



Redefining Safety to New Heights

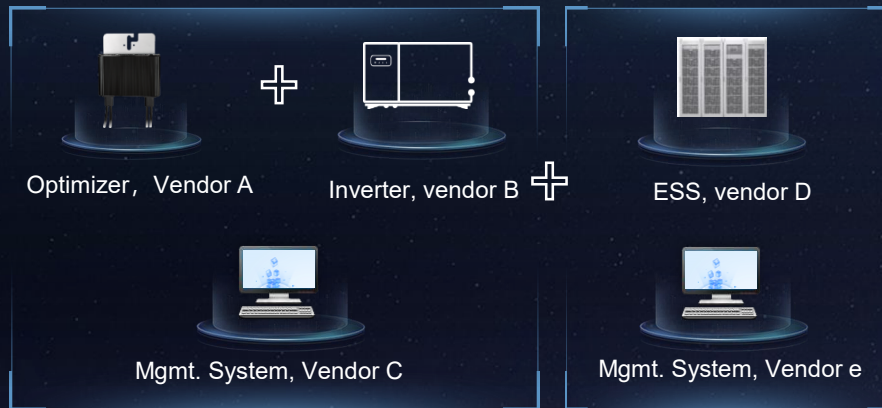
C&I Smart String ESS Solution

Author: Alexandros Chatzialexiadis

One-stop PV+ESS Solution, Better Synergy & Simple Aftersales Service

Traditional: multi-vendor product portfolio

Multi-vendor product portfolios, insufficient synergy & complex aftersales



5

Supplier interfaces
Low deployment efficiency

2

Mgt. system
Insufficient synergy

5

service interfaces,
Poor aftersales experience

VS

Huawei: E2E PV+ESS solution

E2E PV+ESS solution, better synergy, simple aftersales



1

Supplier interface
Efficient deployment

1

Mgt. system
Support multi-mode

1

Service window
Simple aftersales,

LUNA2000-200KWH-2H0/2H1



1 Distributed Air Conditioner
2 units per ESS cabinet

2 Battery Pack + Optimizer
18 pcs 280Ah battery cells in the pack with built-in battery optimizer

3 Battery Rack
12 battery packs per rack
1 rack per ESS cabinet

4 Smart Rack Controller (DCDC)
1 DC/DC module in each cabinet, DCDC mounted on the right of the cabinet

5 Smart PCS (100KW)
PCS can be installed on the left of cabinet with the mounting bracket

Total Energy Capacity

200KWH

Charge/Discharge Power

100 kW@0.5C

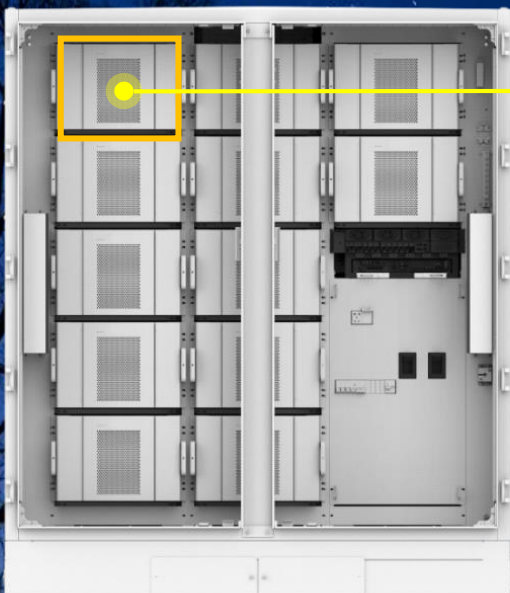
Dimensions (W*H*D)

2570 x 2100 x 950 mm

Weight

<2.6t

LUNA2000-200KWH-2H0/2H1



Battery Pack Spec	
Cell material	LFP
Rated voltage	57.6 V
Nominal capacity	16.13 kWh
Weight	≤ 140 kg
Dimensions (H x W x D)	660 x 442 x 307 mm

Total Energy Capacity

200KWH

Charge/Discharge Power

100 kW@0.5C

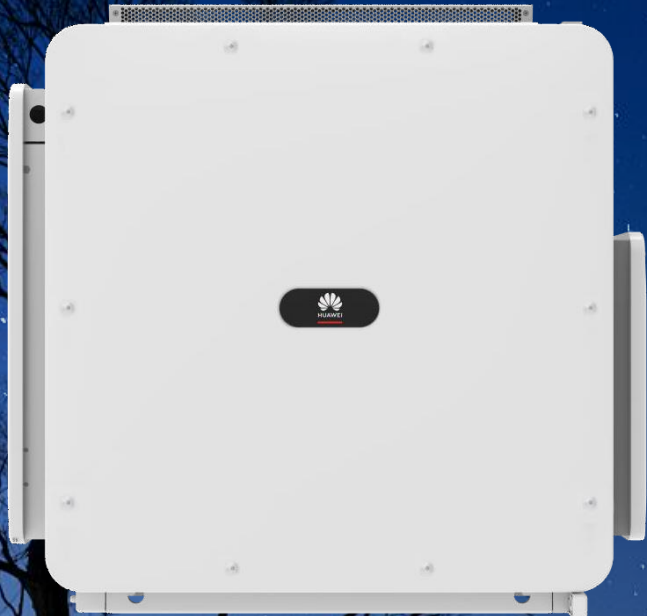
Dimensions (W*H*D)

2570 x 2100 x 950 mm

Weight

<2.6t

LUNA2000-100KTL-M1



Smart PCS Spec	
Rated AC Active Power	100KW
Max DC Voltage	1100Vdc
Rated AC Voltage	400Vac
Max efficiency	98.5%
Euro efficiency	98.2%

Rated Power

100kW@40°C

Max. Efficiency

98.5%

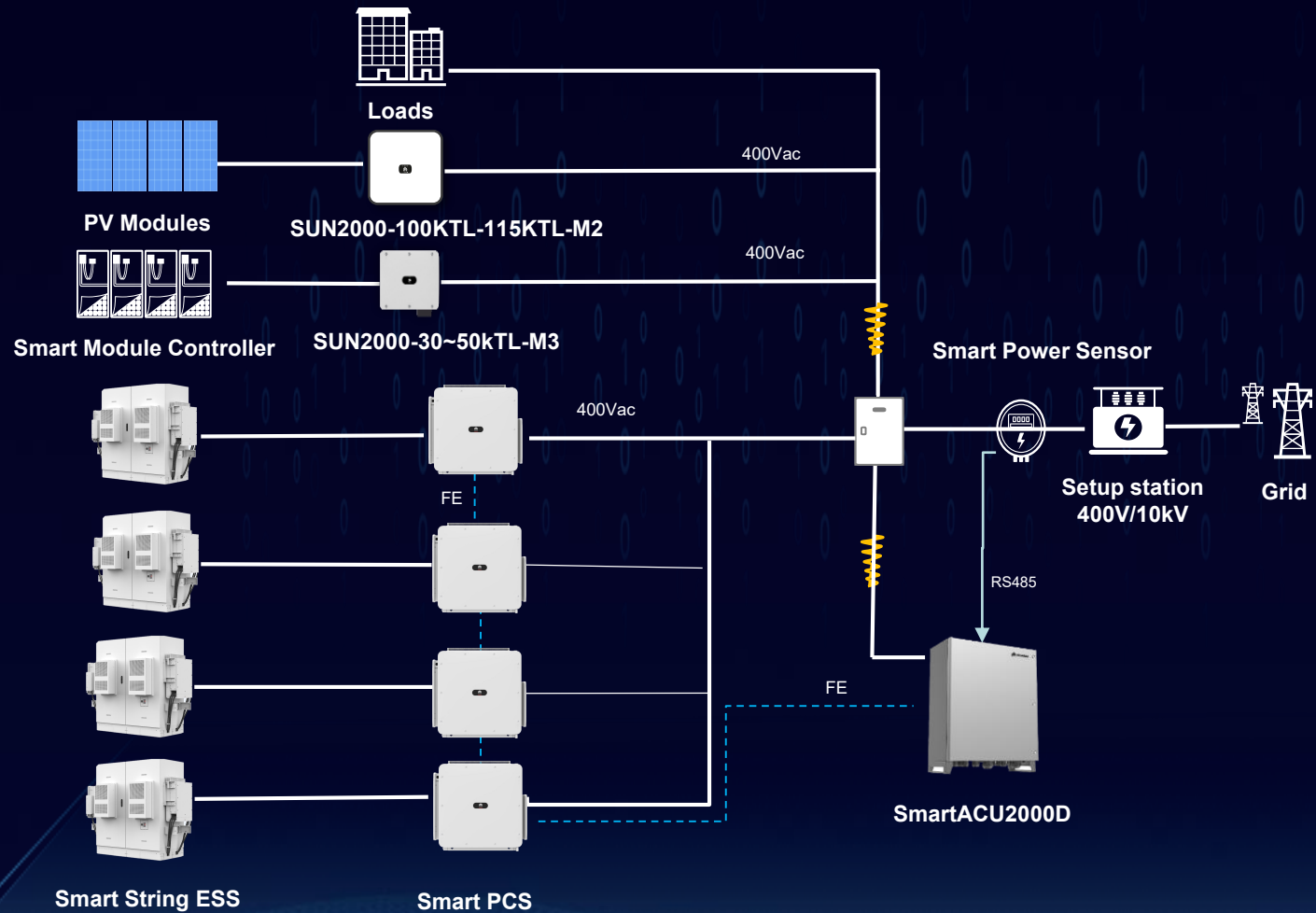
Protection

IP66

Weight

<95kg

PV + ESS: Up to 4 ESS Parallel for a 800KWH/400kW System



Smart String ESS Operation

1. Currently up to a 800KWH/400kW system
2. Battery pack need onsite installation
3. Only 0.5C charging/discharging rate (1 battery cabinet + 1 PCS)
4. Need to reserve 5M maintenance channel between battery cabinets (for forklift to pass)

BESS Challenges: Inconsistency Leads to Lower Usable Energy, Short Lifespan, Complex O&M and Safety Risks

Safety Risks



An explosion of a 25MWh BESS power plant occurred

- **Battery cell over-charge, over-discharge or others**
- Key components(circuit boards, contactors, etc.) failure cause sparking and arcing

Lower Usable Energy



An project in Qinghai, China, with **only 80% capacity utilization when the batteries are full**

- Series mismatch due to inconsistency between battery cells, which leads to lower available capacity according to Cannikin Law

Short Lifespan



The lifespan of the current BESS power plant is generally 7 to 10 years.

- Poor cooling system design causes temperature difference of batteries to 10°C, **reducing lifespan by 25%**
- Temperature difference between modules & racks further increase module difference, shortening new battery lifespan

Complex O&M



- In an energy storage project, experts are required to **inspect the entire plant each year or half a year**. Manual inspection of SOC at intervals & replacing damaged parts only by experts.

Optimal Electricity Cost: Modular+ Optimization, Achieve 5% More Usable Energy and Higher Availability

Unbalanced SOC Reduces Usable Energy

Case Analysis – Anhui, China

#3 电池组		
额定电压	692.20	V
额定电流	0.00	A
额定功率	33.00	W
额定容量	1721.00	kWh

Highest SOC	16.00	%
Lowest SOC	4.00	%

最高单体SOC	16.00	%
最低单体SOC	4.00	%
最高单体温度	38.00	°C
最低单体温度	6.00	°C
最高单体电压	27.80	V
最低单体电压	1.00	V
最高单体SOC	16.00	%
最低单体SOC	4.00	%

Different manufacture tolerance

Uneven battery aging

Different temperature

SOC differences among battery packs reach 12% in 3 months and the gap will continue to increase

Smart String ESS



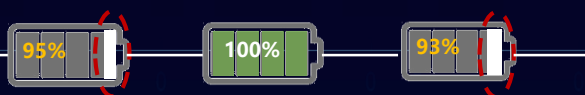
Pack-level optimization



Biomimetic mixed air duct



Distributed air conditioner



650kwh



Usable Energy



688kWh, 5% more with energy optimizer

98%



Availability



99.9%, a single module fault affects only partial output

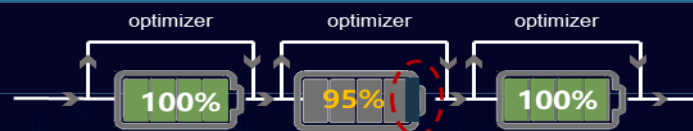
>10°C, accelerate 25% aging



Temperature Difference



<3°C



≥5% More Usable Energy

Smart O&M Replacing Manual Onsite O&M, Less Cost & High Accuracy

Traditional ESS: Manual Onsite O&M



- Site visit for SOC calibration
- Invisible of battery data, site visit for fault location
- Manual adjustment of SOC after battery replacement

\$1700 /year

6 times /year

Low accuracy

¥ Inspection cost

Site visit

Manual calibration

VS

Smart String ESS: Smart O&M



- Automatic SOC calibration, free of site visit
- Cell-level monitoring., remote fault location
- Auto-adjustment of SOC after battery replacement

0

0

High accuracy

¥ Inspection cost

Site visit

Automatic calibration

Smart String ESS Designed for Safety



LUNA2000-200KWH

— 4-Level Active Protection —

Smart String ESS Redefine C&I Scenario, Safer, Smarter and Greener

Traditional ESS



Simple combination of battery → safety risk, uneven SOC

VS

Huawei Smart String ESS



- Cloud BMS & sensors → **AI pre-warning of risk** based on battery data
- Optimizer in each battery → **pack-level protection & optimization**

Active Safety

4-Level active safety protection

Reliable power

Automatic switchover between on-grid & off-grid

More Energy

Pack-level optimization, 5% more energy

Smart O&M

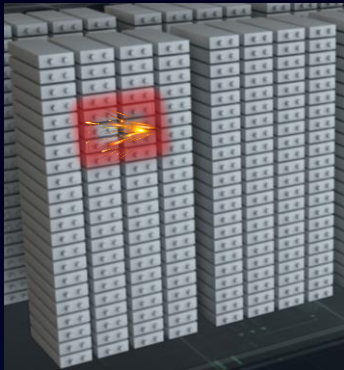
Automatic SOC calibration




One-stop solution

Better synergy & aftersales

Active Safety: Modular+ Safety, Prevent Risk in Advance

Safety Hazards in ESS



-  Fail to detect cell failure
-  Sparking and arcing of component
-  No effective fire fighting system

In 2021, the ESS of a PV plants in South Korea caught fire, causing a loss of 440 million.

Smart String ESS

Pack-level



Fault isolation

Rack-level



Overcurrent protection
+ Fault isolation



System-level



Environment sensors
+ fire fighting

Cloud BMS



internal short-circuit diagnose



**4 Layer
Safety Protection**

4-level Active Safety Ultimate Safety for Personal & Asset

Huawei: Active safety protection

4-Level

Vs

1-Level

Traditional: only fire extinguisher

4-1 Pre-warning

4-2 Detection

4-3 Isolation

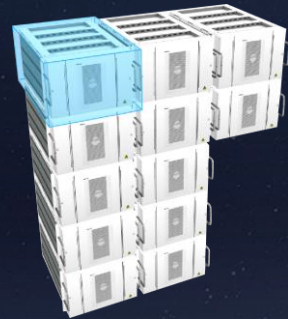
4-4 Emergency protection

24h pre-warning of risk



AI analysis of battery running data to identify risky battery

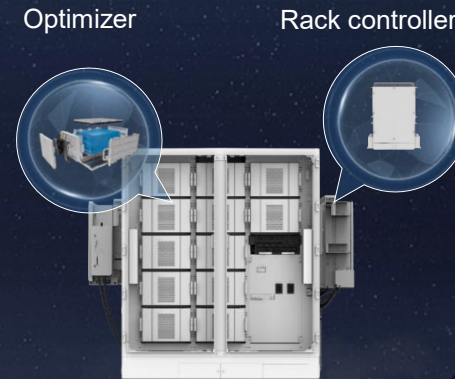
Cell-level monitoring



97% SOH
3200mv Cell voltage
20 °C Temperature
85% Cell SOC
12.8A Current

Cell-level monitoring temp., current, voltage etc.

Active isolation avoid risk



Active Isolation of rack controller & optimizer to avoid risk

Blast release from top



Instead of front blast release, avoiding personal injury

Stages Process

Installation



Supervision



Commissioning



Operation



Commercial & Industrial BESS

Valencia, Spain

100KW/ 200KWh,

Fruit Industry (Self-Consumption)

Automatic SOC calibration, save O&M cost
Safe & reliable - 4-level Protection of BESS

High Availability of Project

COD: Q4.2022-Q2.2023



Global Largest Micro-grid Project

Red Sea Project, Saudi Arabia

400MW/1.3GWh

(Provide power to ~1M population in Neom City)

Stable operation of micro-grid via **Grid-forming Tech.**

Micro-grid **fault ride through**

4-level Protection of BESS

COD: Q4.2022-Q1.2023

[Video red sea project \(LinkedIn\)](#)



Largest BESS Project in Southeast Asia

Sembcorp BESS Project, Singapore
(Spinning Reserve, Frequency Regulation)

200MW/200MWh
(Huawei 50% share)

Longer consistent power output via Rack-level Optimization, realizing more revenue of frequency regulation service

Automatic SOC calibration, save O&M cost

Safe & reliable, satisfy strict local safety standard
acquired CoC certificate, and conform to EN ISO 1182 and EN ISO 1716

COD: Nov. 2022

Thank you.

Bring digital to every person, home and organization for a fully connected, intelligent world.

**Copyright©2023 Huawei Technologies Co., Ltd.
All Rights Reserved.**

The information in this document may contain predictive statements including, without limitation, statements regarding the future financial and operating results, future product portfolio, new technology, etc. There are a number of factors that could cause actual results and developments to differ materially from those expressed or implied in the predictive statements. Therefore, such information is provided for reference purpose only and constitutes neither an offer nor an acceptance. Huawei may change the information at any time without notice.

