EnerC+

Containerized Liquid-Cooling Battery System

Basic Parameters		
Module configuration	5P*2P52S*8	
Cell capacity	280Ah	**306Ah**
Rated voltage	1,331.2V	
Rated energy	3.72MWh	**4.07MWh**
Product weight	35 T	36T
IP Level	IP55	
Dimension (L*W*H)	6058mm*2438mm*2896mm	

| Testing and certification

IEC 62619 · UL 1973 · UL 9540A · IEC 62477-1

High level of safety

- LFP batteries with high thermal stability
- Protection level of IP55 to meet the requirements of outdoor applications
- Resistance up to C5 corrosion level, with 20-year reliability
- Prevention-oriented fire protection strategy, with a separate fire protection system
- **Support explosion-proof fan，Optional dry pipe**

Long service life

- **Available for integration with CATL's advanced technologies (e.g. optional cell with super-long cycling up to 12,000 cycles)**
- Integrated high-efficiency liquid-cooling system, with the temperature difference in the container limited to 5℃

High integration

- Modular design for the 1,500V system
- Separate arrangement of electrical room and battery room for convenient maintenance
- Non-walk-in/modular design with high integration, saving the floor space by 50%
- Prefabricated installation, reducing on-site installation costs and commissioning time

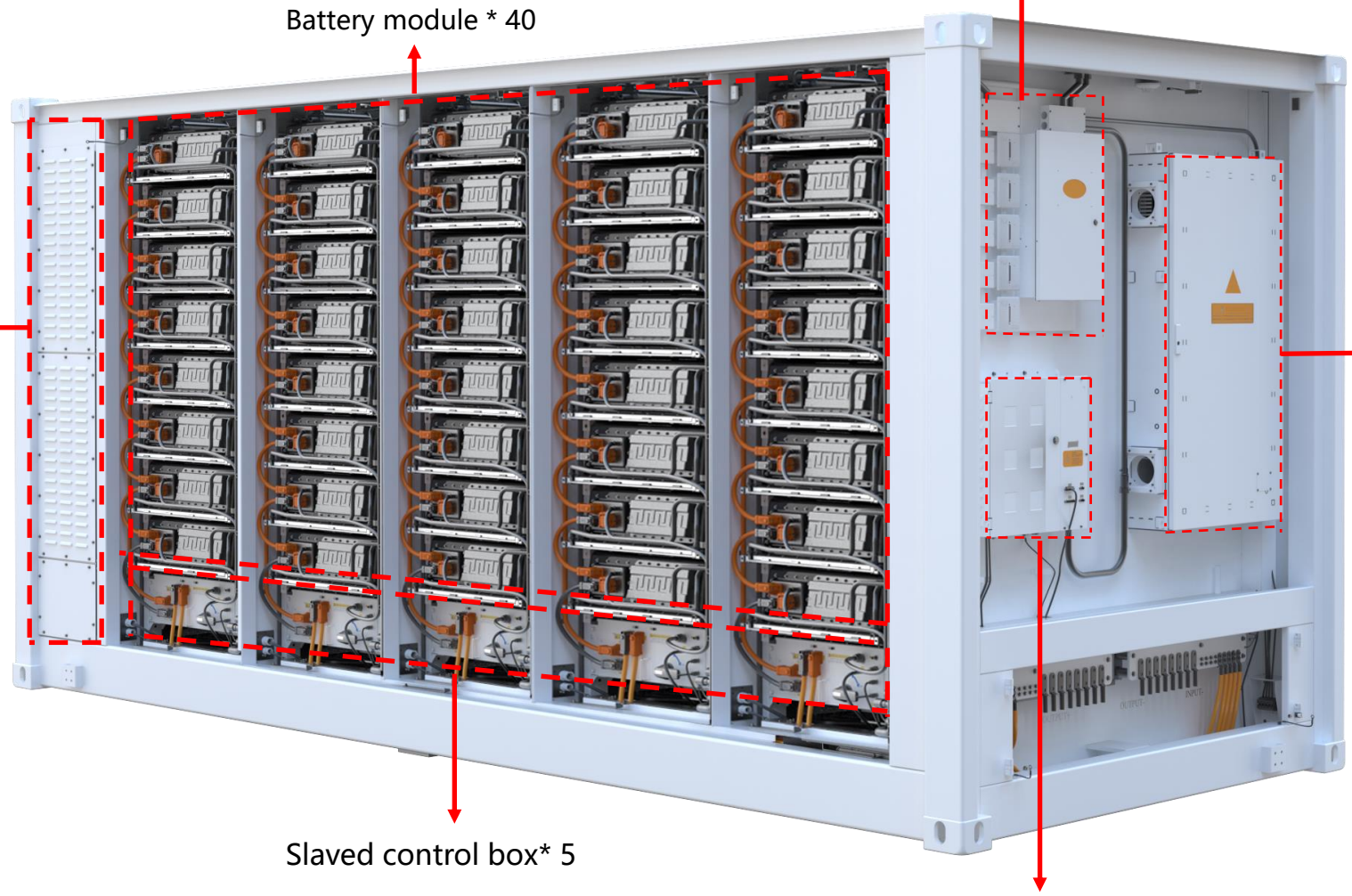
Product Specification Battery Container

Item	Specification
Configuration	10P416S
Rated Energy	4073.47kWh
Rated Voltage	1331.2VDC
Voltage Range	1164.8V to 1497.6V
Dimension	6058mm(W)x2438mm(D)x2896mm(H)
IP Rating	IP55
Weight	~36t
Operation Temperature Range	-25℃ to 55℃
Application Altitude	⩽2000m
Cooling	Liquid: 50% Ethylene glycol aqueous solution
Humidity	<95%, No condensing
Charging/Discharging Power	2036.73kW
Color	RAL7042
Auxiliary power supply	Voltage Range: 400(±10%Vac),3AC+N+PE,50/60Hz Voltage Range: 230(±10%Vac), L+N+PE,50/60Hz Maximum Power: 36.7kW @25℃ @0.5P
Noise Class	92dB @1m
Enclosure Coating	ISO 12944, C4
Communication protocol	CAN, RS485, TCP/IP
Grounding	Grounding copper bar
Installation	Concrete: anchor bolt

*For reference, subject to technical agreement

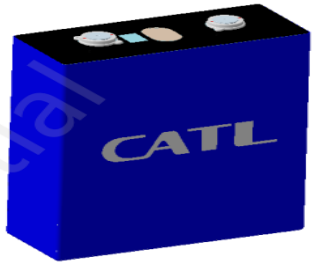
Product Specification Battery Container

➢ Overview



Product Specification Battery Container

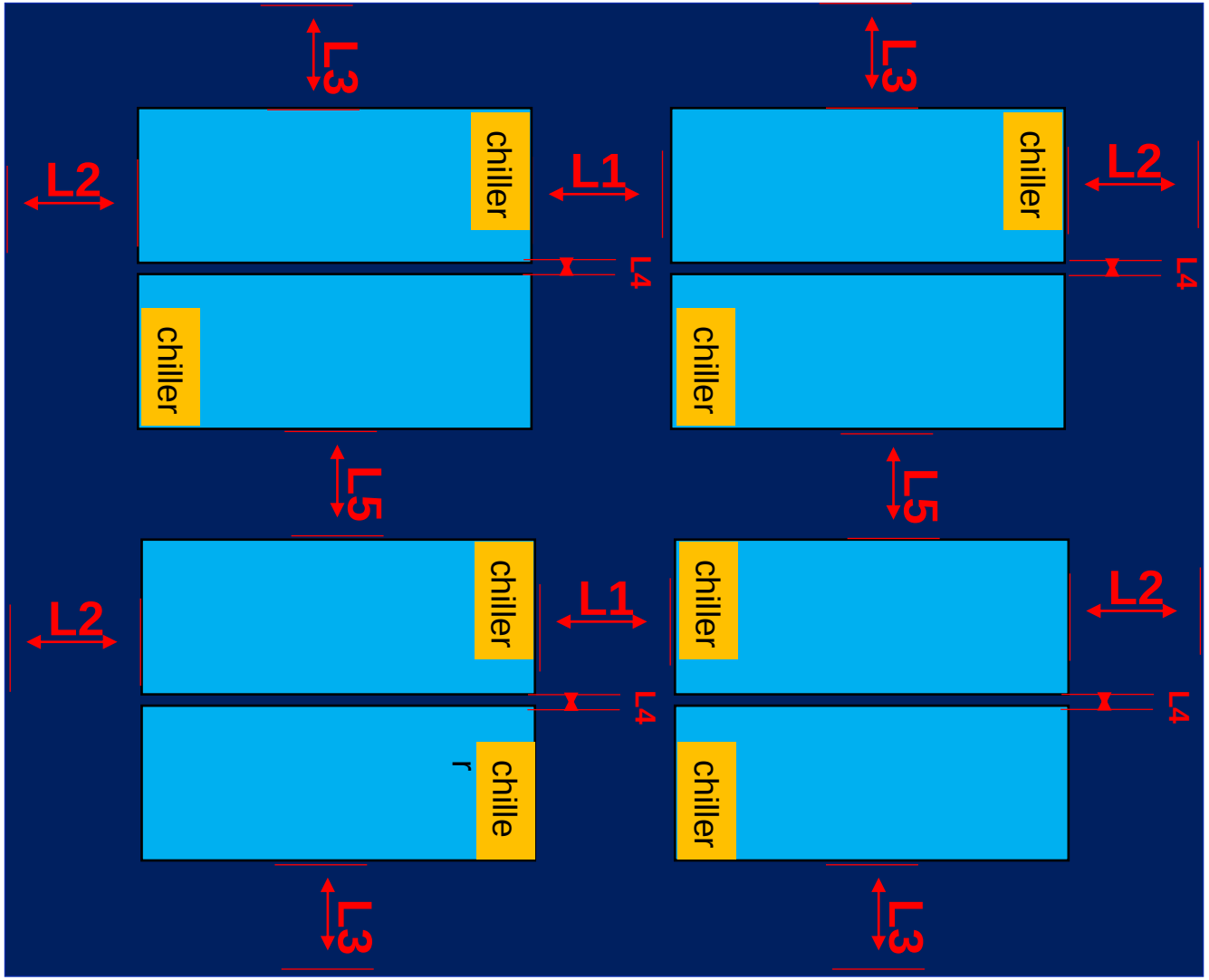
➢ Specification:



Item	Cell-306Ah	Module	Container
Configuration	/	2P52S	10P416S
Dimension	174(W)*72(D)*207(H)mm	830.0(W)*2206.5(D)*250.0(H)mm	2438 (W)*6058(D)*2896(H)mm
Weight	5.50±0.30kg	~640±5kg	~36000kg
Rated Voltage	3.2V	166.4V	1331.2V
Voltage Range	2.5 ~ 3.65V	145.6 ~ 187.2V	1164.8 ~ 1497.2V
Rated Energy	0.979kWh	101.837kWh	4.073Wh

*For reference, subject to technical agreement

Installation---Layout



To avoid the hot air interaction for two containers，and to maintain the container， the minimum distance must be followed :

L1 : 3.00m (Just for reference, TBD)
L2 : 3.00m (Just for reference, TBD)
L3 : 3.50m
L4 : 0.20m
L5 : 3.50m

L1 : 4.00m (Just for reference, TBD)
L2 : 2.00m (Just for reference, TBD)
L3 : 3.50m
L4 : 0.20m
L5 : 3.50m

*For reference, subject to technical agreement

AC 400MW/800MWh

BESS Project Solution

Prepared By

BYD | Energy Storage

Revision Num.	Date	Description	Author	Project Location	Update
1.0	9/6/2023	Initial Release	syed.furqanrafique@fdbatt.com	Australia	Chelion BESS

Contents

[Technical Specification]

This technical description and specification provide BYD's battery energy storage system solution for the AC 400MW/800MWh ESS project. The solution includes the design, manufacturing, delivery, procurement of the energy storage system. BYD ONLY supplies the devices listed in this proposal, the buyer or buyer's contractors shall be responsible for all the other works and equipment such as site infrastructures and preparation, installations, etc.

1. Background of Design

Since the buyer demands a minimum of 400MW-800MWh capacity at the POI, 96% efficiency for AC cable/bus, PCS, MV transformer and MV wiring and Substation and Battery Auxiliary losses is considered to be 2.84%. Therefore, the DC side capacity specification is 859.2MWh.

Hereunder in this proposal BYD will provide 859.2MWh ESS, an initially DC side energy storage solution, to meet the required capacity through 15 years of system life. The standard operating mode of the ESS is Grid-Connected (GC) mode.

Table 1.1-1 Project initial configuration

Project Size		400MW-800MWh
Initial DC usable energy in BYD proposal		859.2MWh
BYD products		10+1 System
MC Cube Quantity		192

Table 1.1-2 Energy storage system scope

CODE	DEVICE	DESCRIPTION	REMARKS
1	10+1 System	(D*W*H 2438*6058*2896mm)	Each 10+1 System includes 10 battery units and 1 distribution junction unit. (including batteries, BMS, HVAC, fire detection and suppression system, etc.)
2	Connection Cables	Including the cables inside 10+1 System	**Exclude any cables from the BESS to buyer's devices and the grounding cables**

2. Energy Storage Proposal

Initially there are **192** × 2.240MW-4.472MWh usable (@SAT) ESS units all together in the 859.2MWh system to ensure 800MWh discharge required at AC side at BOL. The 15 years proposal will be set forth in Chapter 5 Energy Proposal.

3. Terms and Definitions

1) Nominal Energy (Usable Energy)

The nominal energy is the buyer's target value, which is also the target value for the system SAT. Normally, ESS finishes FAT that is before shipment and needs to be transported to the project site. Then the system will be installed and commissioned, etc., and finally SAT phase will be executed. The supplier requires that the ESS system be from FAT to SAT for a period not exceeding 3 calendar months.

2) Nominal Working Condition

Each ESS unit Battery system under conditions of the 10+1 System internal temperature shall be 10～25°C, the average SOC of battery shall be about 50% when in operation, the suggested SOC long term storage range of battery is 20% to 60%, RH 5% ~ 95%, altitude is less than 2000 meters:

(1) Condition 1: the battery is charged at nominal charging power of 2.240MW, and is discharged at nominal discharging power of MW. Maximum 1 cycles per day, and cumulatively less than 730 cycles per year.

(2) Condition 2: Testing condition only once a year, following the standard test condition in 3) of section 3.

3) Battery energy standard test condition and round trip efficiency

Each ESS unit Battery system under conditions of RH 5% ~ 95%, altitude is less than 2000 meters:

(i) The 10+1 System BESS internal temperature shall be 10～25°C.

(ii) The initial temperature of the battery cell shall be 20～28°C.

(iii) Pre-charge and pre-discharge before Energy and round trip efficiency test.

(iv) Measured at the AC side of the 10+1 System BESS output, excluding the auxiliary consumption.

(v) The battery is discharged until any battery cell reaches the discharging cut-off voltage, then stop discharging.

(vi) The battery is charged at nominal charging power until any battery cell reaches the charging cut-off voltage (which should correspond to up to 100% SOC), then stop charging and record the cumulative data (Q1) of the measuring equipment. System should then standby for 60 min.

(vii) The battery is discharged at nominal discharging power until any battery cell reaches the discharging cut-off voltage (which should correspond to down to 0% SOC), then stop discharging and record the cumulative data (Q2) of the measuring equipment.

(viii) Calculate the recorded measurement data.

(ix) Round Trip Efficiency(η), the calculation formula is: η=Q2/Q1×100%

4. Technical Proposal

4.1 ESS System Design

4.1.1 ESS Energy Configuration Table

The initial usable energy @DC side is calculated with the following table.

Table 4.1-1 ESS energy configuration

Item	Initial solution	Remark
Battery model	LFP	
Battery cell rated voltage(V)	3.2	
Number of battery cell per string	416	
Number of battery strings per enclosure	10	
Cell energy per enclosure(MWh)	4.659	
Number of enclosures	192	
Total cell energy(MWh)	894.5	
DC side usable energy(MWh)	859.2	@SAT (Within 4 calendar months from FAT to SAT)
DC side full power energy (MWh)	859.2	@SAT without Auxiliary
AC side energy requirement (MWh)	801.8	@SAT including AC losses

4.1.2 ESS Design

The BYD ESS are specifically designed to withstand in variety of outdoor environmental conditions. Based on initial requirement from buyer, the battery degradation has been calculated according to the specific product data, daily full cycles and site conditions.

Battery system under conditions of the ambient temperature shall be -15~45°C, the average SOC of battery shall be about 50% when in operation, the suggested SOC long term storage range of battery is 20% to 60%, RH 5% ~ 100%, altitude is less than 2000 meters:

(1) Condition 1: The charge and discharge power is DC 2.240MW, maximum 1 cycles per day, and 730 cycles per year.

(2) Condition 2: Testing condition only once a year, following standard test condition.

If there are any changes to the system working condition, the energy retention need to be reevaluated.

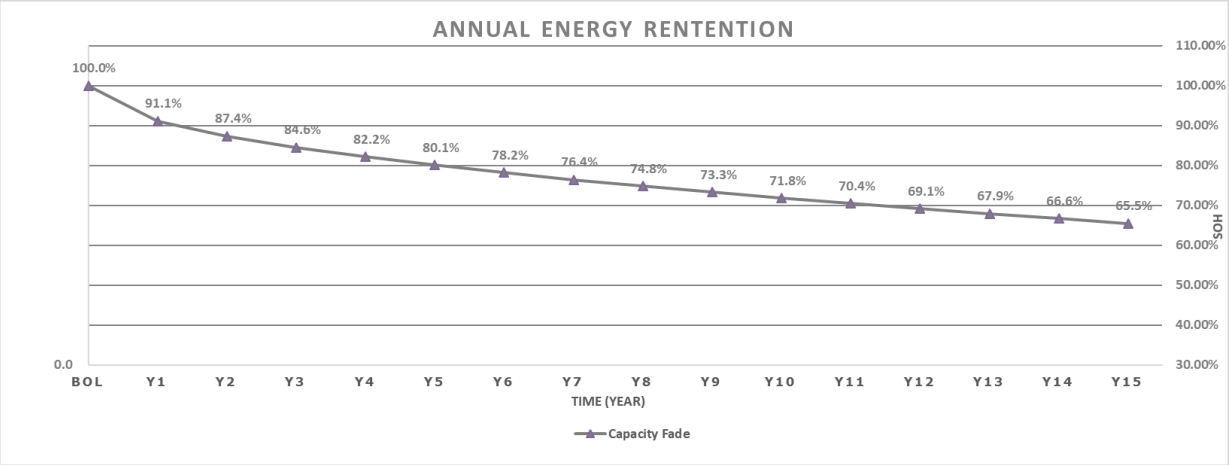


Figure 4.1-1 Degradation curve

4.1.3 ESS Unit Design

4.1.3.1 System Electrical Topology

In this technical specification, the ESS connects to buyer's PCS at the DC side. The electrical topology of the battery energy storage system is shown as below:

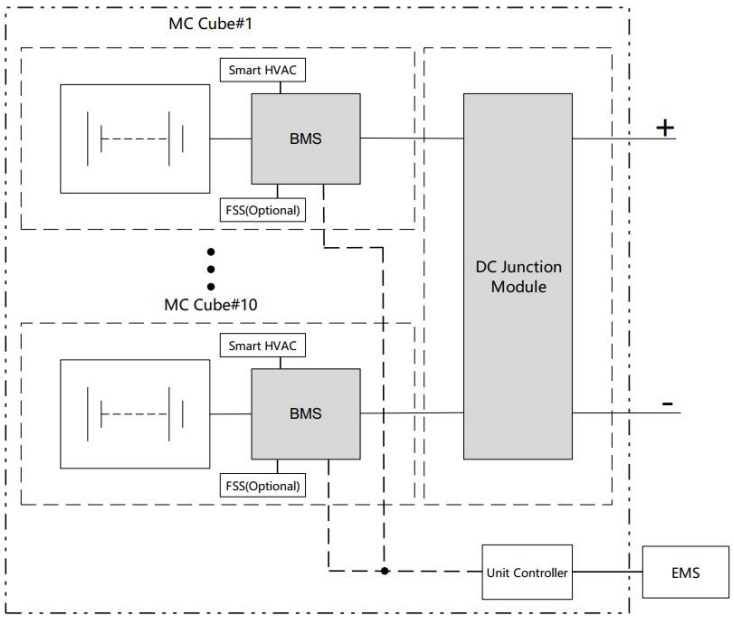


Figure 4.1-2 Battery energy storage system electrical topology (for reference)

4.1.3.2 ESS Unit Communication Topology

In this specification, the system provides communication interface for buyer's side SCADA system. The communication protocol of the communication interface is Modbus TCP/IP.

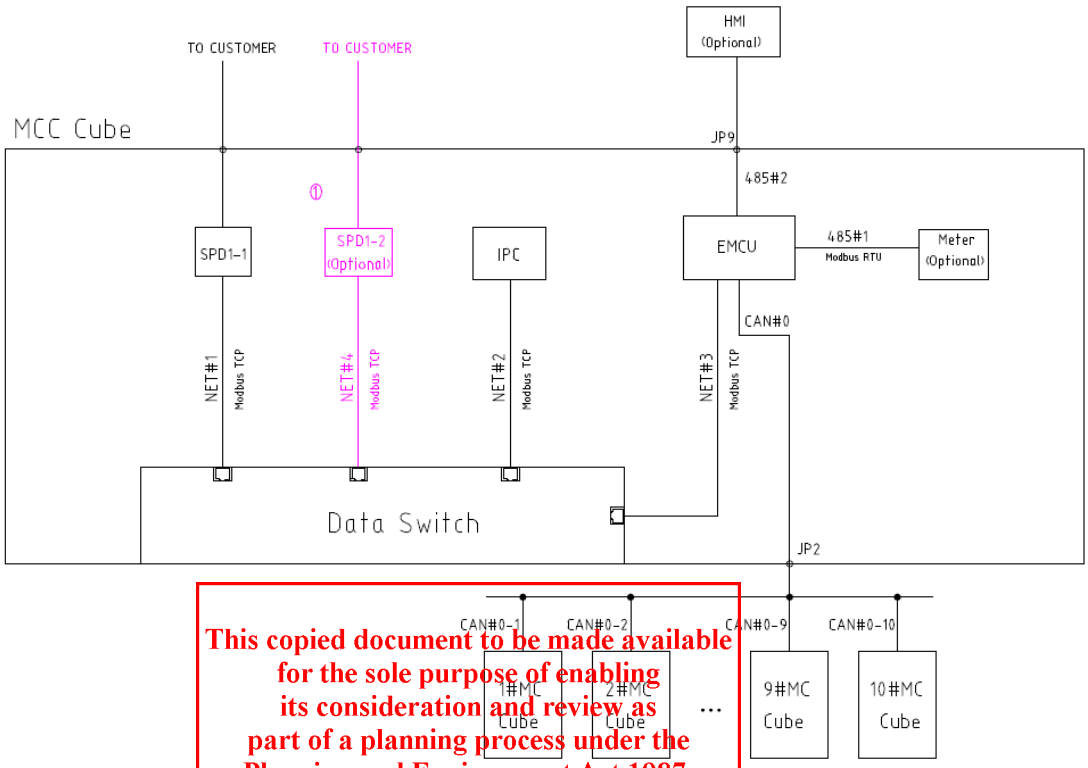


Figure 4.1-3 Single battery energy storage system unit communication topology

4.1.3.3 ESS Technical Parameters

The parameters of this project ESS unit are shown as follows.

Table 4.1-2 Project ESS unit technical parameter

NO.	Item	Parameter	Remark
1	Max charge and discharge power (MW)	2.240	DC
2	Charging and discharging power (MW)	2.240	@Testing condition, only once a year, following standard test condition
3	DC usable energy (MWh)	4.472	@SAT(The duration time from FAT to SAT is no more than 4 calendar months)
4	DC full power usable energy (MWh)	4.472	Full power usable SOC range is 100%
5	Nominal output voltage (V)	1331.2	DC

NO.	Item		Parameter	Remark
6	Output voltage range (V)		1081.6～1497.6	
7	Max output current (A)		1750	
8	Working mode		On-grid	
Operation environment				
9	Permissible ambient temperature of enclosure (℃)		-30～+55	Operation above +45℃ may result in reduced power and capacity
10	Best operation temperature for battery (℃)		+10～+25	Best ambient temperature
11	Permissible relative humidity (%)		5～100	
12	Permissible altitude (m)		＜2000	
Other parameter				
13	Noise (dBA)		≤75	1 meter distance outside enclosure
14	Ingress rating		IP55	
15	Standard Color		RAL 9003	Main color
16	Communication mode		Ethernet	
17	Dimension (D×W×H, mm)		2438*6058*2896mm	
18	Weight of 10+1 System BESS (tons)		Around 42.252	
19	External interface	DC1500V interface (pcs)	1	Positive and negative poles. A flame-retardant cable is recommended. Cable type and size shall be determined by Buyer or its EPC contractor.
		Auxiliary power supply interface (pcs)	1	AC 400V/50Hz, 3 phase 4 wire (L1/L2), about 76kVA for each enclosure. The auxiliary power supply needs to be connected with an isolation transformer.
		Communication interface (pcs)	2	Ethernet interfaces for connection with the on-site communication equipment from Buyer to receive the instructions from the power grid or Buyer's controller and then upload the BESS

NO.	Item		Parameter	Remark
				data to Buyer's EMS.
		Grounding interface (pcs)	1	1 for each enclosure, Flame retardant green grounding cable with a diameter of not less than 2/0 AWG is recommended.

Data Provided by DC block

Parameters of System are provided to Buyer, including power, voltage, current, state (operation, stop, alarming, trigger, charging, and available kW/kWh) and related working data or setting parameter listed in the table below.

Items	Remote Access (Y/N)	Unit
System High Accumulated Input Energy	Y	kWh
System Low Accumulated Input Energy	Y	kWh
System High Accumulated Output Energy	Y	kWh
System Low Accumulative Output Energy	Y	kWh
Allowable Active Power Discharge Limit	Y	kW
Allowable Active Power Charge Limit	Y	kW
Allowable Reactive Power Supplied Limit	Y	kVar
Allowable Reactive Power Absorbed Limit	Y	kVar
Dc Power	Y	kW
Dc Voltage	Y	V
Dc Current	Y	A
Soc (Battery String)	Y	%
Current (Battery String)	Y	A

Max. Cell Temp (Battery String)	Y	℃
Min. Cell Temp (Battery String)	Y	℃
Max. Cell Voltage (Battery String)	Y	V
Min. Cell Voltage (Battery String)	Y	V
Alarms For Battery String	Y	
Operating State	Y	
Operating State (Battery String)	Y	

4.1.4 BESS System Installation Area

10+1 System BESS:

Design for UL9540A

Integrated battery, battery management system, protection circuit, temperature control system and fire protection unit.

4.472MWh cell energy LFP battery is in a battery 10+1 System BESS.

Figure 4.1-4 The appearance of a 10+1 System BESS unit (for reference)

The 10+1 System BESS can be used in large-scale power station, small-scale power station, and can be installed in the narrow and long area of the site.

The installation layout is shown in the following figure.

Unit:mm

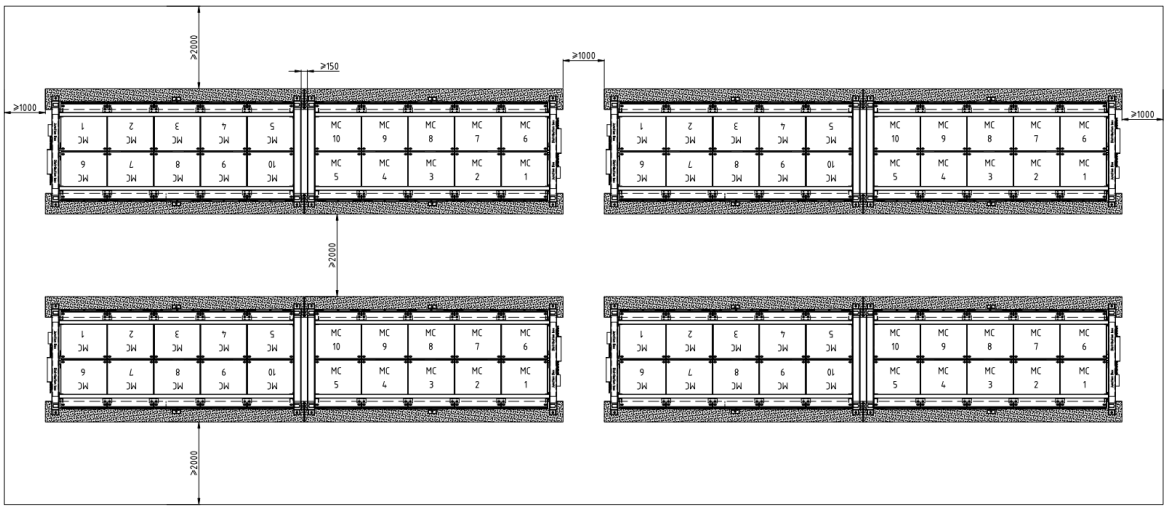


Figure 4.1-5 BESS site layout (for reference)\

5. The Scope of Supply of 15 Years Energy Storage Proposal

5.1 ESS Equipment

The proposed solution scope of supply is as below:

Table 5.1-1 Energy storage system (Initial)

CODE	DEVICE	DESCRIPTION	QUANTITY	REMARKS
1	10+1 System	(2438*6058*2896mm)	192 pcs	Each 10+1 System includes 10 battery units and 1 distribution junction unit. (including batteries, BMS, HVAC, fire detection and suppression system, etc.)
2	Connection Cables	Including the cables in the enclosure	1 set	**Exclude any cables from the BESS to buyer's devices and the BESS grounding cables**

5.2 Warranty period

Table 5.2-1 Warranty years of initial energy storage system

CODE	ITEM	WARRANTY YEARS	REMARKS
1	Battery system	15 warranty years	
2	BMS	15 warranty years	

5.3 The 15 Years total Energy Proposal

The total energy is shown as below.

Table 5.3-1 The 15 years total energy

SOLUTION	ITEM	CELL ENERGY (MWH)	DC SIDE USABLE ENERGY (MWH)
Initial installation schedule (15 years)	Initial Installation	894.5	859.2

ESS system energy degradation of 15 years is shown as below:

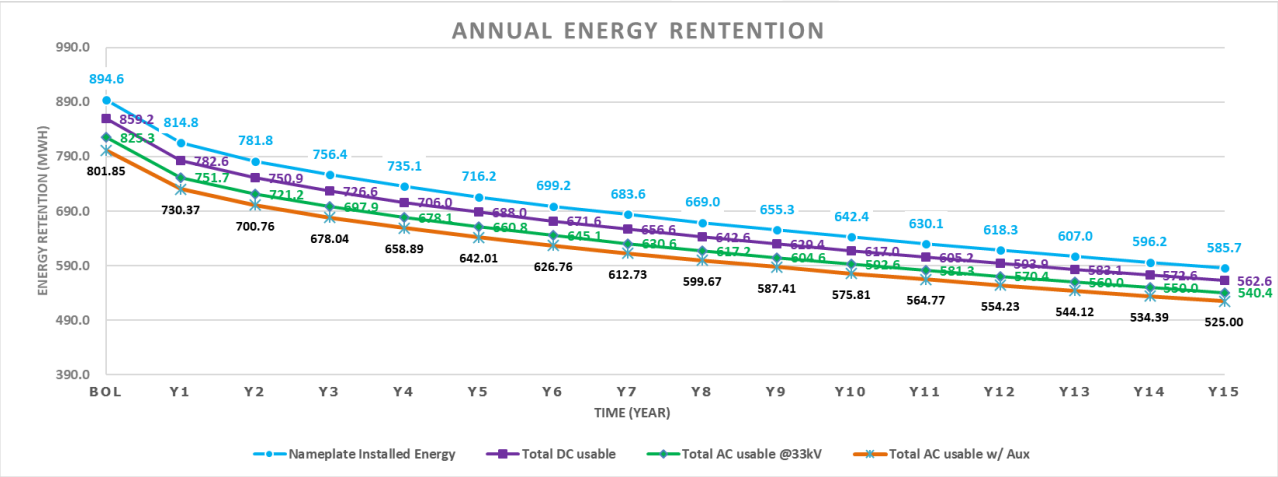


Figure 5.3-1 BESS systems energy degradation of 15 years（energy @POI）

6. Appendices

The technical proposal of this project consists of the following appendices:

-Technical Specification for 10+1System Battery Energy Storage System

-Warranty term sheet

---------- NOTHING FOLLOWS ----------