell Dimensions	174.7*71.5*207.1±0.8

Module

The module comprises BMU, battery unit, connection bar, MSD, connector, liquid cooling plate, explosion-proof valve, battery module box, etc. The battery module grouping method is 1P52S, composed of four 1P13S battery units.

S/N	Item	Specification and Parameters	Remarks
1	Module Model	1P52S liquid-cooled battery module	
2	Cell Specifications	314Ah-LFP	
3	Group Mode	1P52S	
4	Rated Voltage	166.4V	
6	Rated Energy KWh	52.25kWh	0.2P,25±2℃
7	Allowable Operating Temperature Range ℃	Charging: 0～55; Discharging: -20～55	
8	Dimensions (L*W*H)mm	1118*780*254 (±2mm)	
9	Weight Kg	＜350	

Cluster

Each battery cluster consists of 8 battery modules (1P52S) and 1 high-voltage box. The grouping method is 1P416S and the energy is 417.997KWh.

S/N	Item	Specification and Parameters
1	Rated voltage V	1331.2
2	Rated capacity Ah	314 @25±2℃
3	Rated energy kWh	417.997 @25±2℃
4	Rated charging and discharging power kW	209
5	Maximum charging and discharging power kW	209
6	Charge and discharge energy efficiency	≥95%（0.2P）
7	Allowable operating temperature range℃	Charging: 0～55; Discharging: -20～55
8	communication method	CAN
9	Operating voltage range V	1164.8～1476.8 (cell 2.8～3.55)
10	Balance strategy	Passive balancing
11	Weight kg	About 3100

5.016MWh BESS

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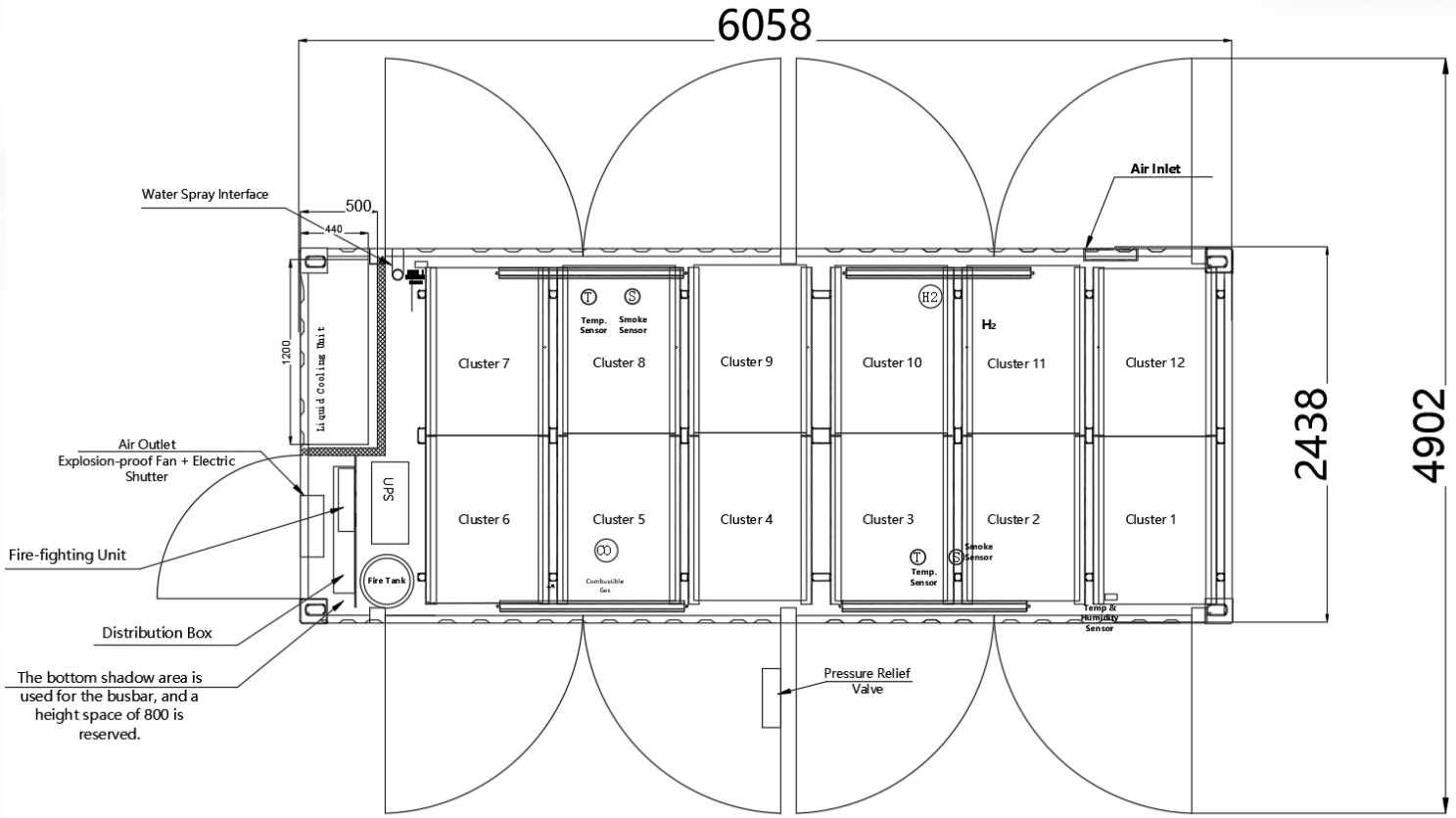
5.016MWh BESS contains 12 battery clusters, 1 control cabinet, 1 fire protection system, 1 liquid cooling unit, etc. The total capacity of the prefabricated cabin is 5.016MWh, of which 12 battery clusters are connected to a collection panel, which is combined into one DC circuit. The internal structural layout of the container is maintainable and replaceable.



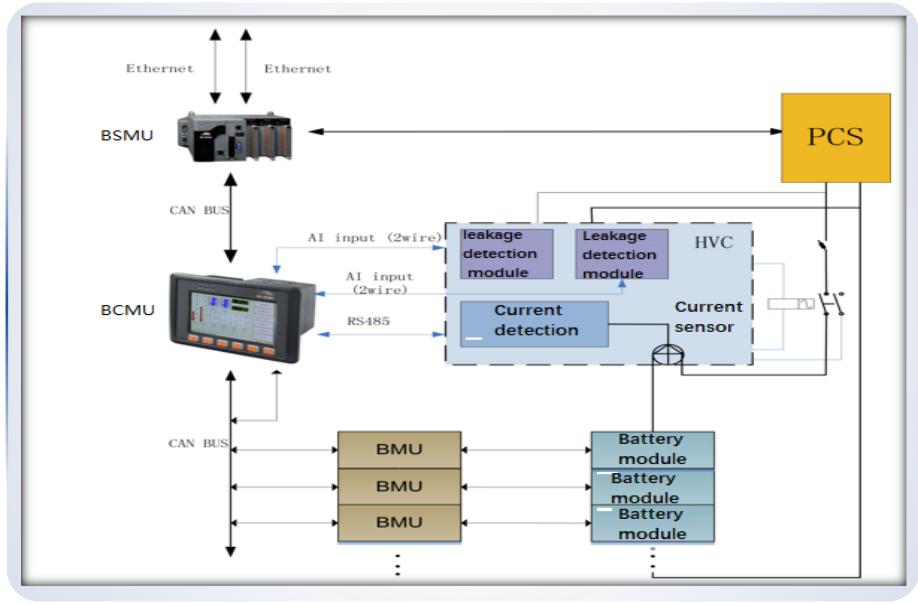
(The layout is for reference only)

Battery Management System (BMS)

Function: BMS consists of the battery module management unit (BMU), battery string management system (BCMU), battery stack management system (BSMU), and high voltage control box. The BMS system has the functions of analogue signal high-precision detection and reporting, fault alarm, upload and storage, battery protection, parameter setting, passive/active balancing, battery SOC calibration and information interaction with other devices.

- Analog Measurement
- Passive Equalization
- Battery System Running Alarm
- Battery System Protection
- Self-diagnosis Function
- Operation Parameter Setting
- Local Running Status Display
- Event And Historical Data Recording
- Communication Function

BMS Three-level Topology

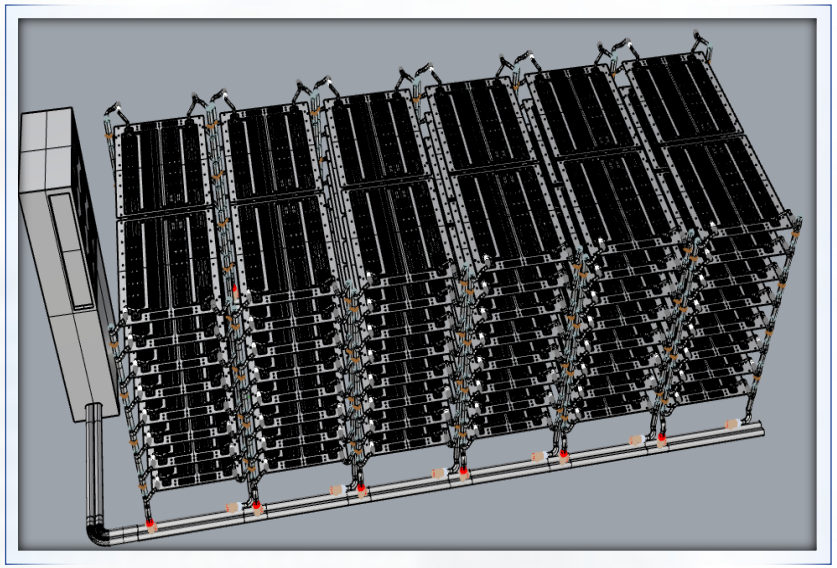


Thermal Management System

- The thermal management system consists of liquid cooling units, pipelines, modular liquid cooling plates, modular liquid cooling pipelines, dehumidification systems, temperature and humidity sensors, etc.

- **Cell:**High-performance thermally conductive interface materials are used between the battery cell and the cold plate to reduce the thermal resistance between the battery cell and the cold plate and improve heat dissipation efficiency.

- **Module:**The multi-channel series-parallel connection of the liquid-cooled plate of the battery module ensures the temperature consistency of the cells within the module. Through multiple simulation iterations and optimization of the cold plate, the uniformity of the cells within the module is improved to meet the design goal of a cell temperature difference within the module of ≤ 2 °C.

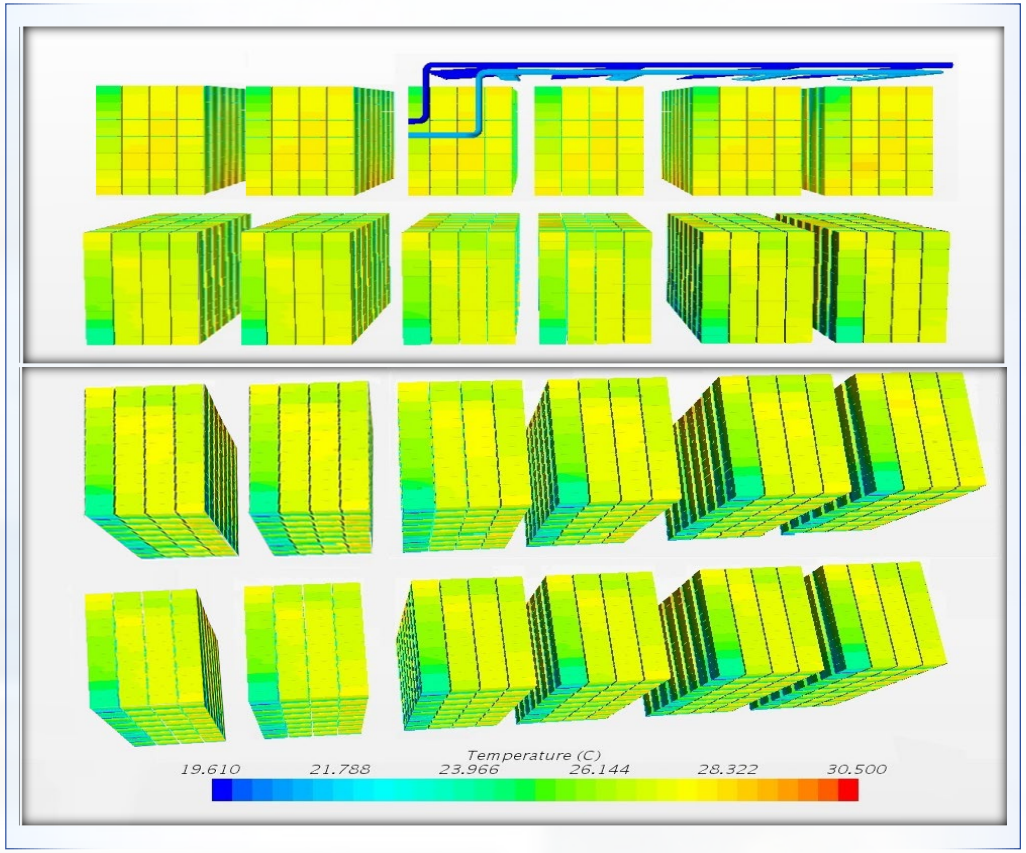


(Picture for reference only)

Thermal Management System

- **Cluster:**Each battery cluster serves as an independent temperature control unit. Through the design of secondary and tertiary pipelines, the flow difference is less than 5%, improving the temperature consistency of the battery cells within the entire cluster.

- **Cabin:**Through the passive control method of primary and secondary pipeline flow balance, the flow difference of all modules in the cabin is less than 10%. Through simulation iterative optimization and experimental verification, it is guaranteed that the temperature difference of the cells in a single cluster is ≤ 3 ℃, and the temperature difference of all cells in the cabin is guaranteed to reach the design target of ≤ 5 ℃.



(Picture for reference only)

Fire Fighting System

Fire fighting system offers automatic features:

- **Fire detection and alarm:** The system automatically detects fires and triggers an alarm.
- **Automatic extinguishing:** The system automatically activates the extinguishing agent upon fire detection.

Additionally, the system provides flexible control options:

- **Automatic control:** The system operates autonomously.
- **Manual control:** Users can manually activate the system.
- **Emergency operation:** A dedicated mechanism allows for manual emergency operation, independent of other controls.

Furthermore, the system includes comprehensive safety features:

- **Audiovisual alarms:** Alarm bells and flashing lights signal fire and extinguishing agent release.
- **Self-testing and monitoring:** The system performs regular self-tests, automatically checks for faults, and raises alarms in case of any issues.

Container

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Anti-Corrosion: The protective layer is customized based on your project site's specific temperature, humidity, and salt spray levels. This ensures that the container's appearance, mechanical strength, and resistance to corrosion meet performance standards for 15 years.

Fire Extinguishing: Flame retardant materials, thermal insulation, and interior/exterior finishes are incorporated throughout the container shell.

Water-Proof: The design prevents water accumulation on the top, leaks, and seepage. Rain stays out, and no water enters from the bottom.

Anti-Dust (including wind and sand): Standard, easily replaceable ventilation filters are installed at air inlets and outlets of both the container and equipment. This effectively prevents dust infiltration, even during strong winds and sandstorms.

Shock and Vibration: The container and its internal equipment are engineered to withstand transportation and earthquake stresses without deformation, malfunctions, or post-vibration issues.

UV Radiation: Materials inside and outside the container are UV-resistant to prevent property degradation and heat absorption.

Protection Level	IP54	**Anti-corrosion Level**	C3-C5
Rockwool Thickness	50 mm	**Paint Film Thickness**	≥180 μm
Rockwool Specification	80 kg/m³	**Fire Resistance Time**	1.5 h

Power Conversion System (PCS)-Parameters

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DC input parameters	
Voltage range	1000~1500Vdc
Max DC current	2400A
AC(on-grid)	
Rated output power	2400kVA
Max AC power	2640kVA
Rated voltage	690Vac，3P+PE
Voltage range	587~759Vac
Rated frequency	50Hz
THDi	<3%（Rated load）
Power factor	-1 to +1

Power Conversion System (PCS)-Parameters

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AC(off-grid)	
Rated voltage	690Vac，3W+PE
Voltage imbalance	< 2%, momentarily not exceeding 4%
THDU	< 3% (no-load or rated resistive load)
Dynamic Voltage Transient Range	< 10% (during resistive load / balanced load, when the load experience a sudden change from 20% to 100% or from 100% to 20%)
Efficiency	
Max efficiency	99%
Protection function	
DC input protection	load switch + fuse

AC input protection	circuit breaker
Island protection	YES
Overheat protection	YES
Overvoltage protection	DC TypeII/AC TypeII
General parameters	
Dimensions	W2438*D2896*H6058mm
Communication	RS485, CAN2.0, Ethernet
IP level	IP66
Operation temperature	-40 ~ +60℃ (> 45℃derating)
Relative humidity	0 ~100% non-condensing
Operating altitude	≤5000m (No derating within 3000m)
Cooling	Liquid Cooling

Configuration table

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S/N	Product Name	Specification	Qty	Unit	Remarks
1	Battery Energy Storage System	5.016MWh battery energy storage system	2	Set	
1.1	Battery Cluster	1331.2V, 417.996kWh，Includes battery racks, 8 battery modules, 1 control box, power and communication harness	12	Set	314Ah-1P52S-8S-12P
1.2	20 Feet High Container	6058*2438*2896mm、Including prefabricated cabin body, safety passage, nameplate and indication sign, lighting (including exterior) and power distribution, etc	1	Set	
1.3	BMS (Battery Management System)	Three-tier architecture, including BMU and acquisition harness, high-voltage box with BCMU and inter-box communication power harness, convergence cabinet with BSMU and display screen including communication power harness to the cabinet high-voltage box	1	Set	
1.4	Temperature And Humidity Control System	Liquid cooling thermal management	1	Set	
1.5	Fire Fighting System	Includes aerosol fire extinguishing device, controller, fire detection (smoke, temperature) alarm, including flammable gas detection	1	Set	
1.6	Auxiliary System	Includes auxiliary materials for container interior installation	1	Set	
2	Inverter booster integrated system	2.4MW/3MVA	2	Set	
3	EMS	Optional			Provide when required