

# FusionSolar for a Sustainable Business

Optimal Electricity Cost

| Active Safety

| Smart O&M



Building a Fully Connected, Intelligent World



**01**

# Huawei Digital Power Overview

# Huawei: Leading provider of ICT infrastructure and smart devices



## Vision & mission

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

**195,000**

employees

**170+**

countries and regions

**No. 96**

on Fortune Global 500

**No. 2**

in R&D investment

**54.8%**

of employees are in R&D

# Focusing on ICT to provide products, solutions, and services to three customer groups

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



**Consumers**



**Carriers**



**Enterprises**

Information transmission



Information distribution & interaction



## Devices

Smartphones  
Wearables  
Smart home devices  
Telematics  
Lifestyle services across all scenarios

## Intelligent Automotive Solution

Intelligent driving  
Intelligent sensing  
Intelligent vehicle cloud  
Intelligent communication connectivity  
Intelligent cockpit

## Connectivity

Wireless network  
Data communications  
Transport network  
Access network  
Core network

## Computing

Kunpeng computing  
Ascend computing  
Cluster computing  
Data storage

## Cloud

Public cloud  
Hybrid cloud

## Digital Power

Smart PV  
Data Center Facility  
Site Power Facility  
DriveONE  
DigiPowerCloud

**+ Intelligence**

Information learning & inference



Information processing & storage



# Solid operations and worldwide recognition


## Stable business growth




## Integrating digital and power electronics technologies to promote green and low-carbon transformation in the energy industry

<b>Smart PV</b>	Combine PV and energy storage and make the green PV a main energy source for every home and business; build a new power system based on renewable energy.
<b>Data Center Facility</b>	Reshape power, cooling, management, and architecture to build sustainable, simplified, autonomous driving, and reliable next-generation data center facilities.
<b>Site Power Facility</b>	Optimize construction, operations, and O&M to help carriers build all-scenario and full-lifecycle low-carbon networks based on the green site power target network; serving one third of the world's population.
<b>DriveONE</b>	Work with industry partners to build DriveONE full-stack eMobility solutions that feature convergence & simplicity, safety & reliability, excellent experience, and cloud-based AI through technological innovations.
<b>DigiPowerCloud</b>	Integrate big data and energy AI technologies to build an energy management cloud; leverage the "platform + ecosystem" model to develop the groundwork for energy digitalization with intelligent synergy and integrated scheduling of generation-grid-load-storage.

# Global R&D Teams and Technology Platforms: Leveraging the Domain Specific Advantages Globally to Keep Leading

 170 Countries

 10,000+ Employees  
60% of Employees are in R&D

 12 R&D Centers

 10%+ R&D Investment



**02**

## **Industry Insights**

# Carbon Neutrality has Become a Global Consensus, PV+ESS has Become the General Trend

## Carbon Neutrality Has Become the Global Consensus. Top Enterprises are Practicing Green Transformation

### Carbon Neutrality Targets for Major Economies



China	European Union	United States	Japan
2030 Carbon Peak	Green Deal	Return to the Paris Agreement	Green Growth Plan
2060 Carbon Neutral	2050 Carbon neutral	2050 Carbon neutral	2050 Carbon neutral

### The Top Enterprises Actively Practice Carbon Neutrality

380+ companies joined RE100 alliance, commit to use 100% green electricity

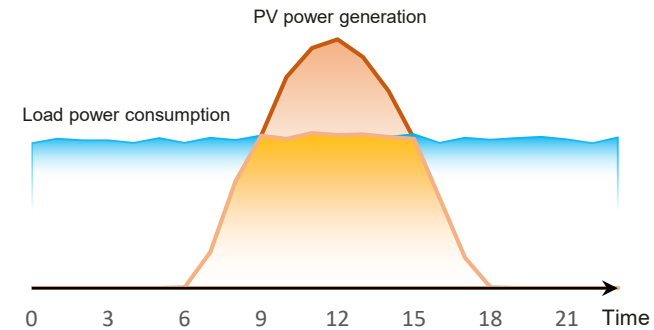


Well-known companies have proposed carbon-neutral goals

Google 2020	ABB 2030	Tencent 2030
Alibaba Group 2030	amazon 2040	P&G 2030

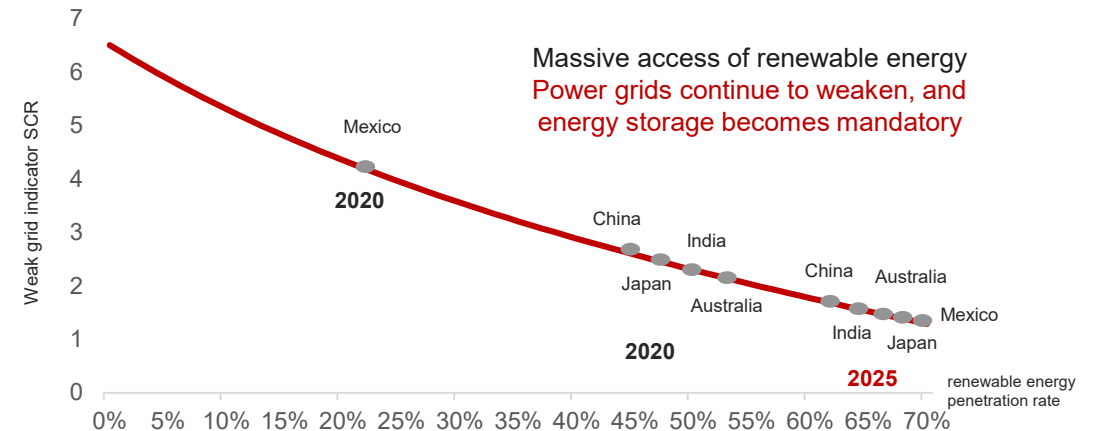
## Energy Transformation Trend: From PV only to PV+ESS Solution

### PV + ESS to Avoid Solar Energy Waste and Maximize the Revenue



- Only PV power cannot cover the 24h power supply
- PV+ESS synergy increases the proportion of green power supply

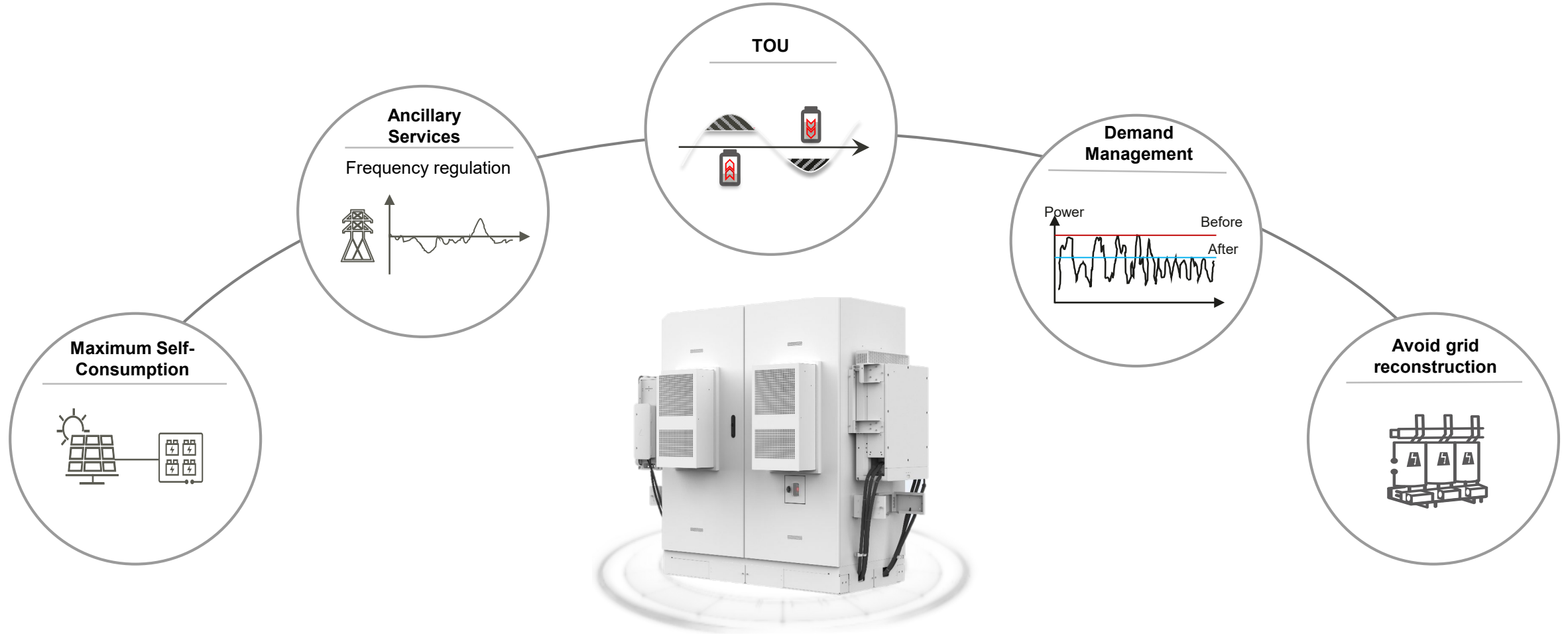
### With the Increase of New Energy Penetration Rate, the Supply Grid Becomes Weaker. Adjustment Provided by ESS is Essential.





# 5 Business Models of ESS to Support Value Implementation

5 Business Models to Support Value Implementation.  
Multi-use Mode is Supported



**03**

# Huawei C&I PV+ESS Solution

# C&I Solution 2.0

Smart Module Controller



- MERC-1100/1300W-P

Smart PV Controller



- SUN2000-50KTL-M3
- SUN2000-100/115KTL-M2



1 + 3  
One-fits-all upgraded

SmartPVMS



Smart String ESS



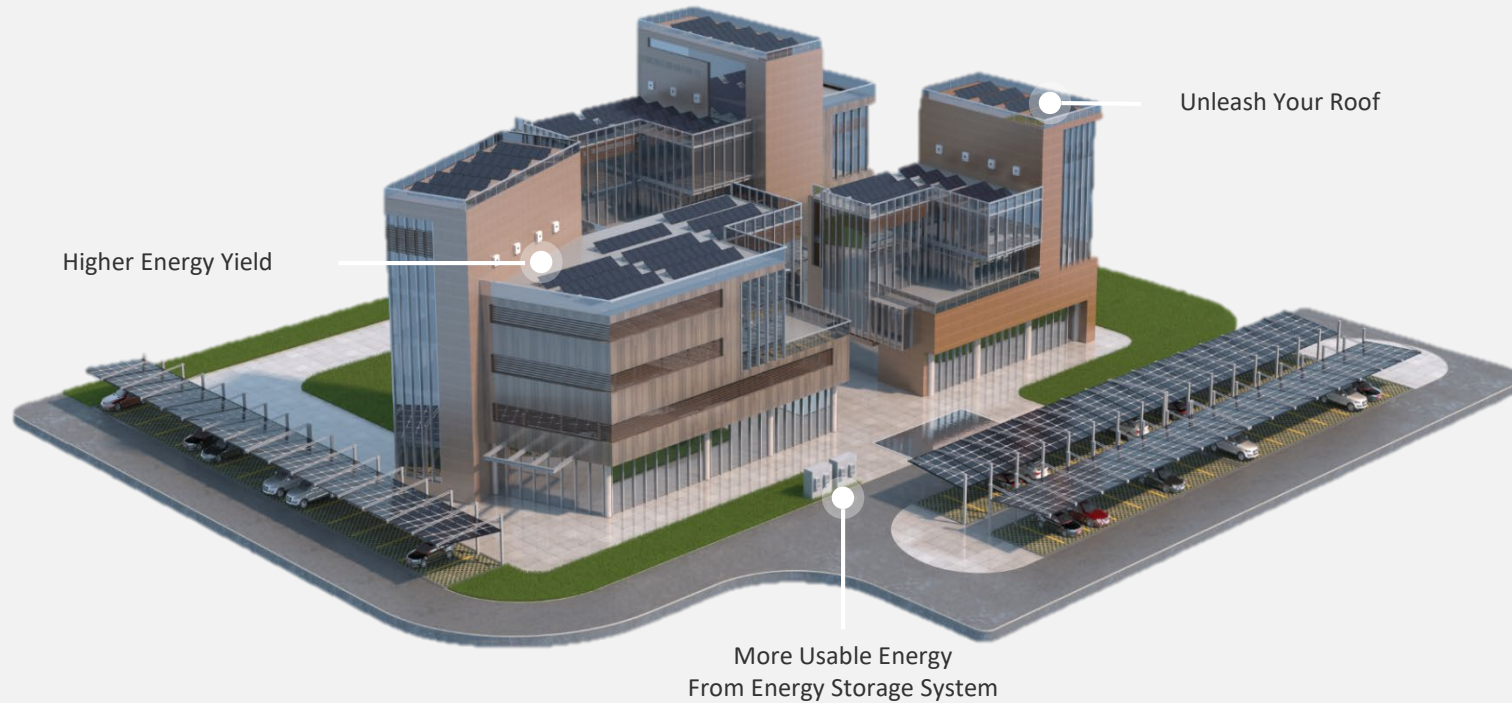
- LUNA2000-200KWH-2H1
- LUNA2000-100KTL-M1

Optimal Electricity Cost

Active Safety

Smart O&M

# Optimal Electricity Cost



## Optimal Electricity Cost



### Smart Module Controller

- 5%-30% More Energy By Optimizing Each Module Performance
- Up to 30% More Modules can be Installed with Optimizer



### Smart PV Controller

- Potential Induced Degradation To Secure Better Module Performance



### Smart String ESS

- Achieving 5% More Usable Energy With Modular+ Optimization



Optimal Electricity Cost

# Active safety



## Active Safety



### Smart Module Controller

- 0V Module-level  
Providing Higher Safety For Firefighters & Installers



### Smart PV Controller

- Active Arcing Protection  
C&I Tailored Active Protection

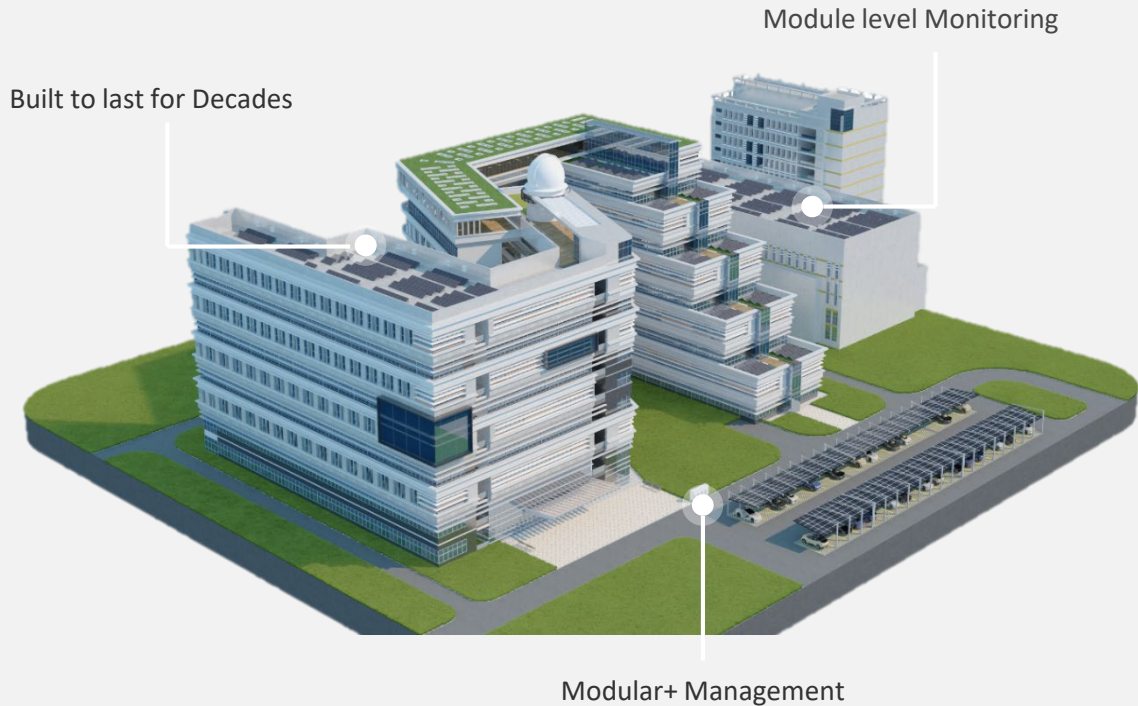


### Smart String ESS

- Modular<sup>+</sup> Safety  
Prevent Risk in Advance

Active Safety

# Smart O&M



## Smart O&M

### Smart Module Controller



- **<40 Sec**  
Module Physical Layout Creating
- **Module level Monitoring**  
Easy Management Of Each Module Anytime & Anywhere

### Smart PV Controller



- **One Dongle For One PV Plant**  
One Smart Dongle Supports Up to 10 Devices
- **Built to last for Decades**  
EMC & Best-in-class Reliability, Providing Qualified Inverter



### Smart String ESS

- **Automatic SOC Calibration**  
With Modular+ Management

Smart O&M

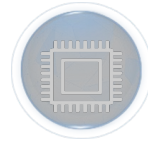
**04**

# Huawei C&I ESS Solution

# Decade of Innovation and Expertise with Mature Deployments Globally



Accumulated shipments  
**>25 GWh**



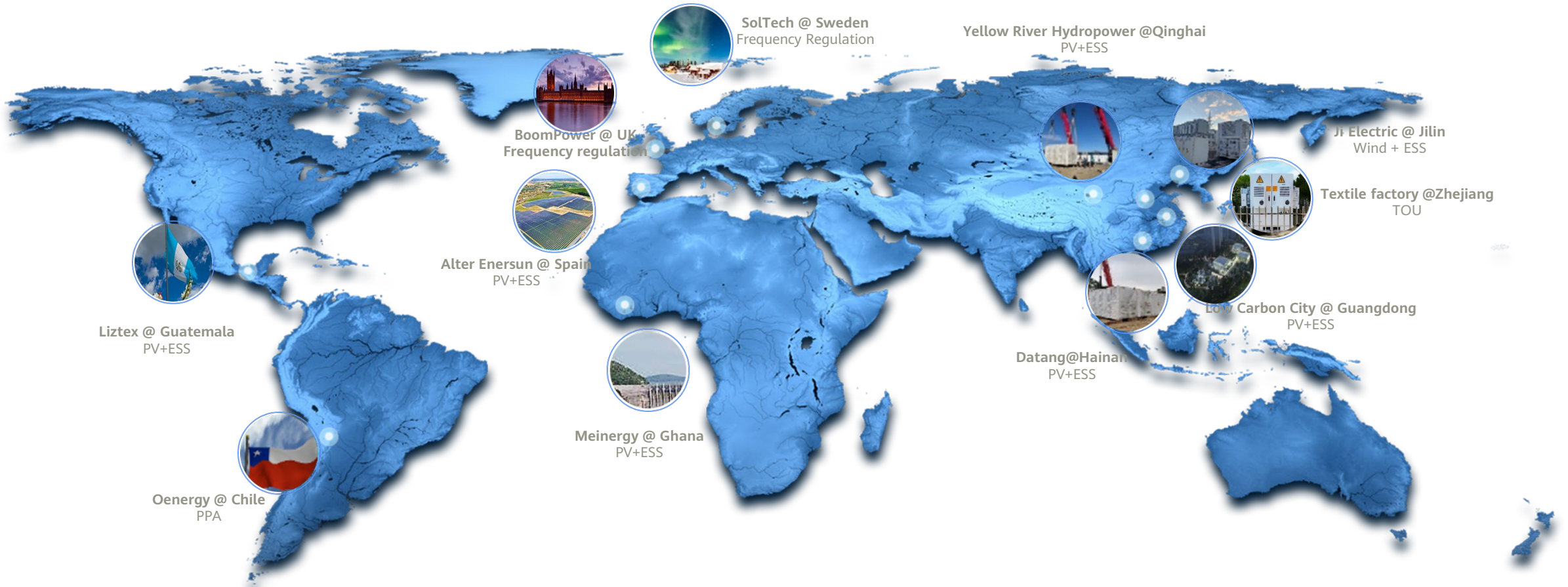
R&D innovations  
**10+ years**



Global R&D center  
**12**



ESS patents  
**150+**





# Smart String ESS



LUNA2000-200KWH-2H1

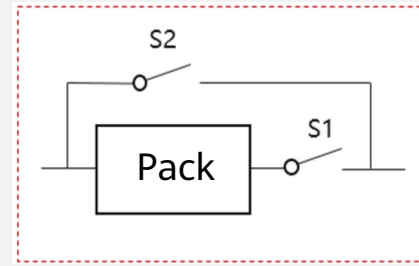


Total Energy Capacity	200kWh
Charge/Discharge Power	100 kW@0.5C
Dimensions (W*H*D)	2570 x 2100 x 950 mm

Modular<sup>+</sup> Design, LCOS reduced by 20%

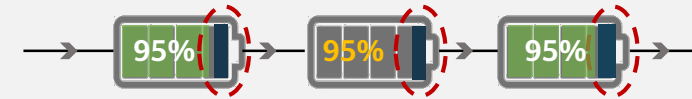
# Achieving 5% More Usable Energy

With Modular<sup>+</sup> Optimization

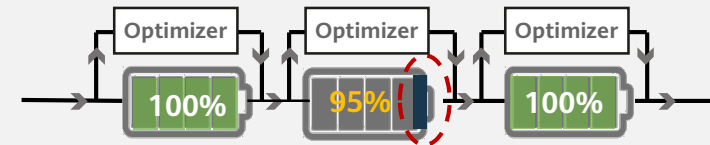


Pack-level optimization

Conventional Energy Storage

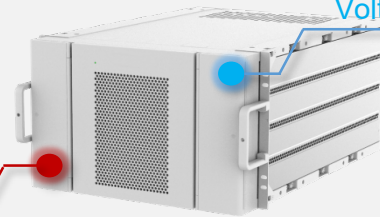


Smart String ESS



**13 pcs**  
Temp. sensor

**18 pcs**  
Voltage sensor



Battery Pack + Optimizer

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

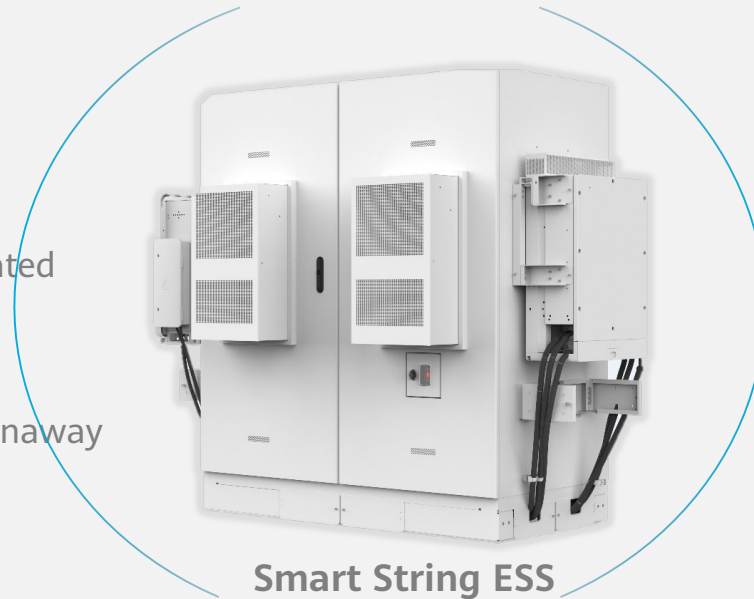
Modular Optimizer Design for 5% More Usable Energy

# Prevent Risk in Advance

## Modular+ Safety

### Active Safety

- Multi-level shutdown & protection
- Faulty packs & racks are disconnected & isolated
- Rapid System disconnection
- One click shutdown while identify thermal runaway



### Proactive Alarm

- Smart internal short circuit diagnosis:
- Pre-alert & bypass the faulty cells
- Fire risk point monitoring:
- Massive sensors monitor system exception
- Live insulation monitoring:
- ISO/IMD pre-alert short circuit risks



Pack-level



Rack-level



System-level

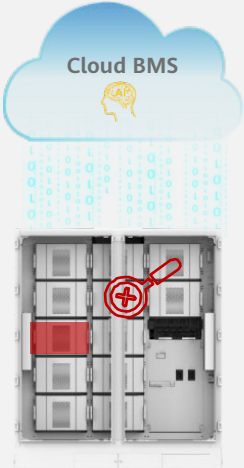
From cell To System

Prevent Risk In Advance

# 4-level Proactive Safety Ultimate Safety for Personal & Asset

## Pre-warning

24h pre-warning of risk

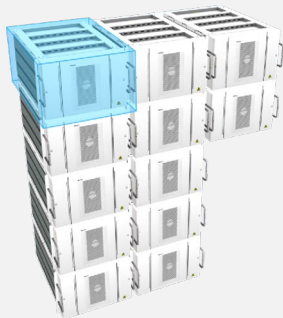


Cloud BMS

AI analysis of battery running data to identify risky battery

## Detection

Cell-level monitoring

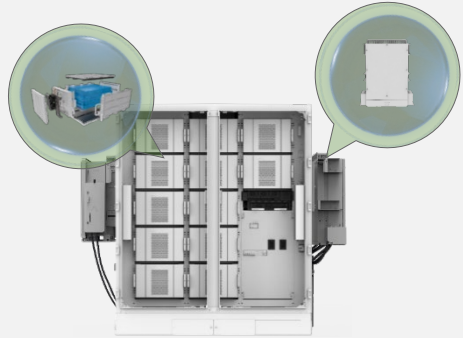


- 97% SOH
- 17mv Cell voltage
- 20 °C Temperature
- 85% Cell SOC
- 12.8A Current

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

## Isolation

Active isolation avoid risk



Optimizer      Rack controller

Active Isolation of rack controller & optimizer to avoid risk

## Emergency protection

Blast release from top

Pressure release window = Safety airbag in car

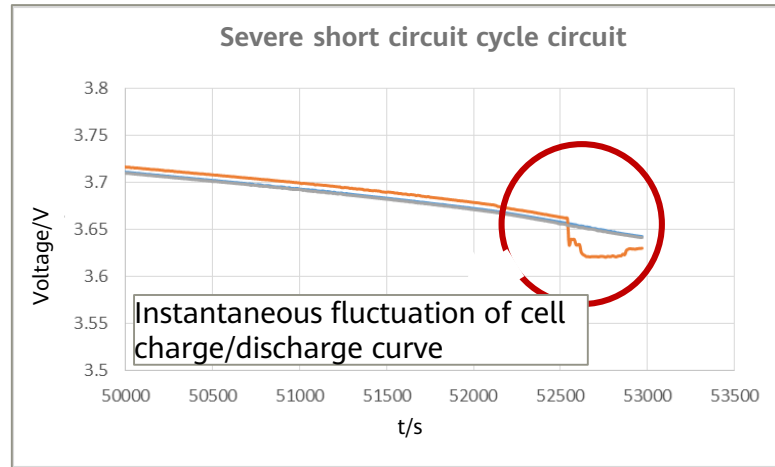


Pressure release windows

Instead of front blast release, avoiding personal injury

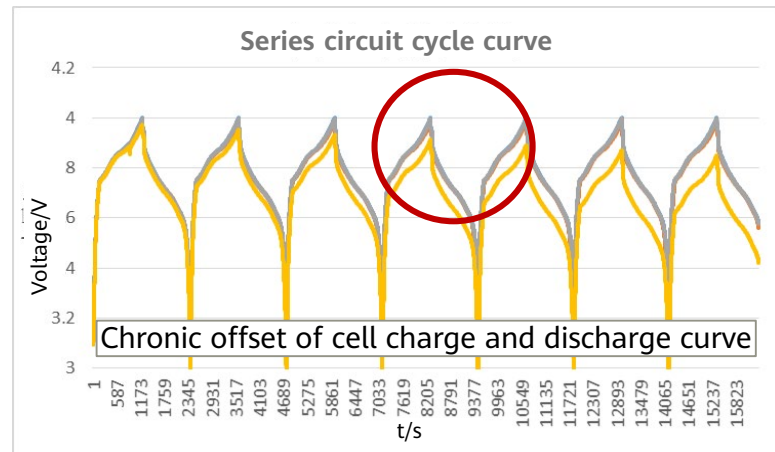
# AI-aided Internal Short Circuit Analysis

## Predict Fire Hazard in Advance



### Sudden Internal Short Circuit - Identification Algorithm

- 100% capture the fluctuation of the charge/discharge curve.
- Instantly identify & cut out packs with hazard for maintenance safety.



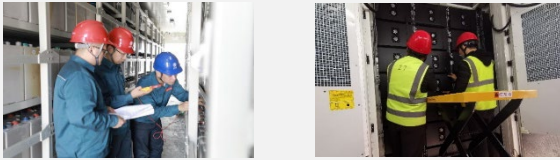
### Derived Internal Short Circuit - AI Outliers Algorithm

- Accurately calculate internal resistance & capture the slight deviation in the curve caused by resistance change.
- Accurately locate and warn potential risks in advance

# Automatic SOC Calibration

## With Modular+ Management

Conventional Solution:



Expert Site Visit  
Manual Inspection

Battery O&M Time: 1-2 days

Expert Site Visit

1-2 days

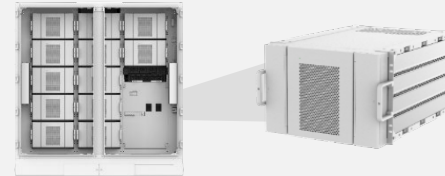
Manual inspection of SOC of battery packs

20-30 mins

Manual adjustment of battery SOC

3 hours

Smart String ESS :



No Need Expert Site Visit  
Automatic SOC Calibration

Battery O&M Time: < 3 Hours

Expert Site Visit

< 3 hours

No Need for inspection

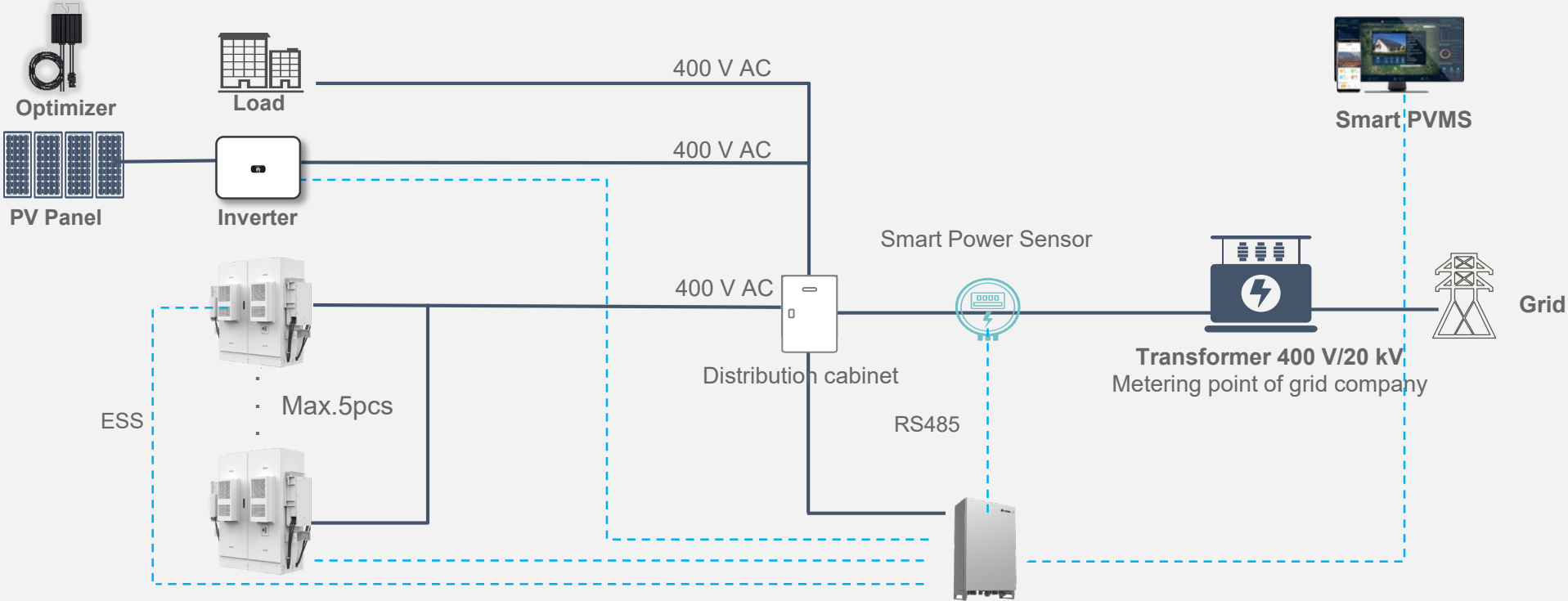
0 min

No Need for manual adjustment

0 hours

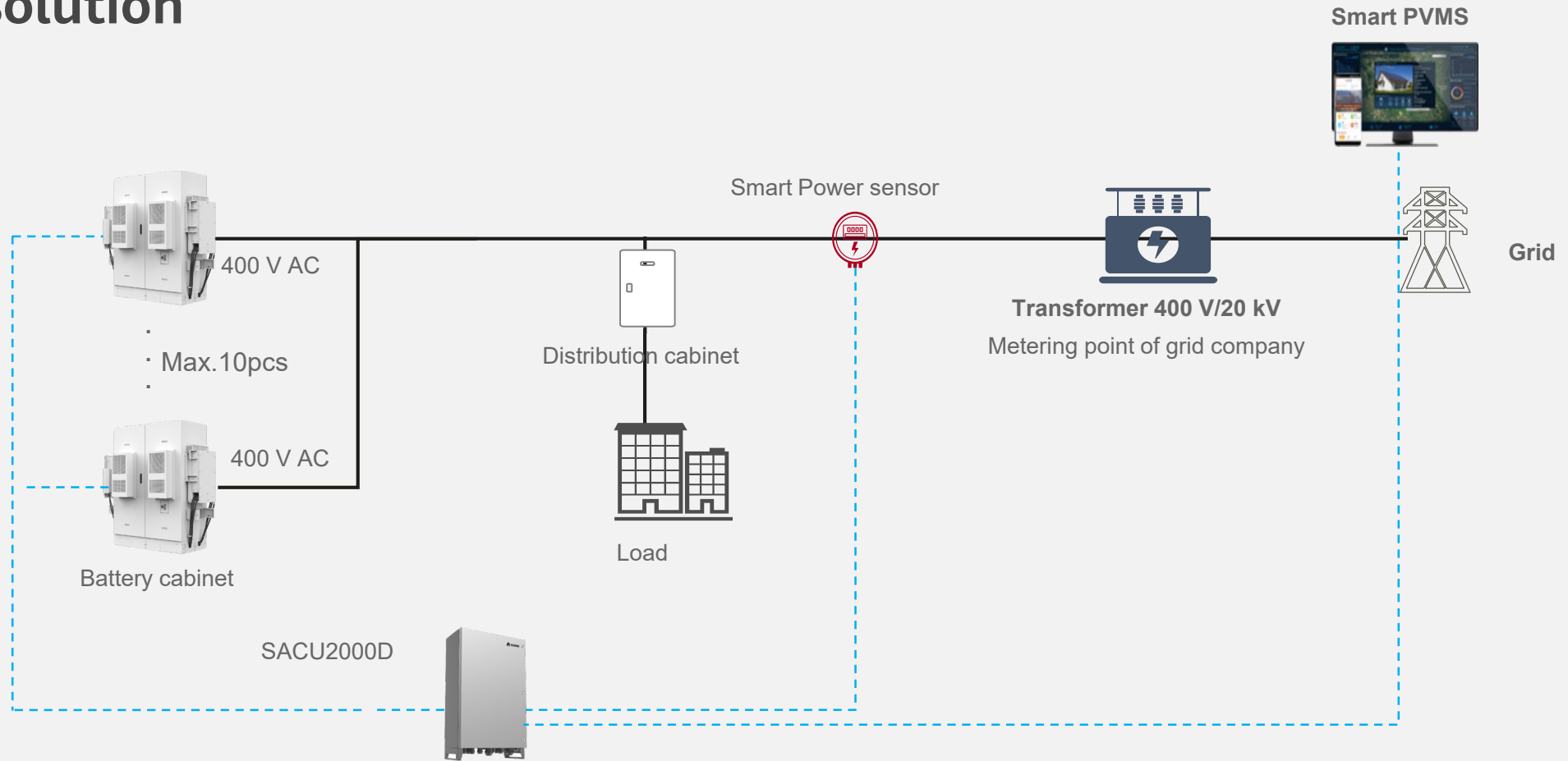
Reduce O&M Costs by 50%

# PV+ESS solution



Required Inverter	50KTL-M3, 30/36/40KTL-M3, SUN2000-100KTL-M1, SUN2000-100/115KTL-M2 ;
ESS	Max. 5 ESS @single grid connection point (2023.04.30)
Auxiliary power supply	Independent grid or 400 V AC bus power supply (Huawei inverter scenario)
Zero export in 2s	Only 50KTL-M3 & SUN2000-100/115KTL-M2 support

# ESS solution



ESS quantity limit	Max. 10 ESS @one grid connection point
Auxiliary power supply	Independent grid or 400 V AC bus power supply (Huawei inverter scenario)



# Outdoor installation

Protection degree	IP55
Salt-mist-resistant	C5-M

No need separate fire resist room to install ESS, reduce the cost for the fire door, the ventilation system, etc..

Simple and Fast



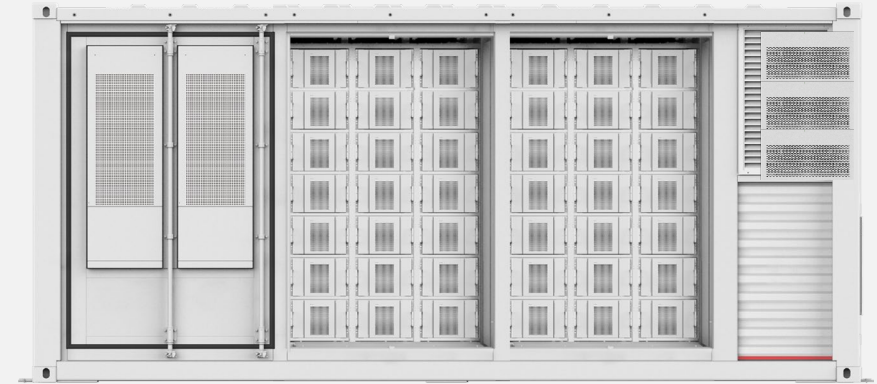
LUNA2000-200KWH-2H1



Reduces Investment Costs up to 20k€

# Smart String ESS - 2MWh

LUNA2000-2MWH-1H1/2H1



20ft container

Total Energy Capacity	2,032kWh
Charge/Discharge Power	$\leq 1C$
Dimensions (W*H*D)	6,058 x 2,896 x 2,438 mm

Modular<sup>+</sup> Design, LCOS reduced by 20%

**05**

**Warranty**

# Warranty




LUNA2000-200KWH-2H1

+




Smart PVMS

**5 Years**

Performance  
Warranty  
 **5000 Cycles**

SACU, Fire Extinguishing System  
**2 Years**

Warranty Extension  
 **5 Years**

ESS+DC/DC+PCS  
**5 Years**

- The advanced warranty (5 years) is automatically obtained after the devices are connected to the Smart PVMS.
- The warranty can be extended an additional 5 years.
- The defined performance guarantee for the energy storage system is equal to 5000 cycles, 100% DOD, 0.5C, 70% EOL, ambient temperature 10 to 30°C.

# Discussion

- Arbitrage trading
- 4-8 cycles per day
- high cyclic battery Cells for projects in the Future.
- ...

# Thank you.

把数字世界带入每个人、每个家庭、  
每个组织，构建万物互联的智能世界。

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

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# Smart ESS



Energy Storage System Parameters	
Battery Configuration	12S1P
Maximum battery capacity of the energy storage system	193.5 kWh
Rated Power	100 kW
Dimensions (W x H x D), including DC/DC and PCS	2570mm×2135mm×1200mm
Dimensions (W x H x D)	1810mm×2135mm×1200mm
Weight (including the battery module)	≤2950kg
Weight (without the battery module)	≤1070kg
Operating temperature range	-30 °C ~ 55 °C
Storage temperature range	-40 °C ~ 60 °C
Operating humidity range	0 ~ 100% (non-condensing)
Maximum operating altitude	4,000 m
Installation Environment Requirement	Outdoor installation
Battery temperature control mode	Industrial-grade air conditioner
Fire suppression of energy storage system	YES
Auxiliary Power Supply	220Vac, ≤4.2kVA
Communication port	Ethernet / SFP
Communication protocol	Modbus TCP
Protection degree	IP55
EMC Protection Rating	ClassA
DC Lightning Protection	Type II

# Battery Pack & Rack Controller



Battery Pack	
General	
Cell Material	LFP
Rated Voltage	57.6 V
Nominal Capacity	16.13kWh
Supported Charge & Discharge Rate	≤ 0.5 C
Weight	≤ 140 kg
Dimensions (W x H x D)	442 x 308 x 660 mm

Smart Rack Controller	
Efficiency	
Max. Efficiency	≥ 98.5.0%
Battery Side	
Rated Voltage	691.2@280Ah
Operating Voltage Range	40 V ~ 1,050 V
Min. Start Voltage	350 V
Bus Side	
Max. DC Voltage	1,100 V
Rated Voltage	665 V
Rated Current	76.3 A
General	
Dimensions (W x H x D)	600 x 270 x 820 mm
Weight	≤ 90 kg
Cooling Method	Smart Air Cooling
Protection Degree	IP66



# Smart PCS

## LUNA2000-100KTL-M1



Efficiency	
Max. Efficiency	98.4%
DC Side	
Rated DC Voltage	645 V
Max. DC Voltage	1,100 V
Operating DC Voltage Range	570 V ~ 1100 V
Max. DC Current	215.8 A
Max. Number of Inputs	1
AC Side	
Rated AC Active Power	100,000 W @40°C
Rated AC Voltage	380 Vac / 400 Vac / 440 Vac
Rated AC Grid Frequency	50 Hz / 60 Hz
Max. AC Current	173.2 A
Adjustable Power Factor Range	-1 ... +1
Max. Total Harmonic Distortion	< 3%
Protection	
Anti-islanding Protection	Yes
AC Overcurrent Protection	Yes
DC Reverse-polarity Protection	Yes
Insulation Resistance Detection	Yes
Residual Current Protection	Yes
DC Surge Protection	Type II
AC Surge Protection	Type II
Communication	
Display	LED Indicators, WLAN + APP
Networking Mode	Ethernet, CAN
General	
Dimensions (W x H x D)	875 x 820 x 365 mm
Weight	< 95 kg
Operating Temperature Range	-25°C ~ 60°C ( Derating above 40°C )
Cooling Method	Smart Air Cooling
Max. Operating Altitude without Derating	4,000 m
Relative Humidity	0 ~ 100%
DC Connector	OT/DT Terminal
AC Connector	OT/DT Terminal
Protection Degree	IP66
Topology	Transformerless

# SmartACU



Technical Specification	SmartACU2000D-D-00	SmartACU2000D-D-02	SmartACU2000D-D-01	SmartACU2000D-D-03
<b>Configuration</b>				
Smart Logger	SmartLogger3000B x 1			
SmartModule1000A	Optional			Standard with SmartModule1000A x 1
RS485	Supported			
No. of MBUS <sup>1</sup>	1	2	1	2
No. of SmartPID2000	0	0	1	2
<b>Environment</b>				
Operating Temperature Range	-40°C ~ 60°C (-40°F ~ 140°F)			
Relative Humidity	4% ~ 100%			
Max. Operating Altitude	4,000 m (13,123 ft.)			
<b>Electrical</b>				
AC Input Voltage for SACU	100 V ~ 240 V, L / N (L)+ PE			
AC Input Voltage for MBUS	380 V ~ 800 V, 3Ph			
AC Input Voltage for PID	380 V ~ 800 V, 3Ph + FE (Functional Earth)			
AC Input Frequency	50 / 60 Hz			
Power Supply	Standard: 12 V DC Optional: 24 V DC <sup>2</sup>			
<b>Mechanical</b>				
Cable Entries	Bottom in & out			
Maintenance	Front			
Dimensions (W x H x D)	640 x 770 x 315 mm (25.2 x 30.3 x 12.4 inch)		880 x 770 x 369 mm (34.6 x 30.3 x 14.5 inch)	
Weight	29 kg (63.9 lb.)	32 kg (70.5 lb.)	49 kg (108.0 lb.)	61 kg (134.5 lb.)
Protection Degree	IP65			
Installation Options	Wall Mounting, Rack Mounting, Pole Mounting			

# Smartlogger



Technical Specifications	SmartLogger3000B	SmartLogger3000B with SmartModule1000A
<b>Device Management</b>		
Max. Number of Manageable Devices	200	
Max. Number of Manageable Inverters	150	
<b>Communication Interface</b>		
WAN	WAN x 1, 10 / 100 / 1,000 Mbps	
LAN	LAN x 1, 10 / 100 / 1,000 Mbps	LAN x 3, 10 / 100 / 1,000 Mbps
Optical Ethernet	SFP x 2, 100 / 1000 Mbps	
MBUS	MBUS x 1, 115.2 kbps, Compatible with PLC	
RS485	COM x 3, 1,200 / 2,400 / 4,800 / 9,600 / 19,200 / 115,200 bps	COM x 6, 1,200 / 2,400 / 4,800 / 9,600 / 19,200 / 115,200 bps
Digital / Analog Input / Output	DI x 4, DO x 2, AI x 4	DI x 8, DO x 2, AI x 7
PT100 / PT1000	0	2
Active DO	12 V, 100 mA (connection with relay, sensor)	
<b>Communication Protocol</b>		
Ethernet	Modbus-TCP, IEC 60870-5-104	
RS485	Modbus-RTU, IEC 60870-5-103 (standard), DL / T645	
<b>Interaction</b>		
LED	LED Indicator x 3 – RUN, ALM, 4G	LED Indicator x 5 – RUN, ALM, 4G (Smartlogger3000B) & RUN, ALM (SmartModule1000A)
WEB	Embedded Web	
USB	USB 2.0 x 1	
APP	Communication by WLAN for commissioning	
<b>Environment</b>		
Operating Temperature Range	-40°C ~ 60°C (-40°F ~ 140°F)	
Storage Temperature Range	-40°C ~ 70°C (-40°F ~ 158°F)	
Relative Humidity (Non-condensing)	5% ~ 95%	
Max. Operating Altitude	4,000 m (13,123 ft.)	
<b>Electrical</b>		
Power Adaptor	AC input: 100 V ~ 240 V, 50 Hz / 60 Hz; DC output: 12 V, 2 A	
DC Power Supply	24 V, 0.8 A	
Power Consumption	Typical 9 W, Max. 15 W	Typical 10 W, Max. 18 W
<b>Mechanical</b>		
Dimensions (W x H x D, without mounting ears)	225 x 160 x 44 mm (8.9 x 6.3 x 1.7 inch)	350 x 160 x 44 mm (13.8 x 6.3 x 1.7 inch)
Weight	2 kg (4.4 lb.)	3 kg (6.6 lb.)

# SUN2000-100KTL-M2



Technical Specification	SUN2000-100KTL-M2
<b>Efficiency</b>	
Max. efficiency	98.6% @ 400 V, 98.8% @ 480 V
European efficiency	98.4% @ 400 V, 98.6% @ 480 V
<b>Input</b>	
Max. Input Voltage <sup>1</sup>	1,100 V
Max. Current per MPPT	30 A
Max. Current per Input	20 A
Max. Short Circuit Current per MPPT	40 A
Start Voltage	200 V
MPPT Operating Voltage Range <sup>2</sup>	200 V ~ 1,000 V
Nominal Input Voltage	600 V @ 400 Vac, 720 V @ 480 Vac
Number of MPP trackers	10
Max. input number per MPP tracker	2
<b>Output</b>	
Nominal AC Active Power	100,000 W
Max. AC Apparent Power	110,000 VA
Max. AC Active Power (cosφ=1)	110,000 W
Nominal Output Voltage	400 V/ 480 V, 3W+(N)+PE
Rated AC Grid Frequency	50 Hz / 60 Hz
Nominal Output Current	144.4 A @ 400 V, 120.3 A @ 480 V
Max. Output Current	160.4 A @ 400 V, 133.7 A @ 480 V
Adjustable Power Factor Range	0.8 leading... 0.8 lagging
Max. Total Harmonic Distortion	<3%