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Huawei FusionSolar

14 May 2024

2:00 pm – 3:00 pm | BST, London  
3:00 pm – 4:00 pm | CEST, Berlin  
4:00 pm – 5:00 pm | EEST, Athens



**Marija Maisch**

Energy storage news director  
pv magazine

pv magazine  
**webinars**

# The value of flexibility and robustness in residential battery storage



**Mauricio Olmos**

BESS Expert  
Huawei FusionSolar

# Welcome!

Do you have any questions?  

Send them in via the Q&A tab.  We aim to answer as many as we can today!

You can also let us know of any tech problems there.

We are recording this webinar today. 

We'll let you know by email where to find it and the slide deck, so you can re-watch it at your convenience.  

**Fusionsolar**

# Huawei Smart String ESS LUNA2000-7/14/21-S1 Mainslides

**A Home That Always Shines**

 May 2024

# Residential Smart PV Solution: Leading One-fits-all Solution in PV Power Generation to Intelligent Power Consumption

## Green power generation

### Optimizer



SUN2000-450W-P2  
SUN2000-600W-P  
MERC-1100/1300W-P

### PV



SUN2000-8-10K-LC0  
SUN2000-3-10KTL-M1  
SUN2000-12-25KTL-M5  
SUN2000-12-25K-MB0

### ESS



LUNA2000-5/10/15-S0  
**LUNA2000-7/14/21-S1**<sup>New</sup>

### Grid



SmartGuard-63A-S0

## Intelligent power consumption

### Charger



SCharger-7KS/22KT-S0

### Load



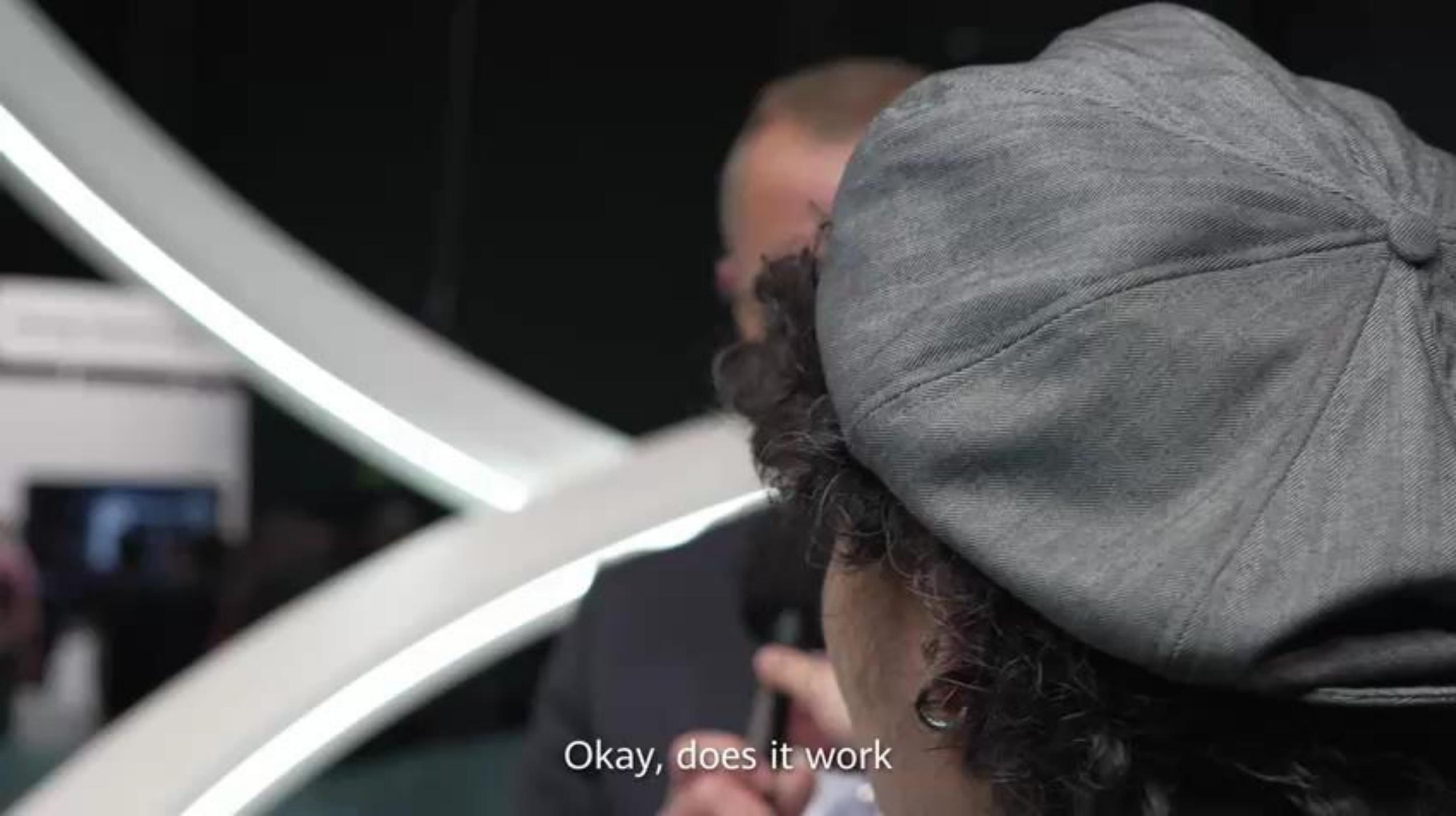
EMMA-A02

### Management



FusionSolar PVMS





Okay, does it work

A tall, white, modular energy storage unit stands on a dark, rocky landscape. The unit is composed of three stacked rectangular sections. At the top, there is a control panel with a Huawei logo and two circular indicators. The background features a dark, mountainous terrain with glowing blue energy trails swirling through the valleys. The sky is a pale, hazy blue.

**Fusionsolar**

## Residential Smart PV Solution Smart String Energy Storage System

LUNA2000-7/14/21-S1

Your reliable power bank

- **Higher** throughput
- **Longer** lifespan
- **Wider** operating temperature range
- **Rigorous 5-layer** safety protection

# Smart String Energy Storage System



LUNA2000-7/14/21-S1

## Module+ Architecture & Pack-level Independent Optimization

**40%+**

Higher Throughput

**15 Years**

\*Maximum Warranty

## Superb User Experience

**-20°C to +55°C**

From Equator to Poles

**29 dB**

Quiet Operation

**No Need**

Pre-charging

## 5-layer Safety Protection



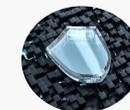
Cell-level Protection



Structural Protection



Electrical Protection



Active Safety



Emergency Protection

\*Warranty conditions vary by region and temperature. Please refer to the warranty letter for details.

# Technical specifications



LUNA2000-7-S1

LUNA2000-14-S1

LUNA2000-21-S1

## LUNA2000-7/14/21-S1



1. Test conditions: 100% depth of discharge (DoD), 0.2C rate charge & discharge at 25°C, at the beginning of service life.
2. CAN is for communication between energy storage in parallel scenarios only. Launch time of FE communication is to be determined, please confirm with your local product manager of Huawei for final version.
3. The weight of the battery modules varies with products, with a tolerance of ±3%.
4. The output power may be affected by temperature. Please refer to the output derating curve for details.
5. The output power may be affected by altitude. Please refer to the output derating curve for details.
6. Outdoor installation is recommended. For indoor installation instructions, please refer to the user manual.
7. The data is from Huawei lab, and the test condition is 1m distance and typical working voltage.
8. Only SUN2000-12/15/17/20/25K-MB0 supports 4 energy storage systems in parallel operation.
9. For details on the timetable of compatibility with SUN2000-8/10K-LC0 and SUN2000-2/3/3.68/4/4.6/5/6KTL-L1, please confirm with your local product manager of Huawei for final version.
10. The power module and battery modules of the storage system are separately order in the required quantity.

Performance			
Power module	LUNA2000-10KW-C1		
Number of power modules	1		
Battery module	LUNA2000-7-E1		
Battery module energy	6.9 kWh		
Number of battery modules	1	2	3
Battery usable energy <sup>1</sup>	6.9 kWh	13.8 kWh	20.7 kWh
Max. charging & discharging power	3.5 kW	7 kW	10.5 kW
Operating voltage range (single-phase system)	350 - 560 V		
Operating voltage range (three-phase system)	600 - 980 V		

Communication	
Display	SOC status indicator, LED indicator
Communication <sup>2</sup>	RS485/FE/CAN

General Specification			
Dimensions (W x D x H)	590 mm x 255 mm x 510 mm	590 mm x 255 mm x 870 mm	590 mm x 255 mm x 1230 mm
Weight (Floor stand toolkit included)	80 kg	148 kg	216 kg
Power module dimension (W x D x H)	590 mm x 255 mm x 150 mm		
Power module weight	10 kg		
Battery module dimensions (W x D x H)	590 mm x 255 mm x 360 mm		
Battery module weight <sup>3</sup>	68 kg		
Installation	Floor stand (standard), Wall mounting (optional)		
Operating temperature <sup>4</sup>	-20°C to +55°C (-4°F to +131°F)		
Max. operating altitude <sup>5</sup>	4,000 m (13,123 ft.) (Derating above 2,000 m)		
Environment <sup>6</sup>	Outdoor/Indoor		
Relative humidity	5%-95%		
Cooling	Natural convection		
Protection rating	IP 66		
Noise emission	< 29 dB <sup>7</sup>		
Cell technology	Lithium iron phosphate (LiFePO <sub>4</sub> )		
Scalability <sup>8</sup>	Max. 4 systems in parallel operation		
Compatible inverters <sup>9</sup>	SUN2000-12/15/17/20/25K-MB0, SUN2000-3/4/5/6/8/10KTL-M1 SUN2000-8/10K-LC0, SUN2000-2/3/3.68/4/4.6/5/6KTL-L1		

Standards Compliance (more available upon request)	
Certificates	CE, RCM, CEC, VDE2510-50, IEC62619, IEC 60730, UN38.3, ISO13849, REACH, RoHS

Ordering and Deliverable Part	
Available for ordering <sup>10</sup>	LUNA2000-7-E1, LUNA2000-10KW-C1, Wall Mounting Bracket for LUNA2000-7/14/21-S1



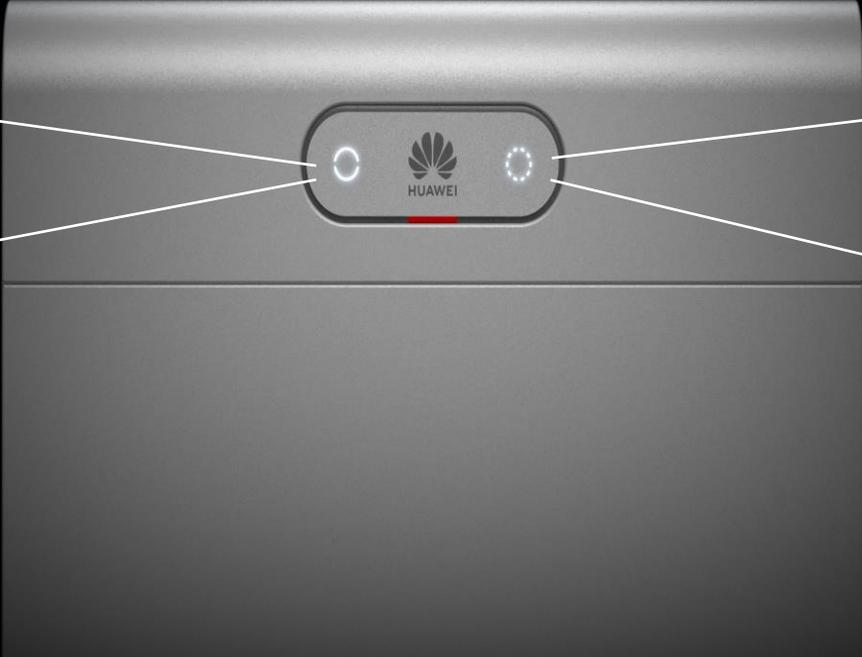
# Design Beyond Limits

# Smart Capsule Interface

Battery Control  
Unit Health



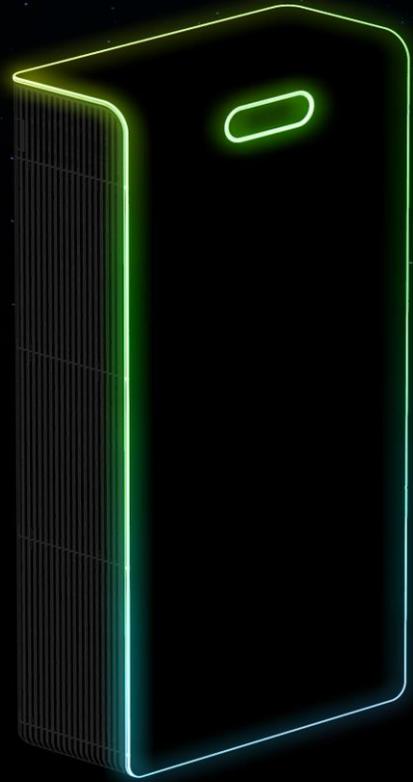
Battery Health



S1 is operating



Average Battery SOC (%)



## A Silky Flow of Green Energy

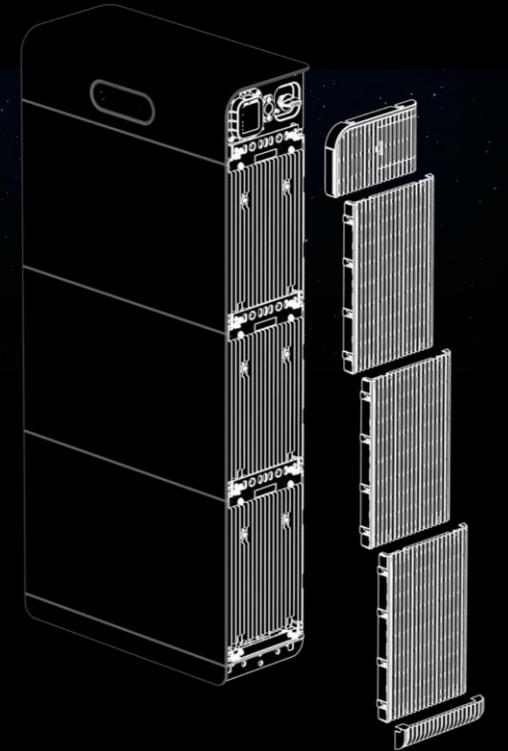
A geometry inspired from an endless flow of renewable energy  
Harmonious balance between friendliness and robustness  
Celebrating the safety of our cutting-edge technology

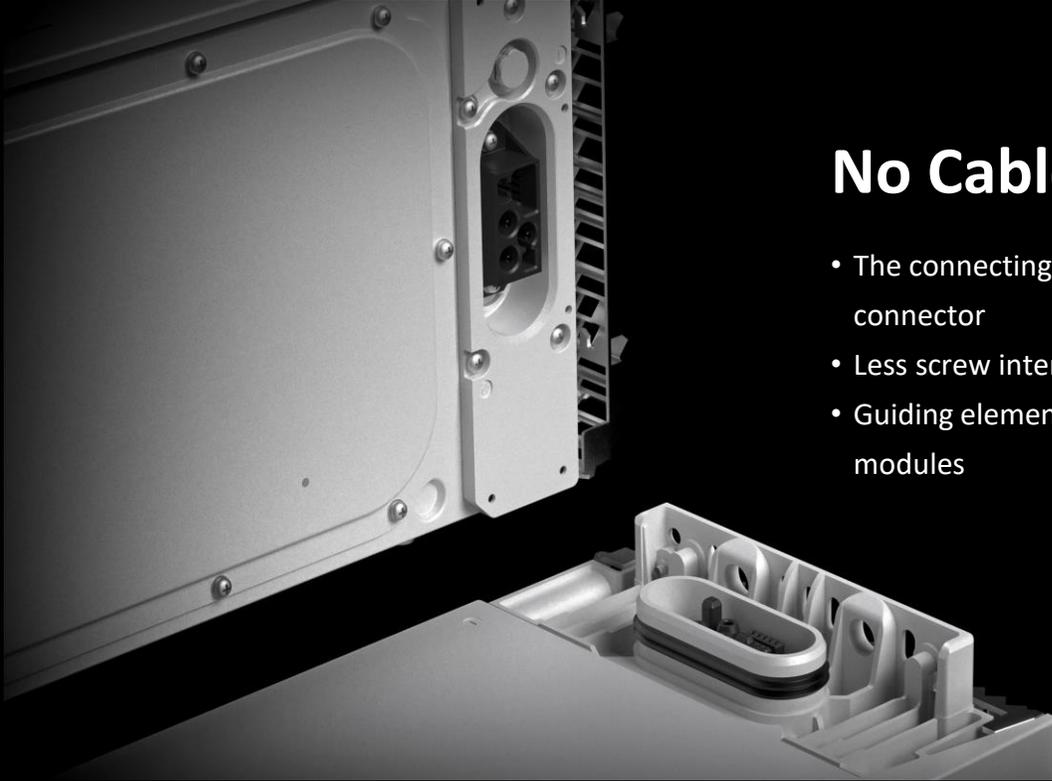




## The Air Grille, for a Silent and Safe Operation

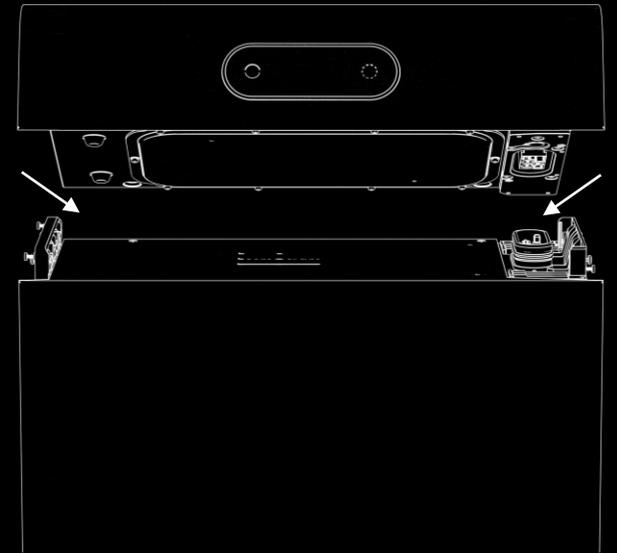
- Promotes heat dissipation through convection
- Prevents from touching the hotter components
- Conceals technical elements for a cleaner look

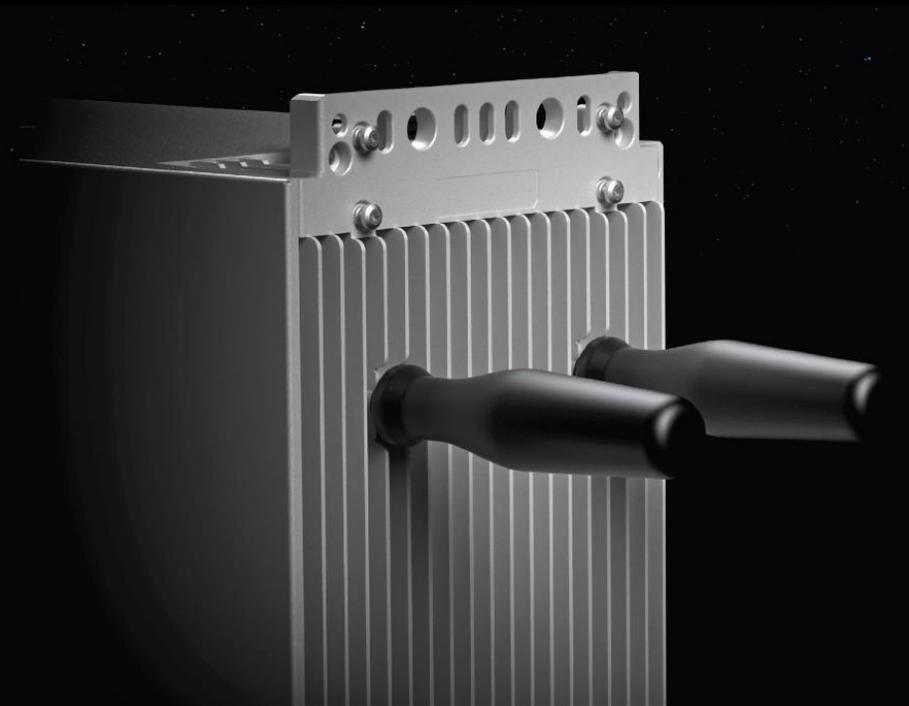




## No Cables, Less Screws, 50% Faster

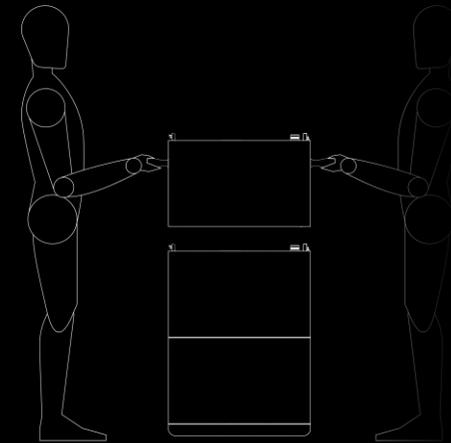
- The connecting cables are replaced by a custom-made connector
- Less screw interactions when securing the modules
- Guiding elements promote an easier connection of the modules





## Ergonomic Carrying Handles

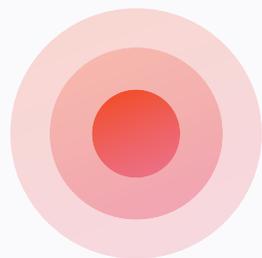
We looked for the best possible way to carry our battery expansion modules, making the installation more enjoyable and respectful of human factors and ergonomics



# Architectural Look & Feel

Minimalism and elegance, to blend into people's home.





# Energy Throughput Beyond Limits



# Higher throughput

**Module+** architecture | **Industry-leading warranty: 15 years** | **≥ 12,000** cycle times

40%+ higher throughput more than other products for the same amount of money

## Throughput

(MWh for each kWh, mentioned in service white letter)

**LUNA S1**

LUNA S0

Vendor B

Vendor T

Compared with other vendors

**4.2**

3.3

3.0

2.8

**40%+**



**Built-in energy optimizer**

## Warranty period

**LUNA S1**

LUNA S0

Products of other vendors

**15 years**

10 years

10 years

# Industry leading 15-year residential PV+ESS solution, 5 years longer than traditional solutions, expanding market space and winning opportunities

## 10-year PV+ESS

Mainstream in the industry

Typical configuration: 8 kW+15 kWh



## 15-year PV+ESS

Huawei LUNA S1

Typical configuration: 8 kW+14 kWh

Germany: additional 5.1 years and 31% revenue

LCOE	0.224	⇒	0.194	13%	↘
Warranty - ROI	3.3 years	⇒	8.4 years	5.1 years	↗
NPV	€11,400	⇒	€15,000	31%	↗

Benefit of an additional €257 per kWh

X in Germany: The 15-year warranty for residential ESS was included in the bidding document.

## Separate Temperature Control System: Safe and Durable

### Challenges of Traditional Solutions

The cell modules are prone to **condensation** in humid conditions, affecting the electrical insulation performance of power components.

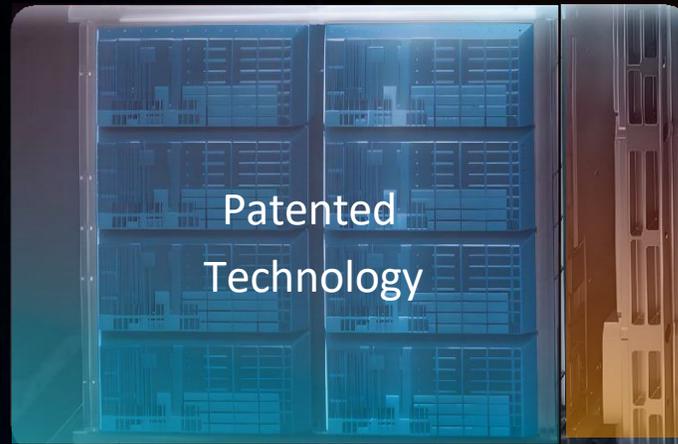
The **heat** generated by power components affects the cell lifespan

**Safety faults are likely to spread** between cells and power components and between battery packs.

# CELLS

**In the Cold  
Compartment**

Protects from heat flow

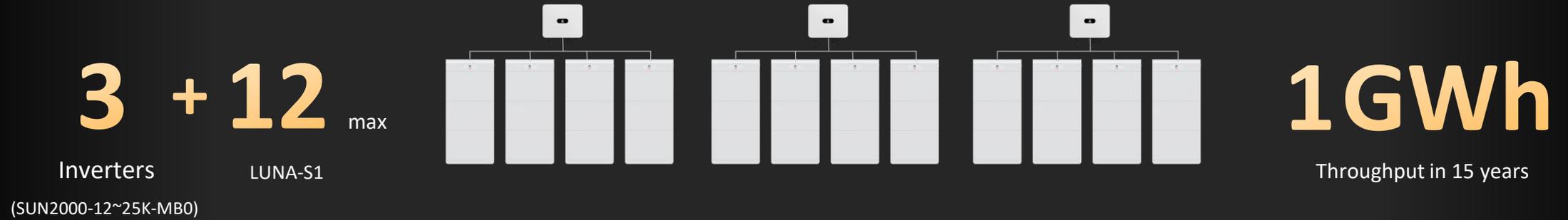


# OPTIMIZERS

**In the Hot  
Compartment**

Protects from condensation

# Scale With Your Demand, Smoothly and Easily



## Inverters support ESS capacity expansion



For LC0, M1, MAP0 inverters:

**Max. two S1**  
**41.4kWh**



For MB0 inverter:

**Max. four S1**  
**82.8kWh**

## Increased Charge & Discharge Power

Max 5 kW ⇒ **Max 10.5 kW**

For single rack of ESS

\*For L1 inverter, only supporting one rack of S1.

# Module+ Architecture Makes It Possible to Customize Better Cell



## Built-in Energy Optimizer

Battery pack level independent management

(From 100 Ah to customized 280Ah)

Less battery cells needed,  
More flexible capacity provided

Operating voltage

Battery cells needed

Capacity per pack (kWh)

### Huawei Module+

Series high voltage

Parallel low voltage

**350 - 980 V**

$\geq 120 \text{ V}$

48 V

**8**

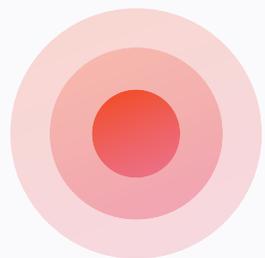
38

15

**6.9**

34

13.4



# Experience Beyond Limits

# Wider operating temperature range

## Built-in Intelligent Temp Regulation System

- Automatically starts cell heating at ultra-low temperatures

	<b>LUNA S1</b>	Vendor B	Vendor P	Vendor S
Operating Temperature Range (Charging)	<b>-20°C to +55°C</b>	-10°C to +50°C	0°C to 50°C	0°C to 50°C

## Unique advantages in multiple cold countries

### Daily average temperature in winter

Sweden	-7°C
Norway	-3°C
Denmark	-4°C
Iceland	-3°C
Finland	-11°C

Data source: Weather.com

**Designed to be quiet**

**<29 dB**  
Operation

\*Based on typical configuration: single/three phase up to 12KW PV+ESS solution, measured 1 m away under typical operating conditions.  
Noise levels within quiet bedrooms should not exceed 30 dB

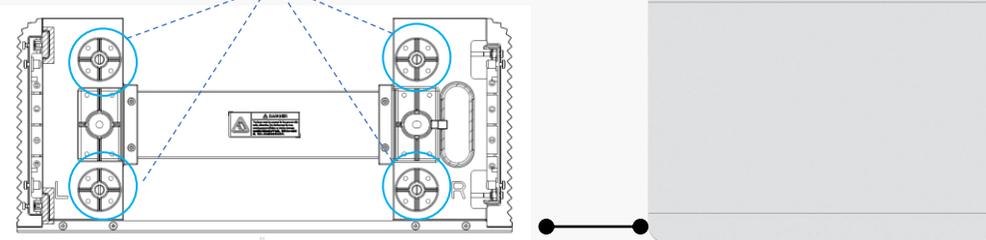
The level can be adjusted, and the power module connection is easier



### Horizontal adjustable, adapting to more terrains

Gradient will be included

Horizontal adjustment nuts

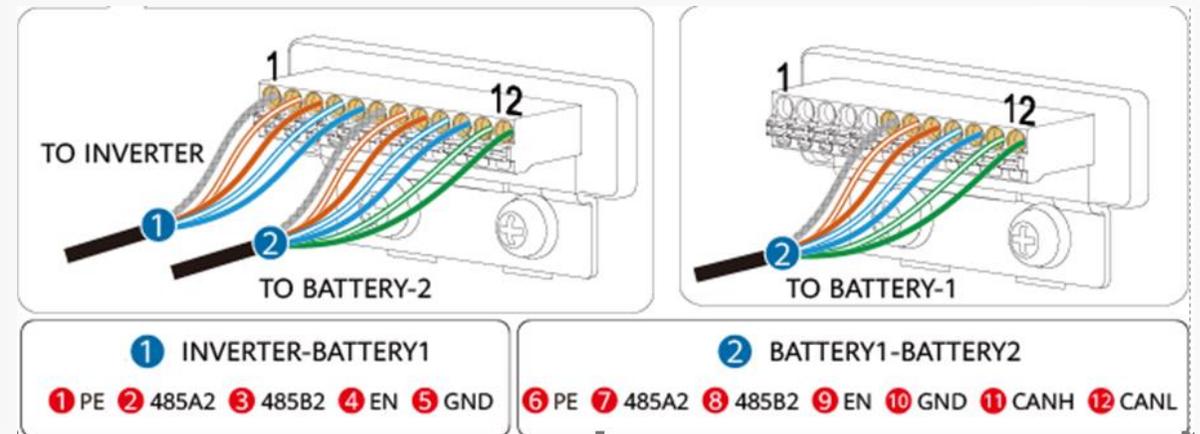


### Greatly improved power module wiring experience

Cable connection operations:	<b>Dual-side</b>	⇒	<b>Monofacial</b>
Cable Label	<b>Difficult to identify</b>	⇒	<b>BOQ clear flag</b>
Sorting Cables	<b>Matrix</b>	⇒	<b>Simple in-line arrangement</b>

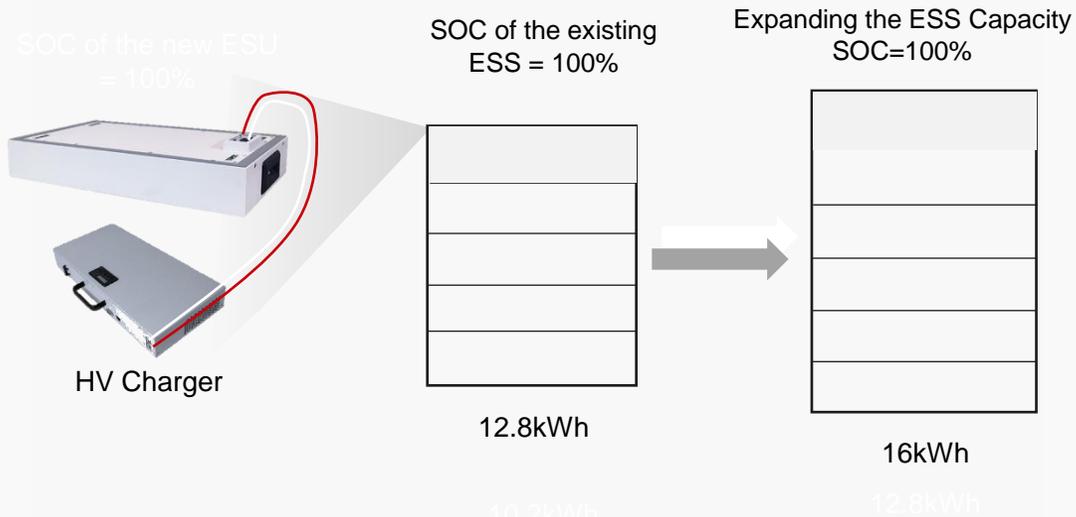
**50%+**

**Cable Connection Time Saving**



# Pre-charging and SOC calibration are not required, simplifying capacity expansion and maintenance

## Conventional High-Voltage ESS

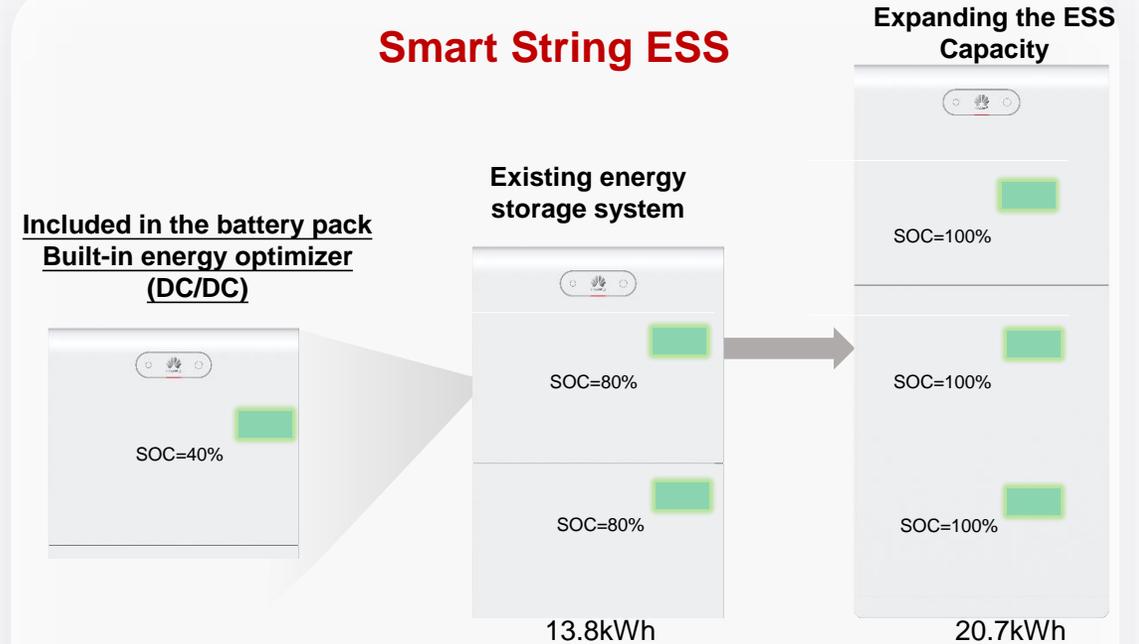


**It takes 40 minutes to precharge!**

- ✓ To expand to a larger-capacity system, the new energy storage module and the existing system need to be precharged to 100%.
- ✓ It takes at least 40 minutes to adjust the SOC before the replacement.

VS

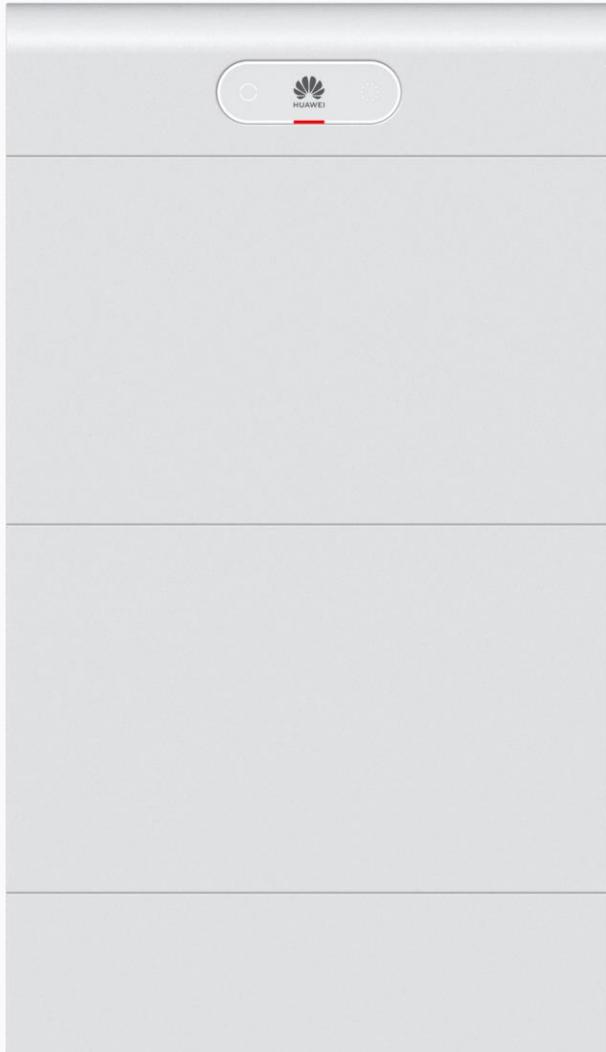
## Smart String ESS



**No pre-charging!**

- ✓ Thanks to the built-in energy optimizer of the battery pack, the new battery pack is plug-and-play and does not need to be precharged.
- ✓ The SOC of the new battery pack will be automatically synchronized with the existing battery pack after a charge/discharge cycle.

# Charge and discharge power upgrade, each battery pack charges and discharges independently



## Discharge Power

**3.5kW**

For one battery module

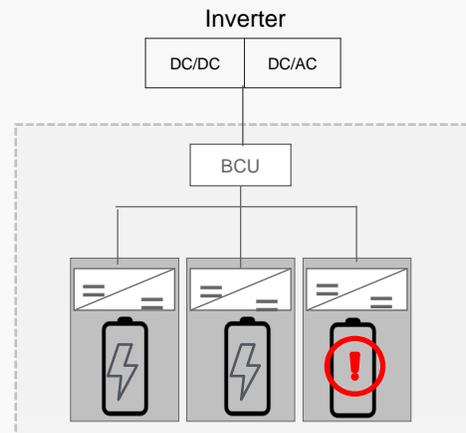
**10.5kW**

For one rack of ESS

## Independent charge & discharge for each pack

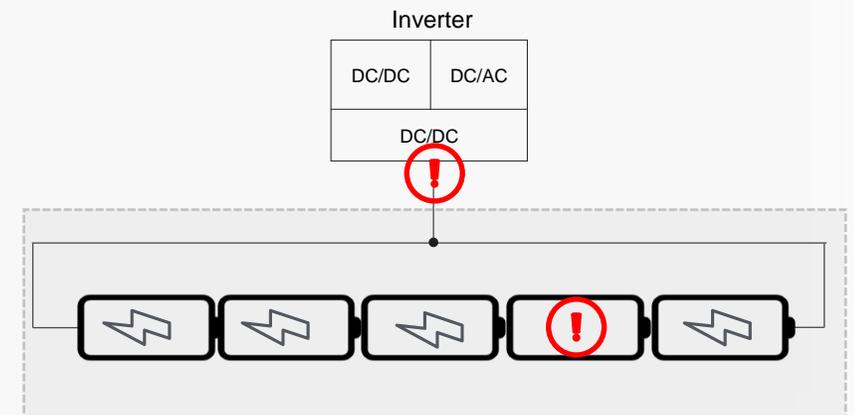
### LUNA2000 S1

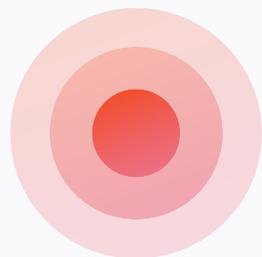
Each battery pack charges and discharges independently, without affecting each other



### Traditional series ESS

One battery pack is faulty, the whole system will fail to charge or discharge





# 5-Layer Safety Protection

# 5-layer enhanced safety, safeguarding every family, every day

## Cell-level protection



- LFP cells from top suppliers
- Subjected to rigorous tests, such as cycle tests (up to 1/8 of cycle life) and puncture tests

## Electrical protection



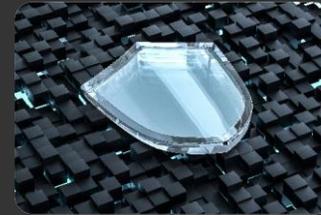
- Multiple protection measures, such as overcharge, overvoltage, overcurrent, and over temperature
- External short circuit protection

## Structural protection



- **Industry-leading IP66** protection, **40 cm** water immersion protection
- High-strength chassis, **5T** heavy pressure resistance, 20% hydrogen explosion test

## Active protection



- Real-time **cell-level** temperature and voltage detection
- Intelligent ports detection
- SOH calibration for full-lifecycle health protection

## Emergency protection



- **Industry-only** emergency fire suppression module
- **Industry-leading** active pressure release technology

Passed safety certification tests, such as VDE 2510-50, IEC 62169, ISO 13849, IEC 63056, IEC 62040-1, IEC 62477 and UN 38.3.

## The Stringent Cell Test

### Drop Test

1.0 m drop  
without leakage

### Puncture Test

Cell puncture test

> 120

Test Items

> 5

Unique Test Items

### Short Circuit

Lower external resistance (1 mΩ) short  
circuit test

### Lithium Plating

No lithium plating

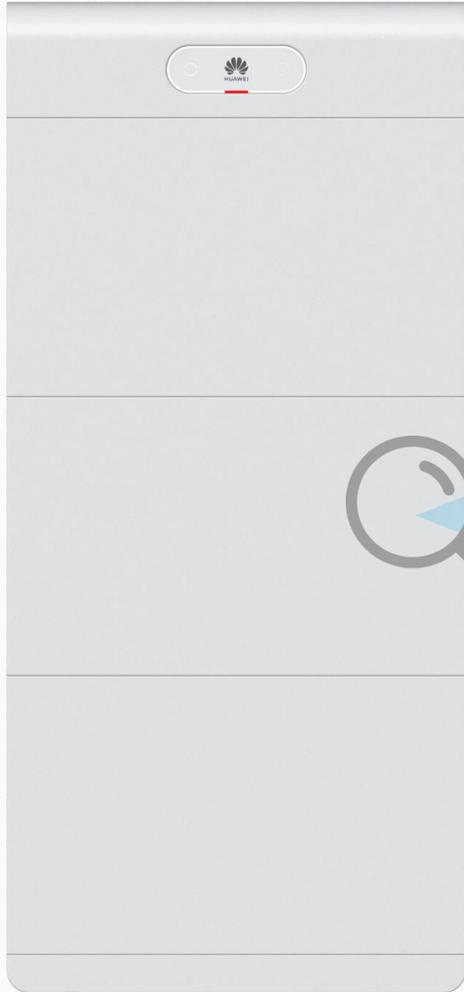
### Cycle Test

1/8 lifecycle test

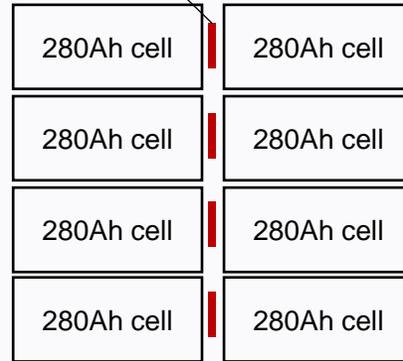
Residential ESS shipped more than **18 million** pcs of battery cells\*

\*shipment data up to 2022

# Cell-level management, real-time high-precision acquisition of key parameters



Each sensor manage a pair of cells



**4** groups of sensors manage

**8** pcs cells

**4x** Improved accuracy

Comparison of conventional schemes  
(Battery package-level monitoring)

# Industry-leading IP66 residential ESS

	LUNA S1	Vendor B	Vendor P	Vendor S
Ingress Protection Rating	IP66	IP55	IP55	IP55

Easily cope with **rain** and **water splashes**



# Industry-leading water immersion protection residential ESS

**40cm**

**72h**

Safe in case of **waterlogging, ice, and snow coverage**



\* Picture of LUNA S1 Summit in Vienna, 2024/03/27

\*The LUNA S1 is a non-professional waterproof device, pls. keep it away from water sources during daily use.

# High-strength chassis

Resistance to **5T** heavy pressure

Accidental bumping in the garage



Impact during moving objects



1. **Test Item:** Compression test

1.1 **Sample No.:** E2307110199-01

1.2 **Test Equipment(s):**

Name	Model	Serial No.	Valid Date to
Computer servo carton compression test device	HD-A505S-1800	E-R-068	2024.06.24
Multifunctional air tightness detector	SFS500	E-R-191	2024.07.24

1.3 **Laboratory Conditions:** Temperature: 25.2°C; Humidity: 53.4%RH

1.4 **Test Standard:** GB/T 4857.4-2008

1.5 **Test Conditions:**

Static pressure: **50KN**

Static pressure time: 10min

1.6 **Judge Criteria:**

- 1) The structural parts should not be deformed (within 1%);
- 2) Pack shell and structural parts should not be broken;
- 3) The air tightness should be normal before and after the test.

1.7 **Test Result(s):**

Sample No.	Test Result	Test Conclusion
E2307110199-01	1) No deformation of structural parts (within 1%); 2) Pack shell and structural parts were not broken; 3) The air tightness was normal before and after the test.	<b>Pass</b>

\*Severe impact affects the stability of the ESS. Avoid impact whenever possible.

# Active pressure release technology, preventing combustion from basic logic

	LUNA S1	Vendor B	Vendor P	Vendor S
Emergency protection	<b>Dual-protection mechanism</b>	NA	NA	NA

Principle: Active pressure relief exhaust, reducing oxygen concentration and eliminating combustion aids

## Thermal runaway

- Internal failure mechanism of Lithium batteries
- External causes such as mechanical, electrical, and thermal



## Active Pressure Relief Exhaust

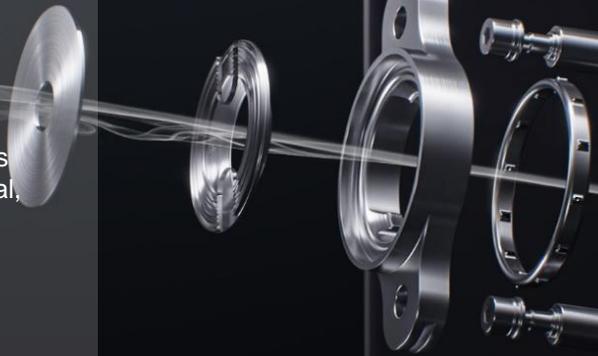
- Exhaust oxygen from the battery pack to form an oxygen-free environment. The high-strength and high-sealing chassis does not open seams, block the elements of combustion



## Auto closure

- Prevent oxygen from entering after pressure relief is complete.

Three elements of combustion: combustible, ignition source, and combustion aid (oxygen)



## VDE2510-50 test report: Thermal runaway without fire and does not spread

6.2.6	Propagation test: stackable BESS		
6.2.6.1	<b>Purpose</b>		P <input checked="" type="checkbox"/> F <input type="checkbox"/> N/A <input type="checkbox"/> N/T <input type="checkbox"/>
	For stackable solutions, hazards as described in 6.2.4 shall be limited to a permissible area. Cell defects shall propagate neither from module to module nor from module to system level.		
6.2.6.2	<b>Test procedure</b>		P <input checked="" type="checkbox"/> F <input type="checkbox"/> N/A <input type="checkbox"/> N/T <input type="checkbox"/>
	Testing shall be conducted according to 6.2.4 (see also Figure 3).		
6.2.6.3	<b>Requirements</b>		P <input checked="" type="checkbox"/> F <input type="checkbox"/> N/A <input type="checkbox"/> N/T <input type="checkbox"/>
	Component verification: For the purpose of fire protection, each single module shall be equipped with a fire protection enclosure in accordance with DIN EN 62368-1 (VDE 0868-1), M 4.3, 6.4.8. The fire protection enclosure may be the one of the secondary lithium battery itself or that of the device in which it is contained. The presence of this fire protection enclosure shall be demonstrated by means of the test report or visual inspection of the relevant materials or by submitting the data sheet of the secondary lithium battery.		
	Test verification: – Cell defects shall only propagate within the module in which the thermal instability of the cell was intentionally caused. – A propagation from this module to an adjacent module shall be precluded by testing (see above). – Hazards (liquid electrolyte, fire, explosion or ejected parts) shall not propagate beyond the system boundaries (except vented gases which are considered separately in 7.10.3).	No external fire from the battery system. No battery case rupture.	P <input checked="" type="checkbox"/> F <input type="checkbox"/> N/A <input type="checkbox"/> N/T <input type="checkbox"/>



Emergency fire suppression,  
an extra protection for families

### Emergency Fire Suppression Module

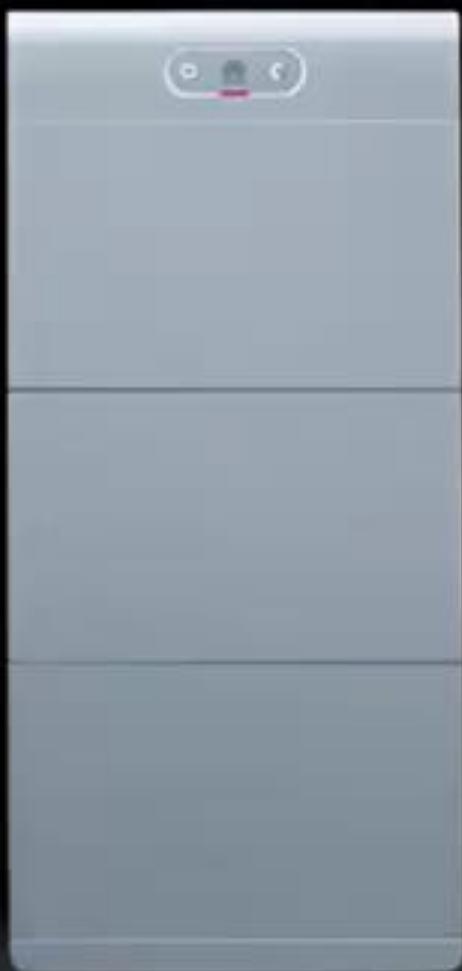


### Working Principles

Step 1: Start at a high temperature ( $190\pm 15^{\circ}\text{C}$ ).

Step 2: The fire extinguishing package releases the cleaning extinguishing agent

- A large amount of gas produced quickly
- The extinguishing agent is pushed to erupt from the module in a pulse mode, instantly producing a large amount of gas to blow out the flame
- The eruption gas can absorb the free radicals and realize the chemical suppression of the flame



HUAWEI FusionSolar Residential Smart PV  
**Behold the Hardcore**

# Thank You

**A Home that Always Shines**

this  
**Webinar** is powered by  
Huawei FusionSolar

14 May 2024

2:00 pm – 3:00 pm | BST, London  
3:00 pm – 4:00 pm | CEST, Berlin  
4:00 pm – 5:00 pm | EEST, Athens



**Marija Maisch**

Energy storage news director  
pv magazine

pv magazine  
**webinars**

# The value of flexibility and robustness in residential battery storage

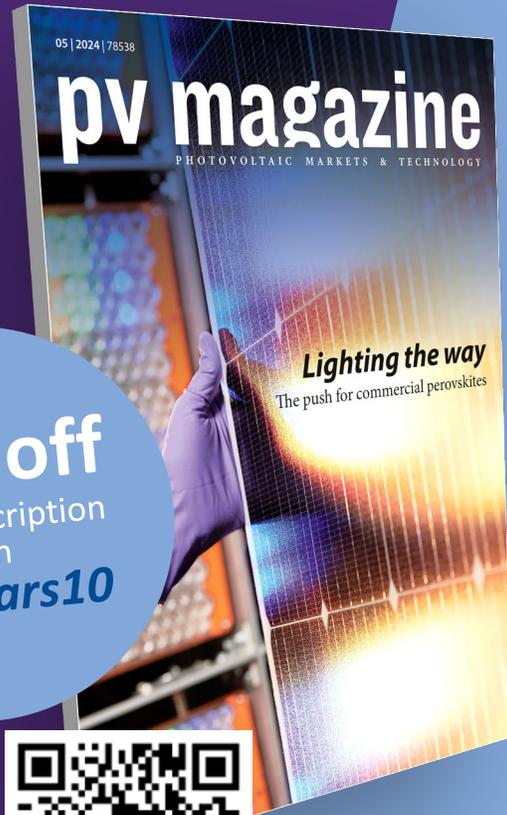
## Q&A



**Mauricio Olmos**

BESS Expert  
Huawei FusionSolar

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**Italy bans PV from agricultural land**  
by Sergio Matalucci



**Longi announces 27.30% efficiency for heterojunction back contact solar cell**  
by Emiliano Bellini



**Most-read online!**

# Coming up next...

## Wednesday, 15 May 2024

3:00 pm – 4:00 pm CEST, Berlin, Paris, Madrid  
9:00 am – 10:00 am EDT, New York City

## Thursday, 16 May 2024

11:00 am – 12:00 pm EDT, New York City  
5:00 pm – 6:00 pm CEST, Berlin, Paris, Madrid

Many more to come!

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**Marija Maisch**

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