Customized Energy Storage System Solution for Greece 330MW/660MWh BESS Project

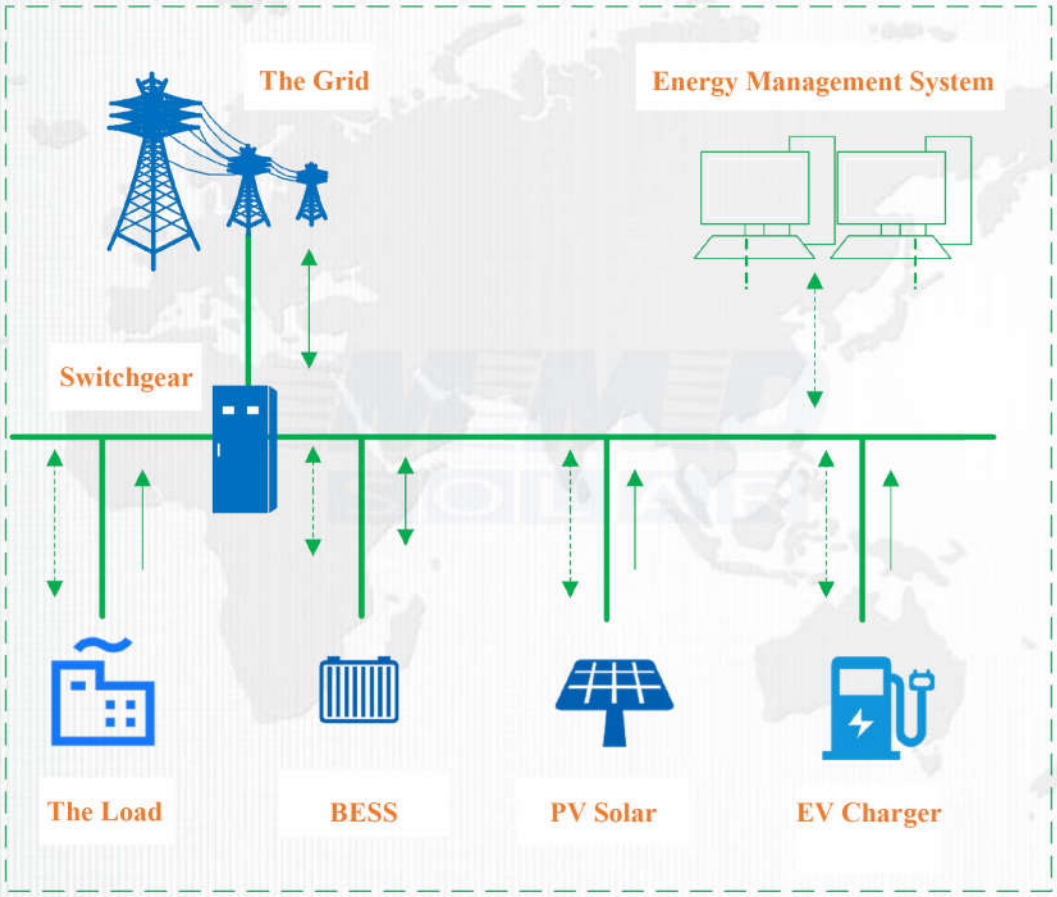
2025.01

01

Innovative Comprehensive Energy Solutions

PART 1

Application Scenarios of Integrated Energy Management



System Overview:

The **Battery Energy Storage System (BESS)** is playing a more and more crucial role to leverage the regulation and response capabilities of the national grid, including:

a) promote precise matching between supply and demand,

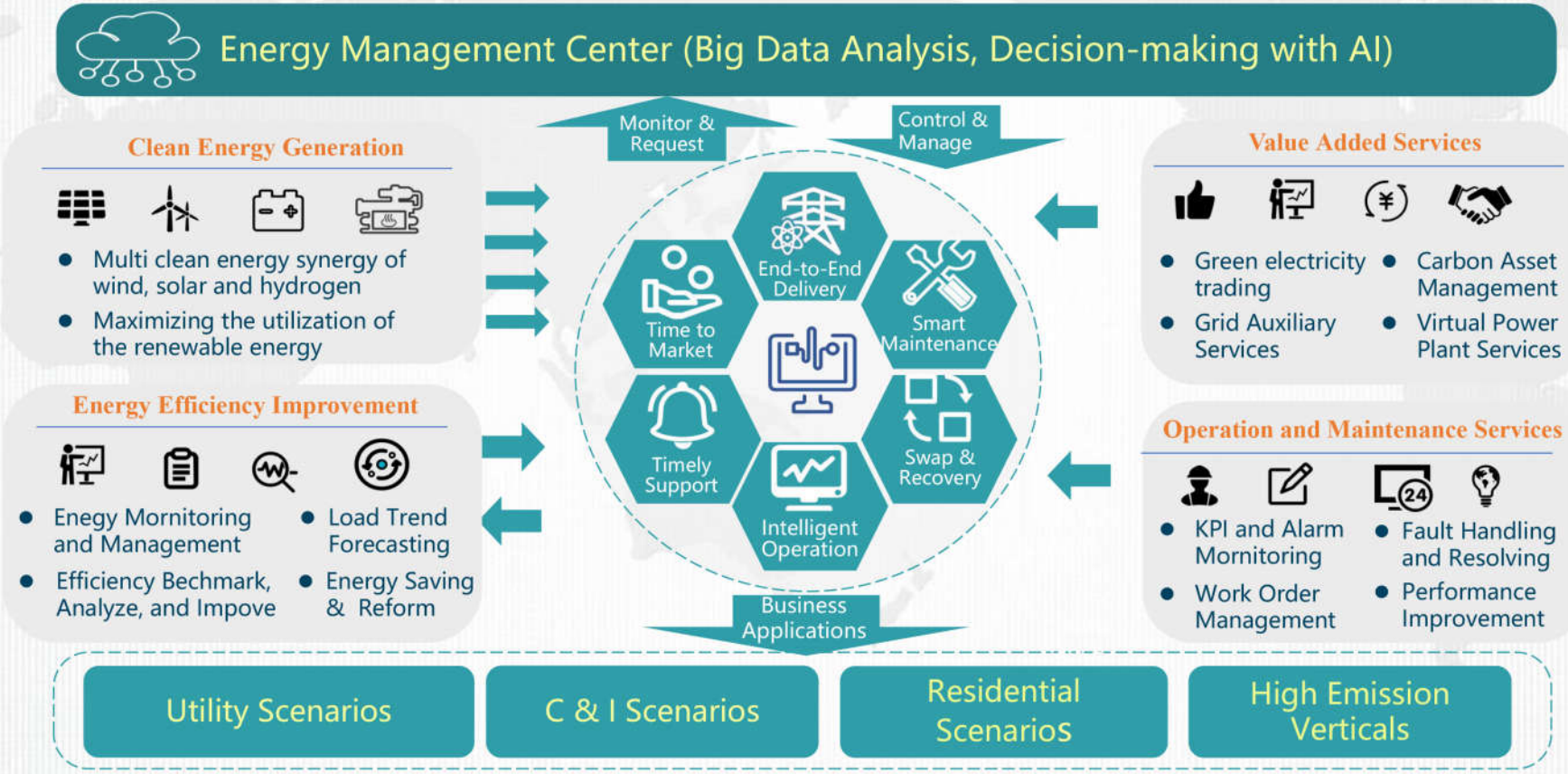
b) improving the agile dynamic power balance ability of the power system more economically, efficiently, and safely through various forms of bilateral interaction.

Business Values of BESS:

- Maximize the usage of Green Power
- Reduce the Carbon Emission towards Net-Zero
- Balance the Power Generation and Load Consumption
- Enable the Business Model as a VPP(Virtual Power Plant) via aggregation of BESS to Montinize from the Grid
- Secure the Continuous Power Supply as an Emergency Backup Power

Landscape of Energy Management Blueprint towards Net-Zero

We are committed and dedicated to facilitate and enable our customers and partners with cutting-edge technologies and competitive solutions for the evolution and transformation towards Net-Zero.



02

Customized BESS Solution for Greece Project

PART 2

Project Background

Project Background:

TThis project will be a new construction project in Greece, the project total capacity of 330MW/660MWh at the beginning of life (BOL).The whole BESS plant includes an integrated inverter boosting system and a prefabricated energy storage battery compartment. The low-voltage side of the transformer is connected to the AC side of the Power Conversion System (PCS) of BESS, and the high-voltage side is connected to the 33kV busbar of the BESS site. The prefabricated energy storage battery compartment should include batteries, Battery Management System (BMS), prefabricated compartments (including ventilation and heating, video monitoring, fire detection and alarm as well as fire extinguishing system, access control system, lighting, prefabricated compartments and related equipment), etc.

1. System

- System requirement 330MW+660MWh
- 314Ah cell meets charge and discharge rate ≤0.5C

2.Working condition

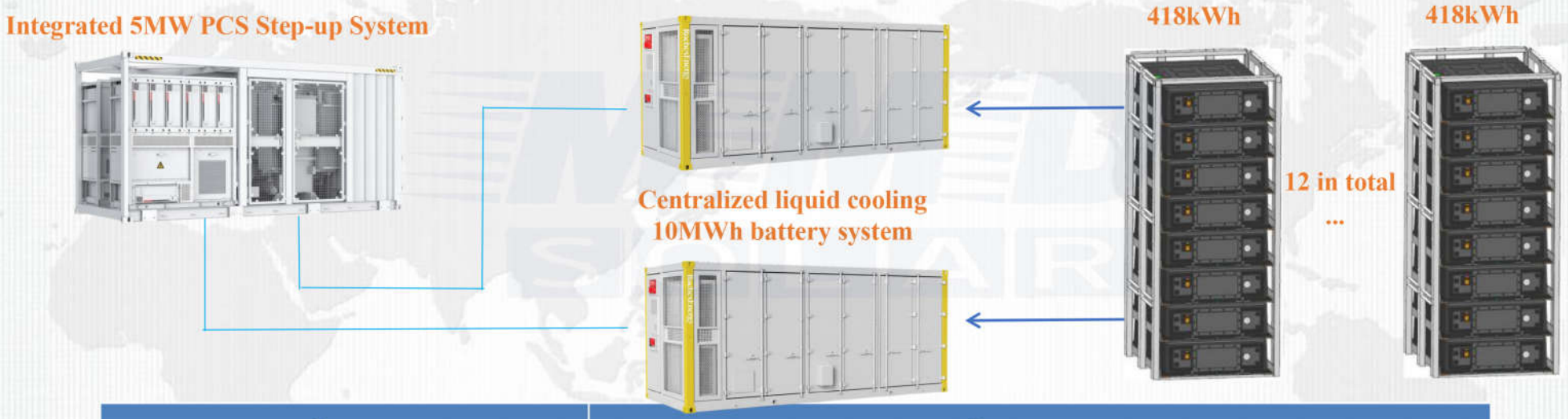
- Battery Charge and discharge C-rate: 0.5C/0.5C

3.PCS Model

- 5000kW String PCS

Proposed Configuration of Battery Energy Storage System

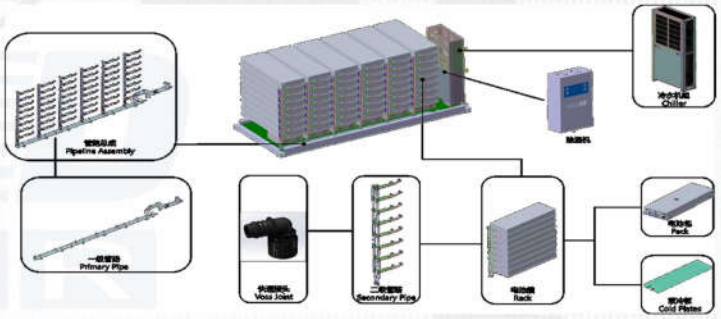
There are totally 66 sets of 5MW/10MWh BESS unis, which is including one set of Integrated 5MW PCS Step-up System and 2 sets of 5MWh Liquid Cooling Battery Systems as below.



Items	Parameters
Power of PCS	5MW
Capacity of Battery	10MWh
Output Voltage	AC 33KV
Dimensions of DC Battery Cabinet	6058 * 2438 * 2896mm (L*W*H)
Dimensions of AC PCS Step-up Cabinet	6058 * 2438 * 2896mm (L*W*H)

Design Philosophy and Specifications of Battery Containers

The Energy Storage System adopts a modular design, with a clear hierarchy of battery cells, modules, clusters, and battery systems. It includes a complete battery rack, battery management system (BMS), temperature control system, lighting system, fire detection and automatic fire extinguishing system, security system, emergency system, etc.

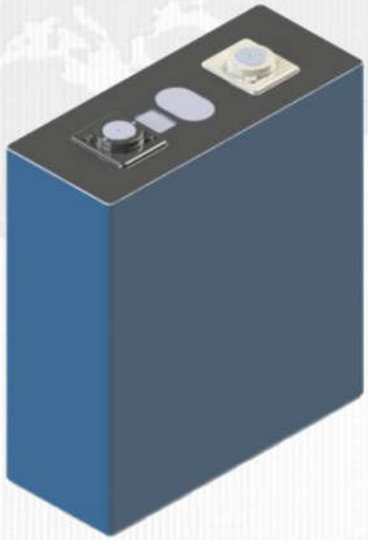


Components of Battery Container

Item	Parameters	Minimum Voltage	Maximum Voltage	Rated Voltage	Capacity (Wh)	Quantity
Battery Cell	314Ah	2.8V	3.6V	3.2V	1004.8	4992
Battery Module	1P104S	291.2V	379.5V	332.8V	104499	48
Battery Cluster	1P416S	1164.8V	1497.6V	1331.2V	417996.8	12
Battery Container	12P416S	1164.8V	1497.6V	1331.2V	5015961.6	1

Specification of Battery Cell

Picture of Battery Cell



Parameters of Battery Cell

No.	Item	Parameter	Remark
1	Cell Type	LFP	LiFePO4
2	Cell Capacity	314 Ah	
3	Rated Voltage	3.2V	
4	Working Voltage Range	2.5V to 3.65V	
5	Recycling Times	≥ 8000	0.5C, 80% EOL @ 25°C
6	Operating Temperature (Charging)	0°C ~ 55°C	
7	Operating Temperature (Discharging)	-20°C ~ 55°C	

Specification of Battery Pack

Picture of Battery Pack

Parameters of Battery Pack

No.	Items		Parameter
1	Nominal Voltage		332.8V
2	Nominal Capacity		314Ah
3	Nominal Energy		104.50kWh (@ 25 ℃ ± 2)
4	Efficiency		≥ 94% @ 0.5P (room temperature)
5	Voltage difference between charging and discharging		≤ 350mV
6	Maximum continuous charging and discharging power		0.5P
7	Rated charging and discharging current		157A
8	Working voltage range		291.2V~369.2V
9	Maximum operating temperature range	charging	0 ℃~55 ℃
		discharge	-30 ℃~55 ℃
10	Optimal operating temperature range	charging	20 ℃~35 ℃
		discharge	20 ℃~35 ℃
11	Transportation and storage temperature (battery at 30% or 50% SOC, with one time of charge and discharge)	Within 6 months	-20 ℃~45 ℃
12	Insulation performance		Resistance value ≥ 500M Ω @ 1000VDC
13	IP level		IP67
14	Environmental humidity		<95% RH (non condensing)
15	Cooling method		Liquid cooling

Specification of Battery Cluster

A battery rack has a total of 2 battery clusters

No.	Items		Parameter	Remarks
1	Nominal capacity		314Ah	/
2	Nominal voltage		1331.2V	/
3	Nominal power		417.9968kWh	
4	Series parallel mode		1P416S	Connected in series with 4 battery packs
5	Charging (constant power)	Maximum continuous charging rate	0.5P	/
6		Charging cut-off voltage	1497.6V	
7	discharge	Maximum continuous discharge rate	0.5P	/
		Discharge cut-off voltage	1123.2V	
8	Charging time	Standard charging	2 h	
		Fast charging	1h	
9	Insulation resistance		> 500M Ω/V	DC1000V
10	Recommended SOC range		SOC:10%~90%	/
11	Operating temperature under charging conditions		0~60 ℃	/
12	Working temperature under discharge conditions		-30~60 ℃	/

Specification of High Voltage Box

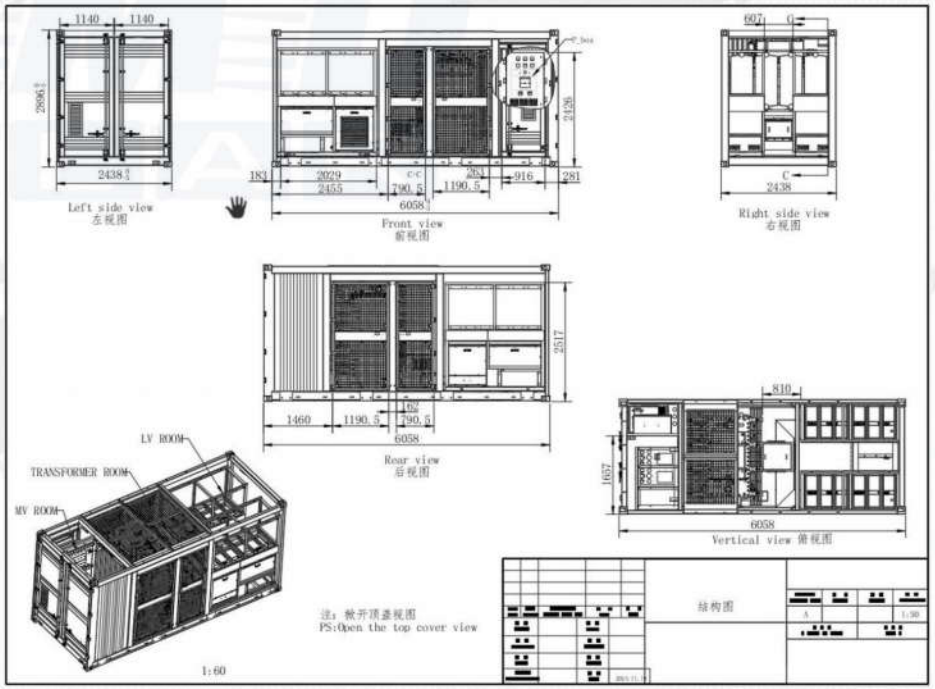
Parameters of High Voltage Box

Parameters of High Voltage Box

No.	Item	Parameter
1	Rated current	250A
2	Operation voltage	1500V
3	SOC accuracy	5%
4	Weight	＜30kg

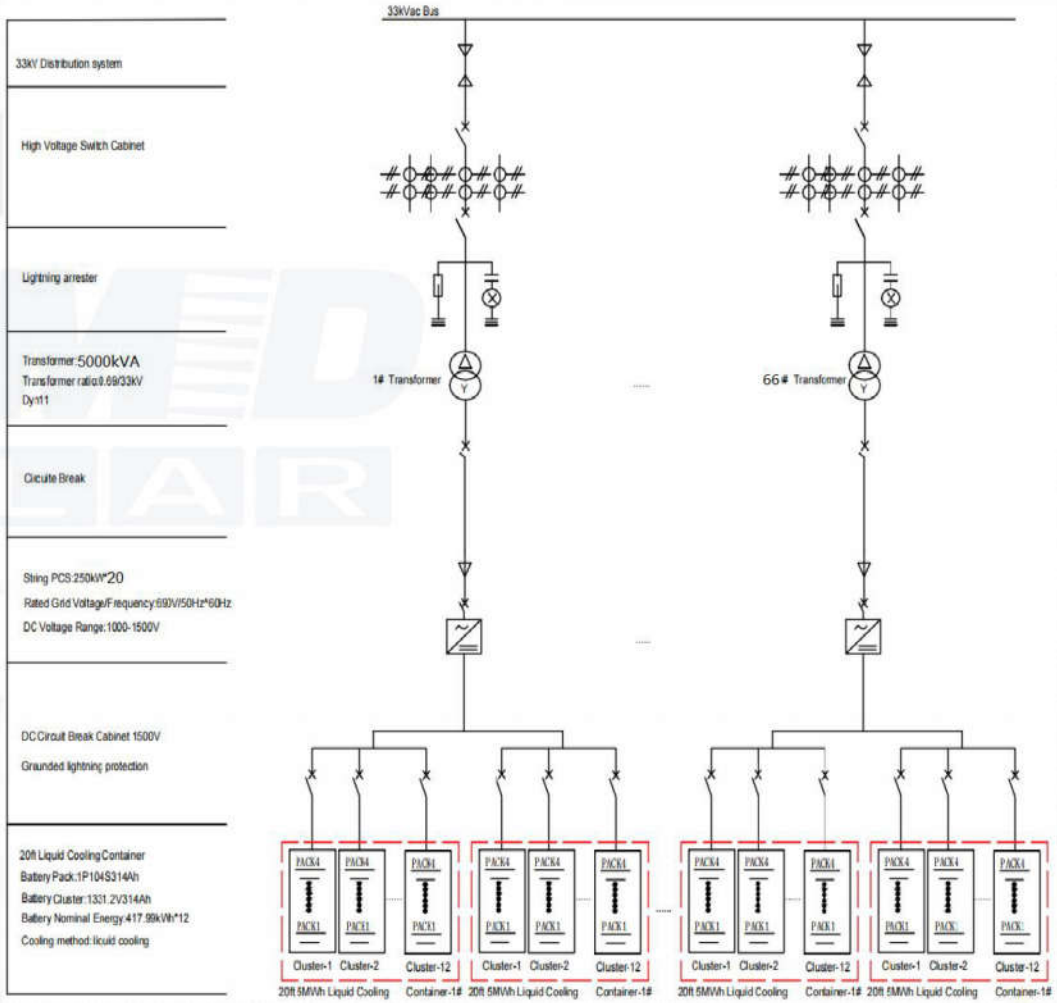
Design Philosophy and Diagram of PCS Step-up System

Inverter boost integrated warehous include 20 sets of 250kW PCS and 1 set of 5000kVA transformer. The PCS are connected in parallel on the AC side and boosted to 33kV through the transformer. The PCS adopts a circuit breaker to form a disconnection point with the transformer, and thelow-voltage side of the transformer is not separately equipped with a low-voltage cabinet. The energy storage unit needs to be connected to the 33kV busbar of the station after converging on the 33kV side.



Electrical Connection Diagram of Energy Storage System

The total capacity of this project is 25MW/100MWh, consisting of 10 sets of 2.5MW/10MWh subsystems in series. The 10MWh energy storage is included in the 2.5MW PCS by two 20ft 5MWh outdoor liquid cooled energy storage containers. The 2.5MW PCS is composed of 10 sets of 250kW PCS forming a series energy storage system. The advantage of the series energy storage system solution is that it can cluster and manage battery clusters, reduce circulation between clusters, and meet the dynamic operation and maintenance management requirements of subsequent energy storage systems. Each DC system consists of multiple battery clusters, DC combiner cabinets, communication distribution cabinets, fire protection systems, temperature control systems, and other equipment. The battery cluster is connected to the DC side of the PCS after being converged by the combiner cabinet, and the AC side of the PCS is connected in parallel to the low-voltage side of the step-up transformer, which is stepped up to 33kV and connected to the load bus through the high-voltage switchgear. The entire system shares one set of EMS.



Configuration List for Delivery - DC Part

No.	Item	Description	Unit	Qty
	BESS within Containers	5MW/10MWh	set	66
1	5MWh Battery Container	5MWh per container with 314Ah Cells	set	132
1.1	Battery cluster	417.996kWh, 314Ah battery cells	cluster	12
1.2	BMS system	Three layers architecture of BMS	set	1
1.3	DC Distribution Cabinet	Converging 12 into 1	set	1
1.4	Thermal management system	Liquid cooling unit	set	1
1.5	Fire protection system	Perfluorohexane fire extinguishing	set	1
1.6	Integrated battery container	Container including UPS, power distribution, control functions	set	1
1.7	Cables and accessories	Cables and connectors for internal equipment connection	set	1

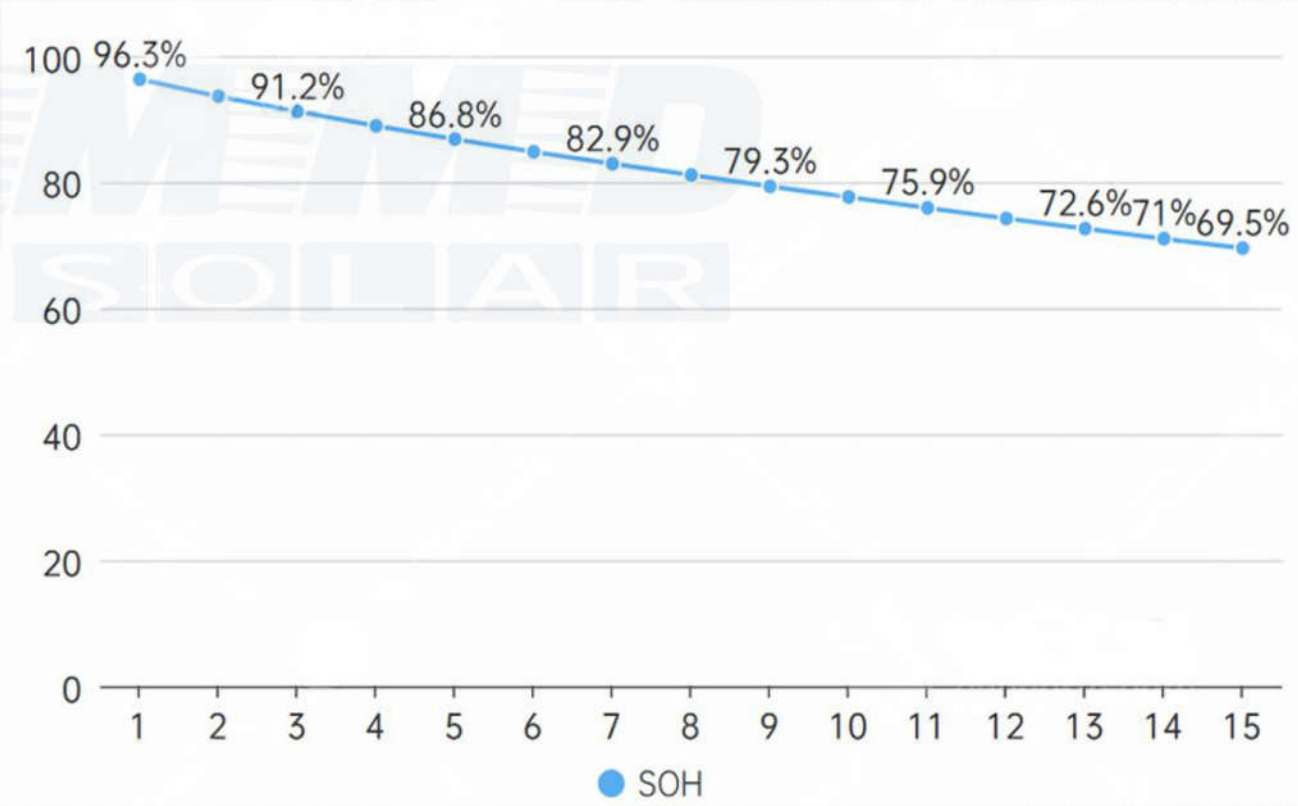
Configuration List for Delivery - AC Part (1)

No.	Item	Description	Unit	Qty
2	PCS step-up system	5000kVA inverter boost equipment	set	66
2.1	PCS	250kW	set	20
2.2	Step-up transformer	5000kVA, 33KV/0.69kV, Dy11	set	1
2.3	High-voltage Switchgear Unit	Including fuse, break switch, lightning rod,etc	set	1
2.4	AC Controlling Unit	Including measurement and control, power distribution	set	1
3	EMS	Energy Management System	set	1
3.1	Hardware Equipment	Including Server, Switcher	set	1
3.2	Software Equipment	Including Operating System (OS), Database	set	1

Degradation Curve of Battery Cell

In case that the battery cell is working under the environmental conditions as below: (1) 100% DOD; (2) 0.5P; (3) One cycle per day; Then the degradation curve of battery cells shall be shown as the following table and diagram.

Year	SOH
1	96.3%
2	93.6%
3	91.2%
4	88.9%
5	86.8%
6	84.8%
7	82.9%
8	81.1%
9	79.3%
10	77.6%
11	75.9%
12	74.2%
13	72.6%
14	71%
15	69.5%



03

Business Competency And References

PART 3

Solid Competitive Advantage of BESS Project fit for Diversity of Requirement

0.8 GWh+ ESS already installed

and 1 GWh+ ESS order in hand

- Rich experience in ESS system design, integration and application of products
- Integrated End-to-End solution of ESS, including PCS, BMS, EMS and boost transformer and advanced liquid-cooling ESS solution
- Experienced O&M team to provide life-cycle technical support

Part of Successful Reference for BESS

Accumulated operational projects exceeding 0.5GWh, cumulative order in hand exceeding 1GWh, including industrial and commercial (I&C) energy storage projects exceeding 600MWh.

Utility Scale BESS for Renewable Energy Projects

All-in-One BESS for Industrial and Commercial Scenarios

No.	Project Name	BESS Scale
1	GUANGZHUO YONGHE INDUSTRY Park Energy Storage Project	1MW/2MWh
2	China HEYUAN Energy Storage Project	3.2MW/6.4MWh
3	China GUANGXI HECHI Energy Storage Project	12MW/24MWh
4	Pakistan Microgrid Energy Storage Project	15MW/60MWh
5	Sabah Malaysia Chinese Chamber of Commerce Energy Storage Project	100MW/400MWh
6	Inner Mongolia Kubuqi Desert Project	75MW/150MWh
7	CNPC Yumen Project	40MW/80MWh
8	QINGYUAN C&T Park Distribution and Storage Project	1MW/2MWh
9	SHENZHEN Univerity Metal Storage Project	1MW/2MWh
10	SHENZHEN GUANGMING Park Project	7MW/14MWh
...	.....	.....


MMD
SOLAR