

Huawei C&I One-Fits-All Solution

Proactive Safety, Premium Quality, Empower Every Industry



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SOLARWORLD
USA

powered by
IBC
SOLAR

An abstract graphic on the left side of the slide. It features a large circle containing a forest landscape with a lake. Inside this circle is a smaller circle, and within that is a third, even smaller circle. The circles are layered, with the innermost circle showing a forest scene, the middle circle showing a lake scene, and the outermost circle showing a forest scene. The circles are surrounded by a white background with a pattern of thin, curved lines that create a sense of depth and movement.

Introduction

Name:

Muzakkir Sondag

Title:

Solutions Architect and Product Manager



构建万物互联的智能世界

Huawei Product Overview



Huawei: Leading provider of ICT infrastructure and smart devices

Vision and mission

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



213,000
employees



53.7%
of employees work in R&D



63.8%
of employees outside China
hired locally



170+
countries and regions



Focusing on ICT to provide products, solutions, and services to three customer groups alongside ecosystems and partners

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



Consumers



Carriers



Enterprises

Ecosystems

Partners

Devices

Smartphones
Wearables
Smart home devices
Telematics
All-scenario lifestyle services

Intelligent Automotive Solution

Intelligent driving
Intelligent vehicle control
Intelligent vehicle cloud services
Intelligent cockpit
Intelligent automotive optics

Connectivity

Wireless network
Data communications
Optical network
Cloud core network

Computing

Computing
Data storage

Cloud

Infrastructure
Data & AI
Databases
Security
Huawei Cloud Stack

Digital Power

Smart PV & Grid-forming ESS
Smart Charging Network
DriveONE
Data Center Facility & Critical Power

Information distribution and
interaction

Information transmission

Information processing, storage,
learning, and inference

Green energy

+ Intelligence

Overall performance is in line with forecast

Revenue in 2025

\$130.64 bn

ICT Infrastructure

\$55.61 bn

Consolidating digital infrastructure

Digital Power

\$11.46 bn

Helping customers go low-carbon

Consumer

\$51.09 bn

Booming HarmonyOS ecosystem

Cloud Computing

\$ 10.69 bn*

The preferred cloud for industry customers

Intelligent Automotive Solution

\$ 6.67 bn

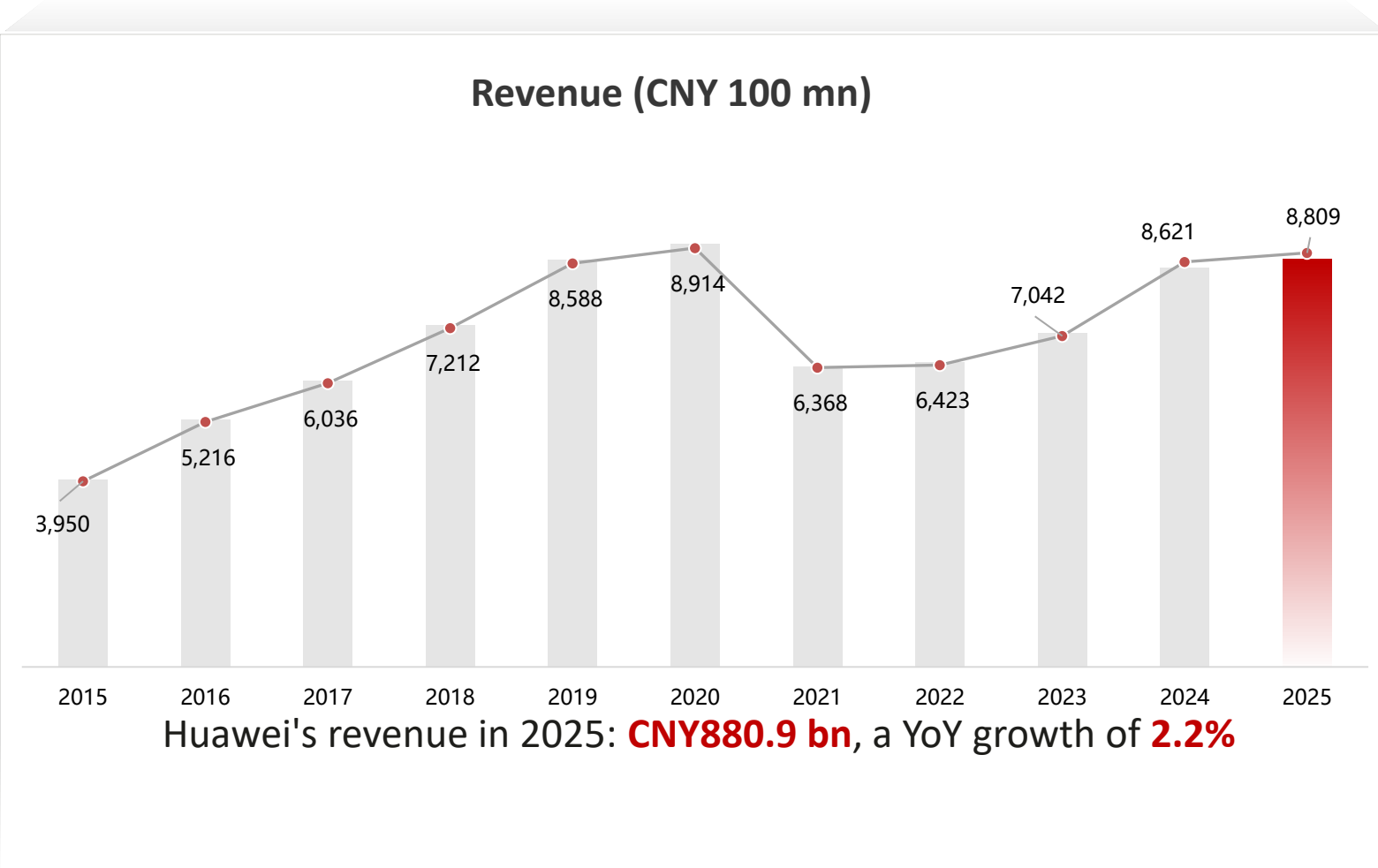
Leading intelligent transformation of the automotive industry

**Revenue from the cloud computing business included revenue from other Huawei segments.*

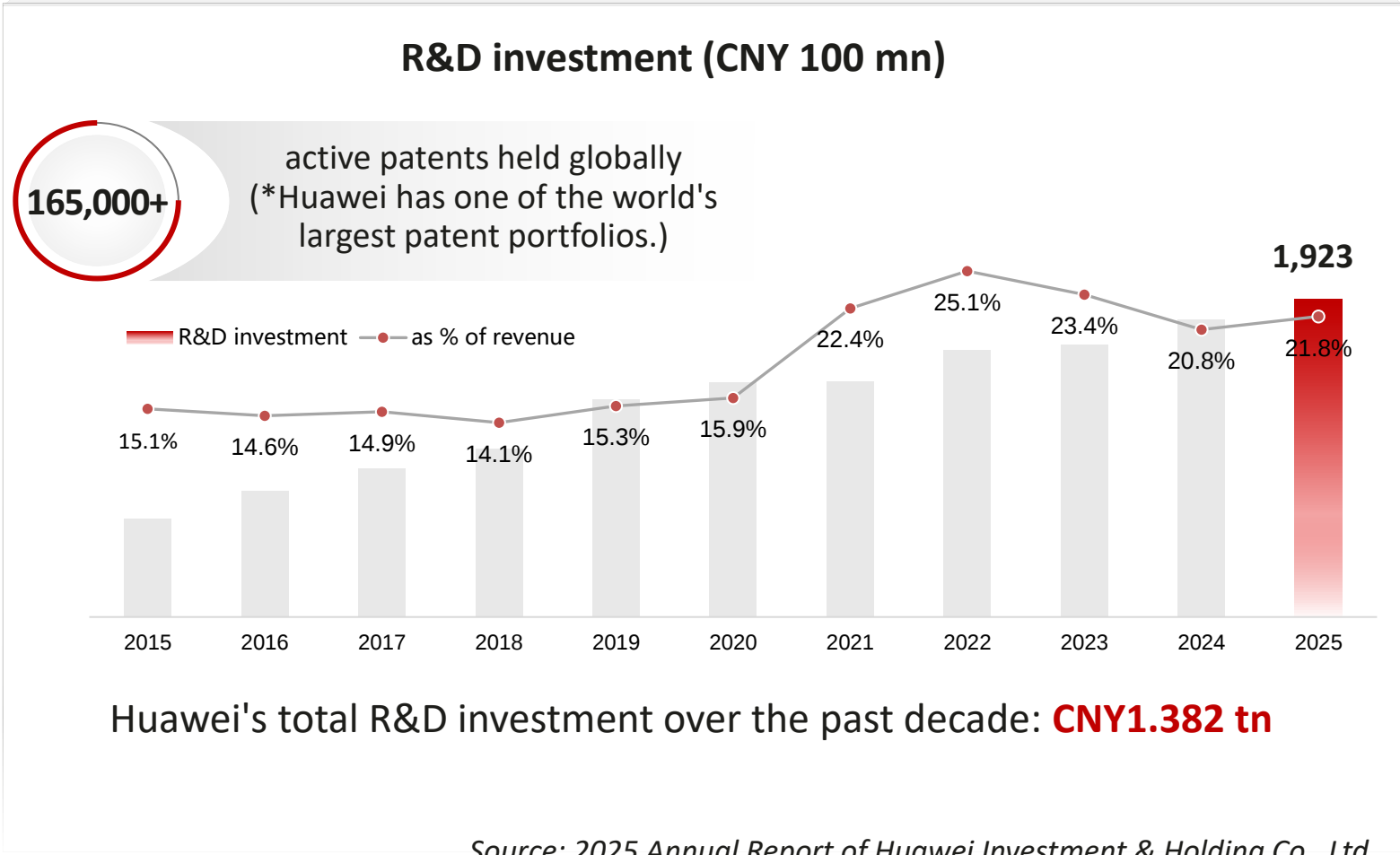
Source: 2025 Annual Report of Huawei Investment & Holding Co., Ltd.

Heavy R&D investment to create more value for customers and society through innovation

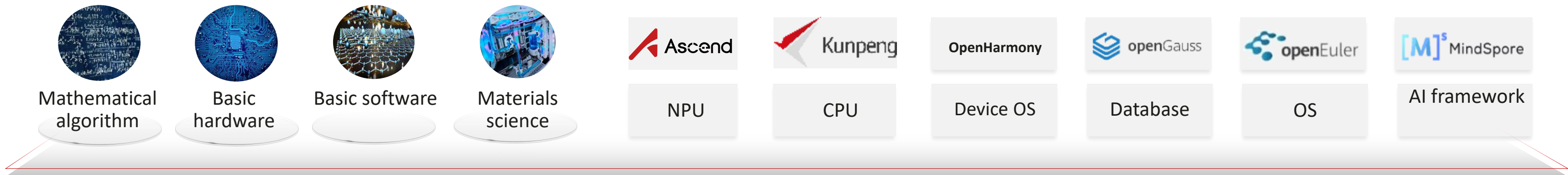
Overall performance is in line with forecast



Heavy R&D investment drives innovation and future development



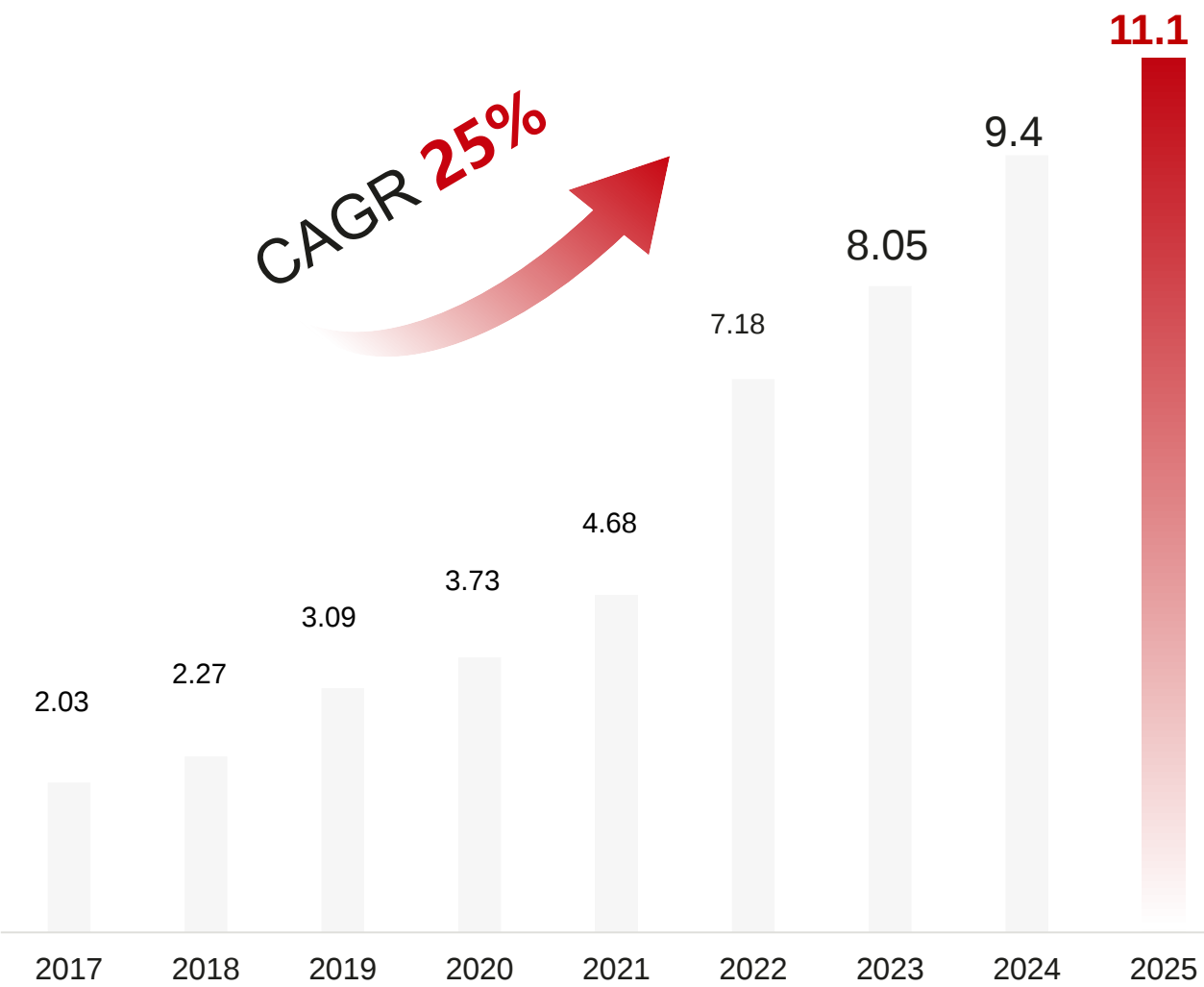
Source: 2025 Annual Report of Huawei Investment & Holding Co., Ltd.



Steady growth of digital power businesses

Stable business growth

Unit: US\$ bn

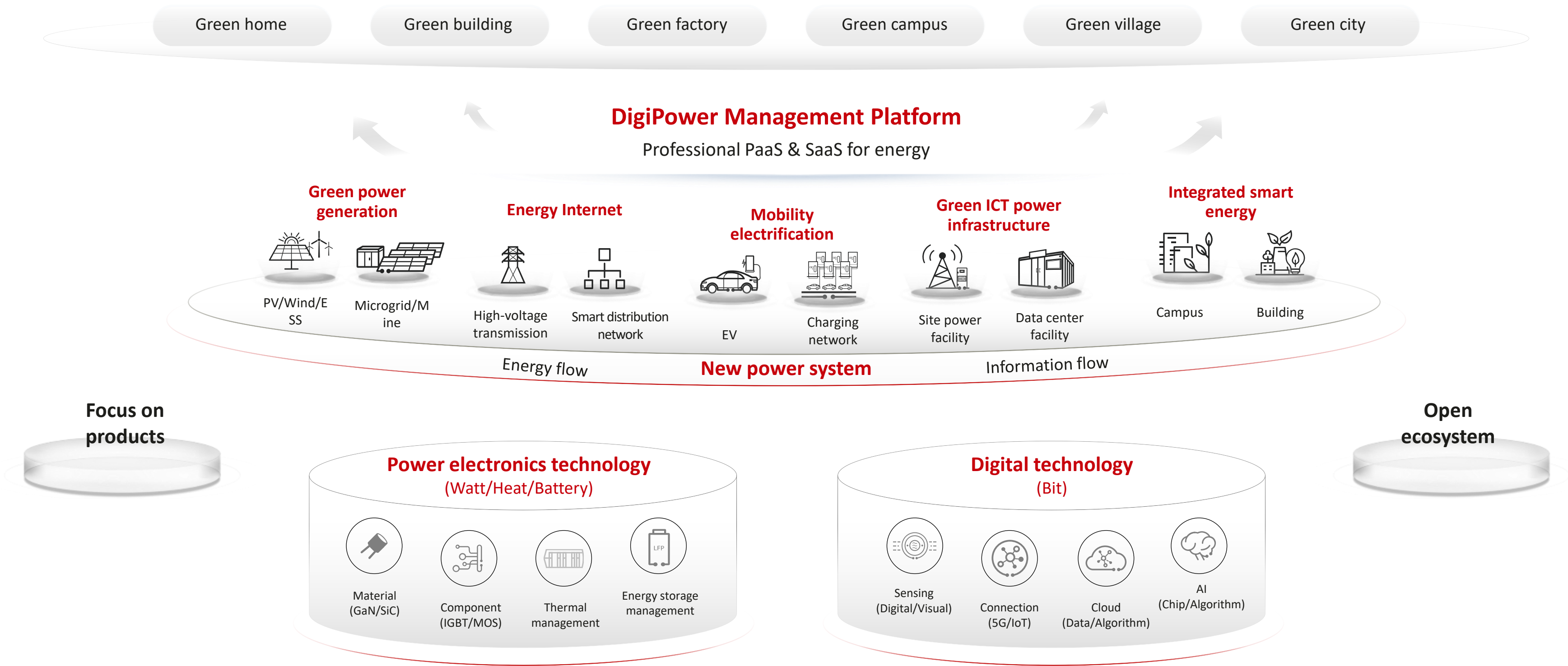


Integrating digital and power electronics technologies to promote green transformation in the industry

 Smart PV	800 GW Cumulative global PV inverter shipment by 2025	No. 1 Global shipment ranking for 11 consecutive years
 Grid-Forming ESS	66 GWh Cumulative global grid-forming ESS shipment by 2025	GWh-scale applications World-leading
 Smart Charging Network	60+ countries/regions, 400+ cities Liquid-cooled ultra-fast chargers widely deployed	20+ Logistics trunk lines with ultra-fast charging 70+ Highways (as of April 2026)
 DriveONE	10+ automobile manufacturers, 50+ vehicle models Adopted DriveONE	2.4 million units Cumulative shipments of ePowertrain (as of 2025)
 Data Center Facility & Critical Power	No. 1 Modular UPS/Modular DC global market share	2 million Total data center racks delivered (Source: Frost & Sullivan, ICTresearch, and omdia)
 Site Power Facility	No. 1 Global telecom market share for 9 consecutive years (2017–2025, source: Frost & Sullivan, except North America)	30% Global population coverage

Vision of Huawei Digital Power: Integrating digital and power electronics technologies, developing clean power, and enabling energy digitalization to drive energy revolution for a better, greener future

Evolving from high carbon to low carbon, and finally to net-zero carbon



Quality strategy: Prioritize safety and quality, and strive for excellence at Digital Power

Prioritizing quality (safety and reliability) and building a robust product-centered quality system



Global R&D teams and technology platforms: Leveraging the domain specific advantages globally to keep leading



170
countries/regions



10,000+ employees
60% work in R&D



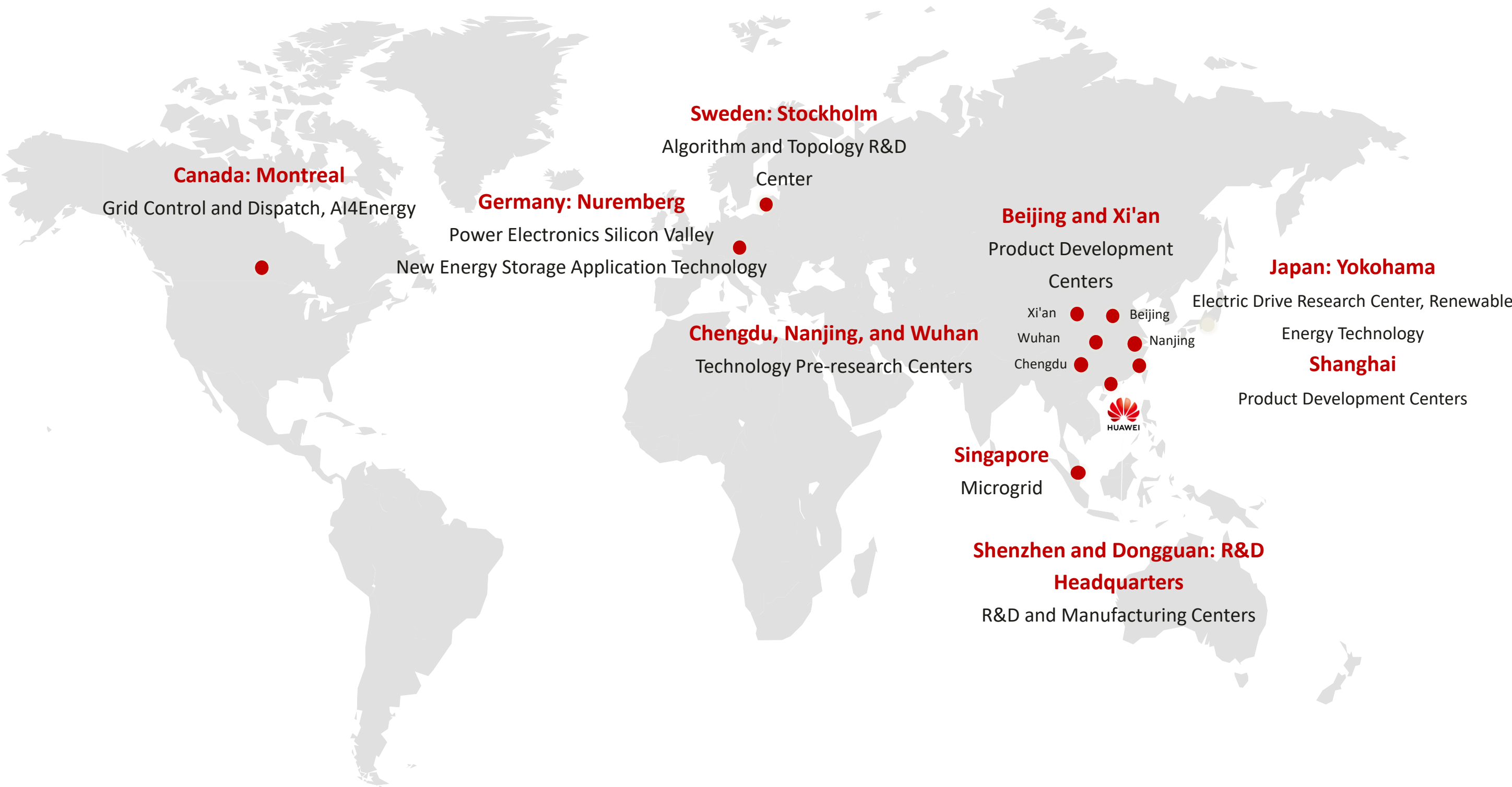
13
R&D Centers



15%+
as % of revenue in 2025



3,484
active patents worldwide



Huawei Digital Power South Africa Supporting Residential, Commercial and Utility Projects



150+ Established Partners for Digital Power SA



HUAWEI South Africa Campus, Located in Johannesburg



- Huawei SA founded in **1998**
- Huawei SA Annual Revenue: **US\$1.2 Billion**
- Huawei SA: **2,000+** employees, Digital Power: **65+ employees**

10+
Utility PV plants

2,000+
C&I PV plants

10,000+
Residential

2.2GW+ Utility PV Plants in South Africa by Q2 2026



SA RMIPP Scatec 540MW



Successfully connected to grid

Campus



**Huawei Office Campus
Johannesburg**

Real Estate



15MWh Real Estate

Mall



6MWh Grove Mall

Mine



Harmony Gold 100MW

Farm/Winery



**Waterkloof Wine Estate
Cape Town**

Industrial



10MWh SABN

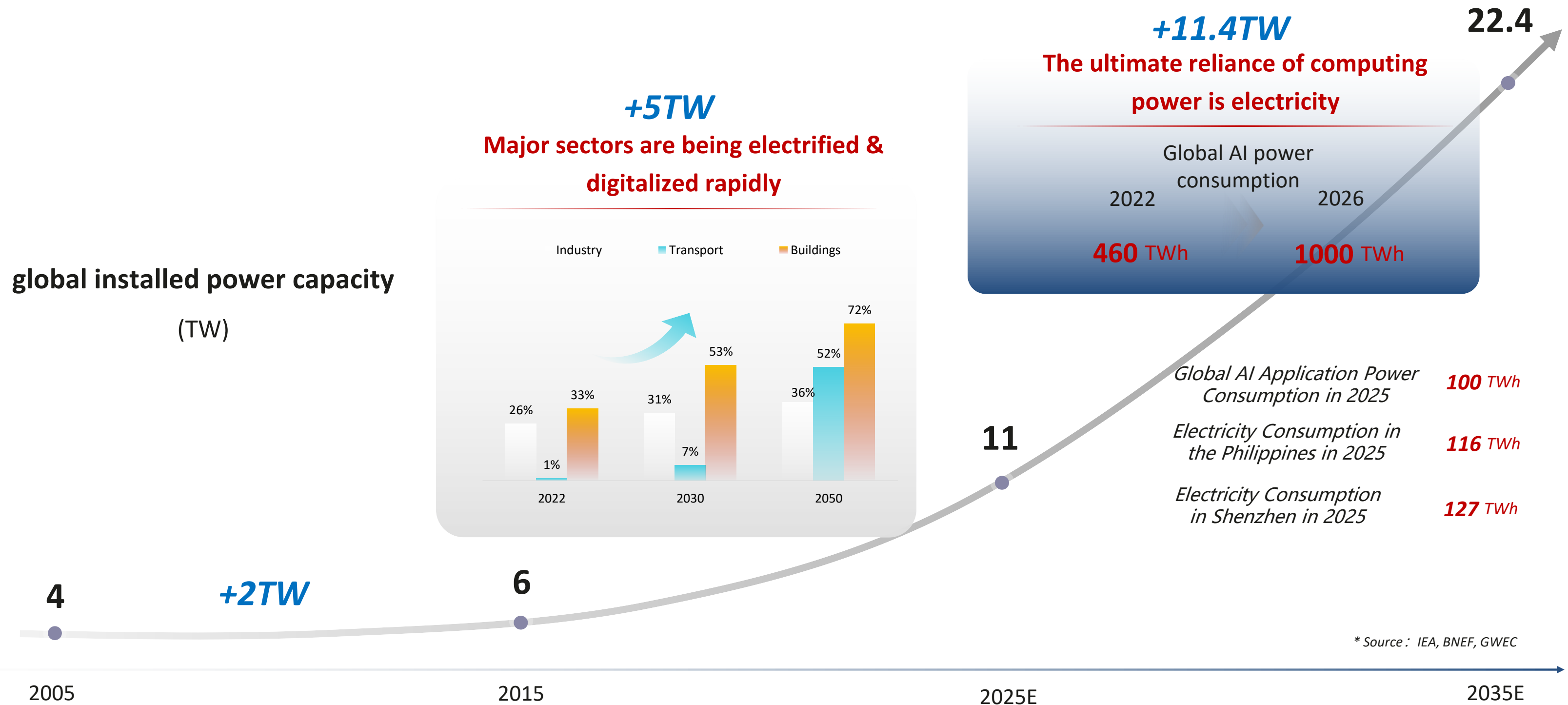




2

Trends and Challenges

The world's power capacity will be doubled in next decade driving by electrification, digitalization and intelligence



How to reduce the cost per kilowatt-hour, achieve rapid deployment, and minimize the impact on the power system are the three key challenges in the context of rapid electricity growth.



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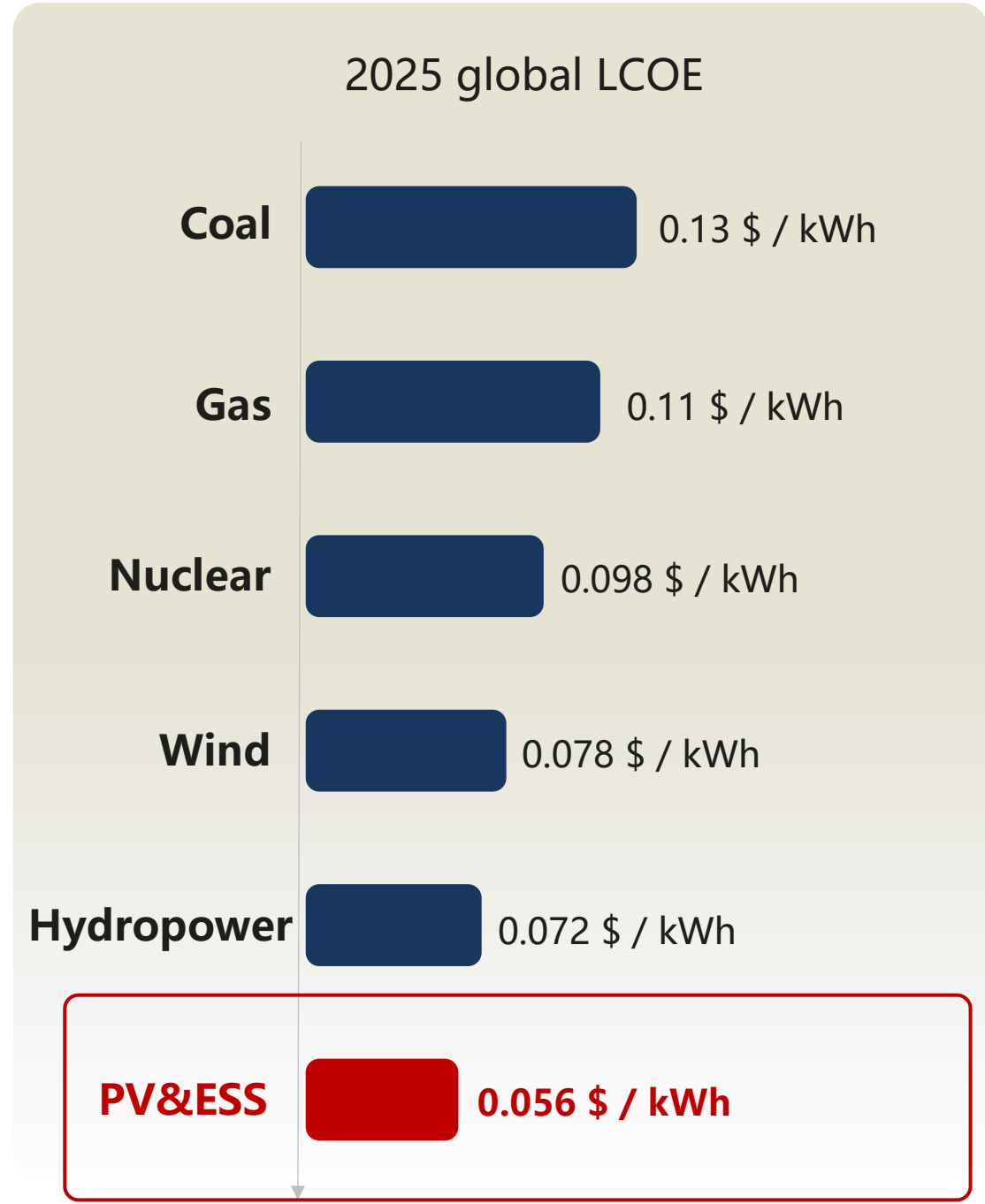


Low cost + easy deployment + grid support technology make solar and storage the primary energy forms for the next decade

The LCOE of PV+ESS < hydropower, the most economical new energy sources

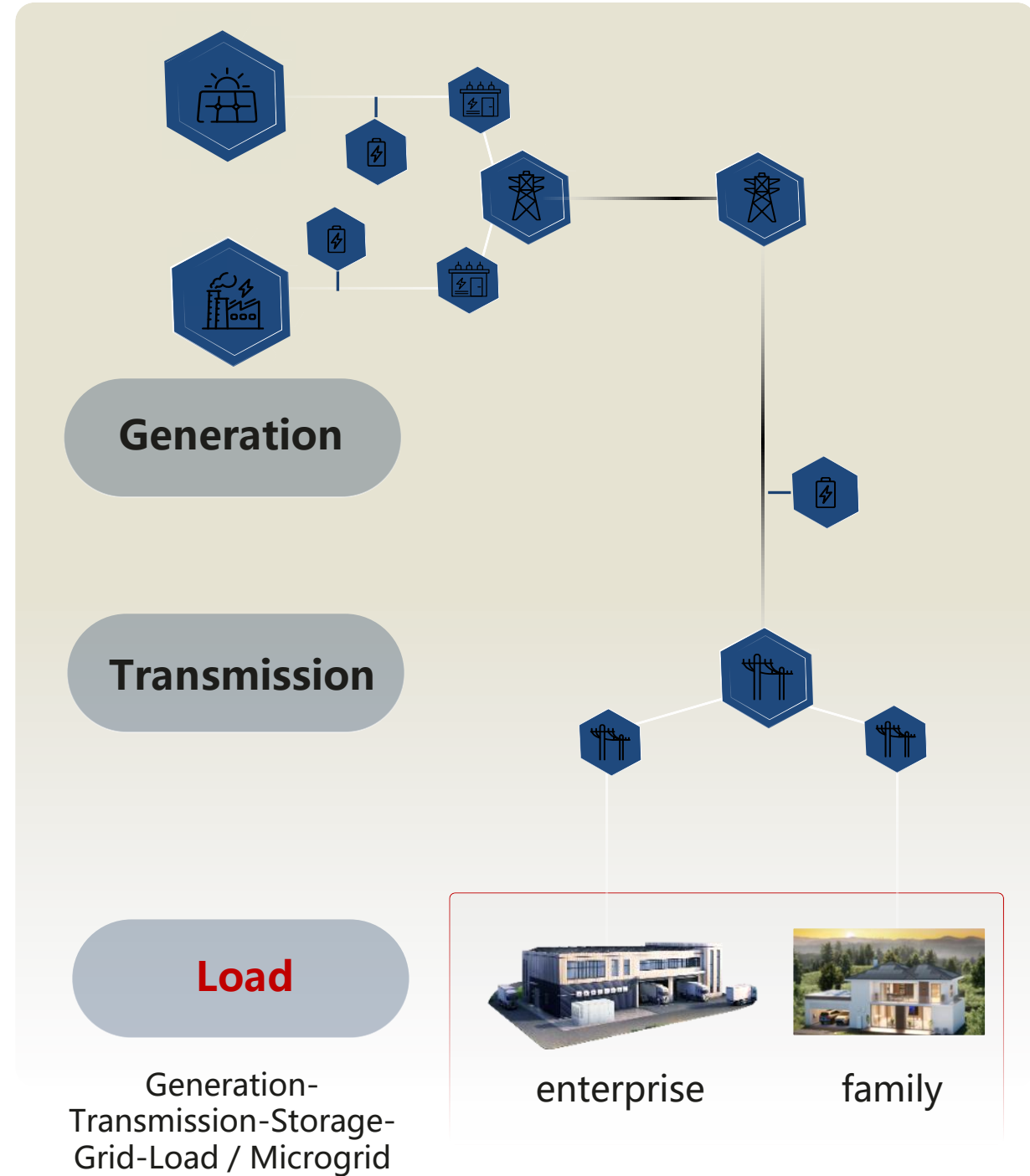
The easiest to deploy and widely accessible forms of new energy

The new power system presents two major opportunities on the load side



* Data Source: IRENA, IEA, BNEF 2025, weighted average, including lifecycle maintenance costs

Power Generation Mode	Construction period	Deployment scope
Coal	10~18 years	Coastal areas, around large rivers/lakes
Hydropower	5~8 years	Main rivers with high elevation differences
Offshore wind	6~7 years	offshore
Onshore wind	2~3 years	Plain, mountain peak
PV&ESS	1~12 weeks	Roof, open space, plain, coastal area, lake...



PV+ESS Genesis has Arrived as Multi Business Modes are Applying Widely

Max. Self-consumption

Payback period ~4 years @Italy,
Concrete factory



Saving cost & reduce CO₂ emission

Time of Use

Payback period ~5 years @China,
Semiconductor Factory



Dynamic electricity price

Peak Shaving

Payback period ~5 years @ Mexico,
Shopping Mall



Reduce demand cost

Grid Reinforce

Payback period ~4 years @Netherlands,
Business Campus



Avoid grid construction

Frequency Regulation

Payback period 1.8 years @Sweden,
Logistic Park



Grid reliability enhancement

Off-grid Application

Payback period ~2 years @ Philippines,
Island



Reliable power supply

Solution with Safety, Reliability, and Revenue Consistency is Urgently Needed

Safety Challenge

Fire last for 6 days
@ESS accidents in California



100+ safety accidents in 2024

- ① 16th Feb, 40% of ESS burned in Moss Landing, US.
- ② 18th Feb, 70% of ESS burned again in Moss Landing.
- ③ 19th Feb, fire broke out at an under-construction 600MWh ESS station in Essex, UK.
- ④ 19th Feb, ESS explosion and building damaged in Schleswig-Holstein, Germany.
- ⑤ 21th Feb, fire lasted several hours at 100MWh ESS station in Scotland, UK.

...

Source: public reports

Quality Challenge

3%~5% high failure rate of industrial inverter



No terminal overtemperature detection



Disorderly cabling caused internal short-circuit

- 91% of inverter vendors phased out since 2008
- 50%+ of ESS vendors phased out in 2024



Pack SOC difference >20% in two years, battery cell manufacturer bankrupted @case in Thailand

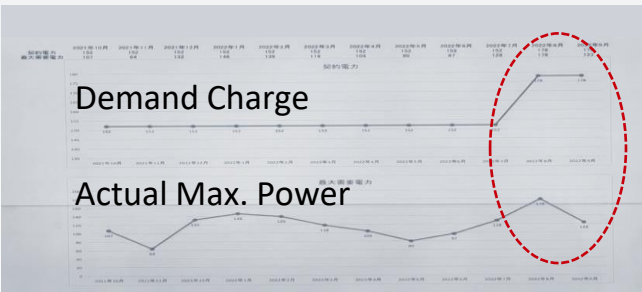
Source: World New Energy Network, GGII Research, China

Revenue Disparity Challenge

30% ESS capacity attenuation in 3 years @ESS case in China



Whole Year revenue loss due to one time failure control in peak-shaving @case in Japan



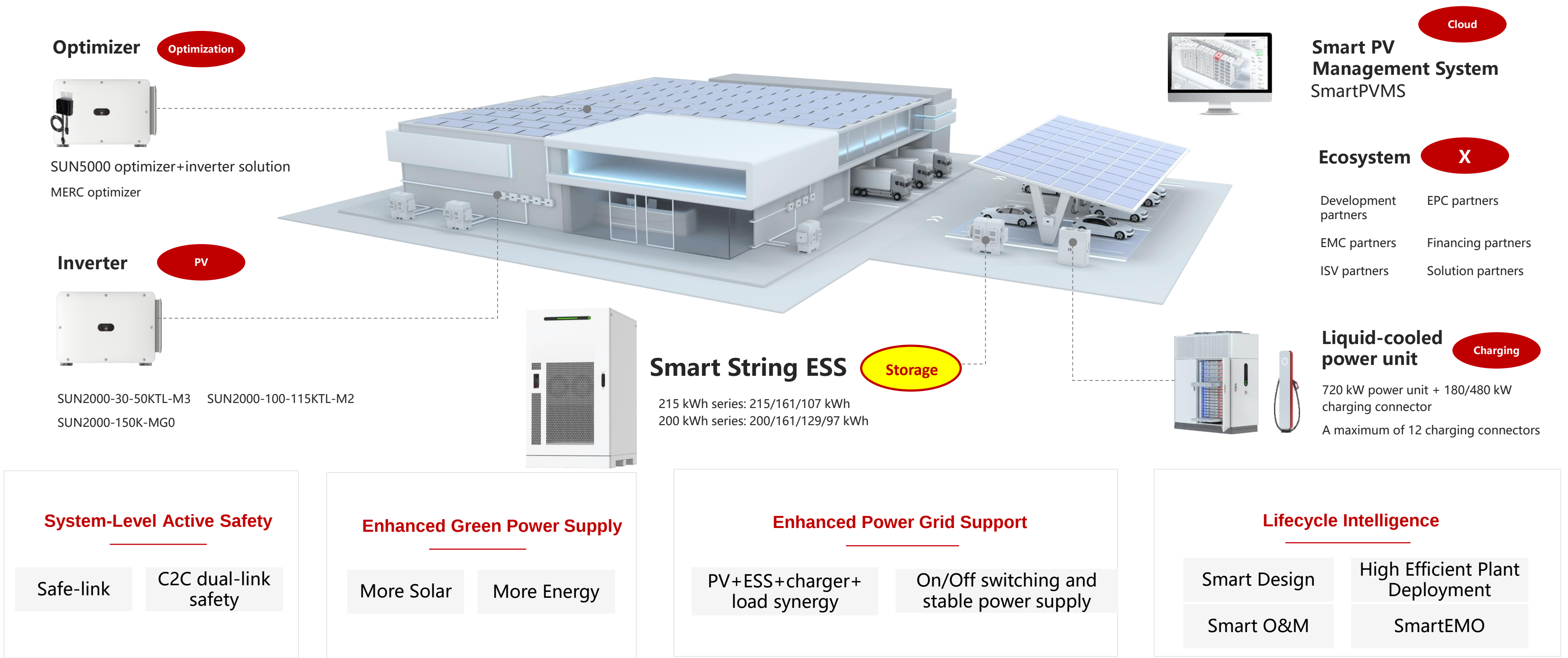
Power demand charged based on the maximum value of the year

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C&I solution: active safety and innovative convergence, making PV+ESS+Charger ubiquitous

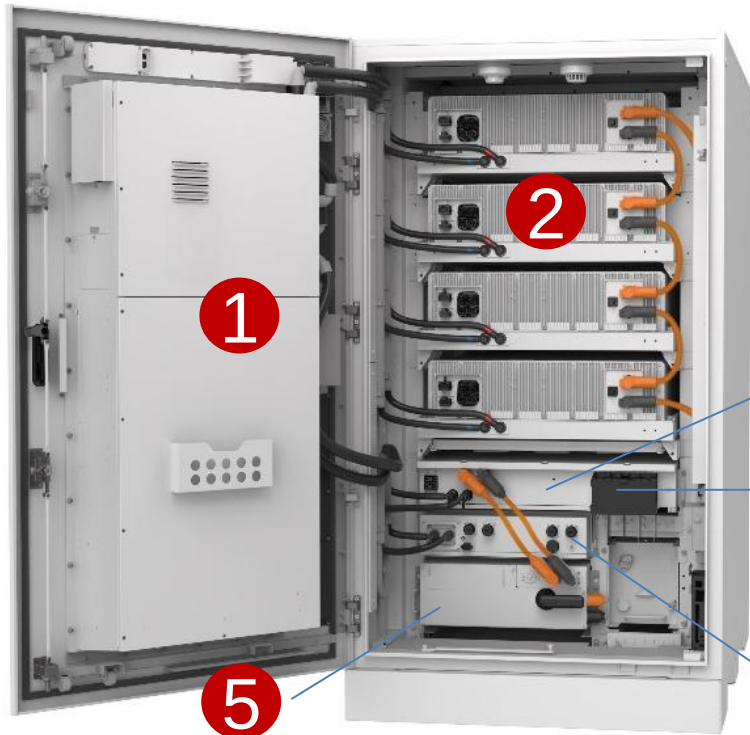


Technical & application innovation, leading the development of C&I ESS industry

The world's first

Hybrid air & liquid cooling C&I ESS

- 108kW / 241kWh (1 cabinet)
- Max. 50 cabinets parallel use (1 SmartLogger)



- 1 - Hybrid cooling system
- 2 - Battery pack
- 3 - Smart PCS
- 4 - AC output port
- 5 - Rack Control Module
- 6 - Rack DCDC (Optional)

C2C Dual-Link Safety

Safety architecture innovation

O&M
Automatic & Intelligent

Intelligent Hybrid Cooling

Thermal mgmt. architecture innovation

SOH
5% Higher in 10 years

Optimal Energy

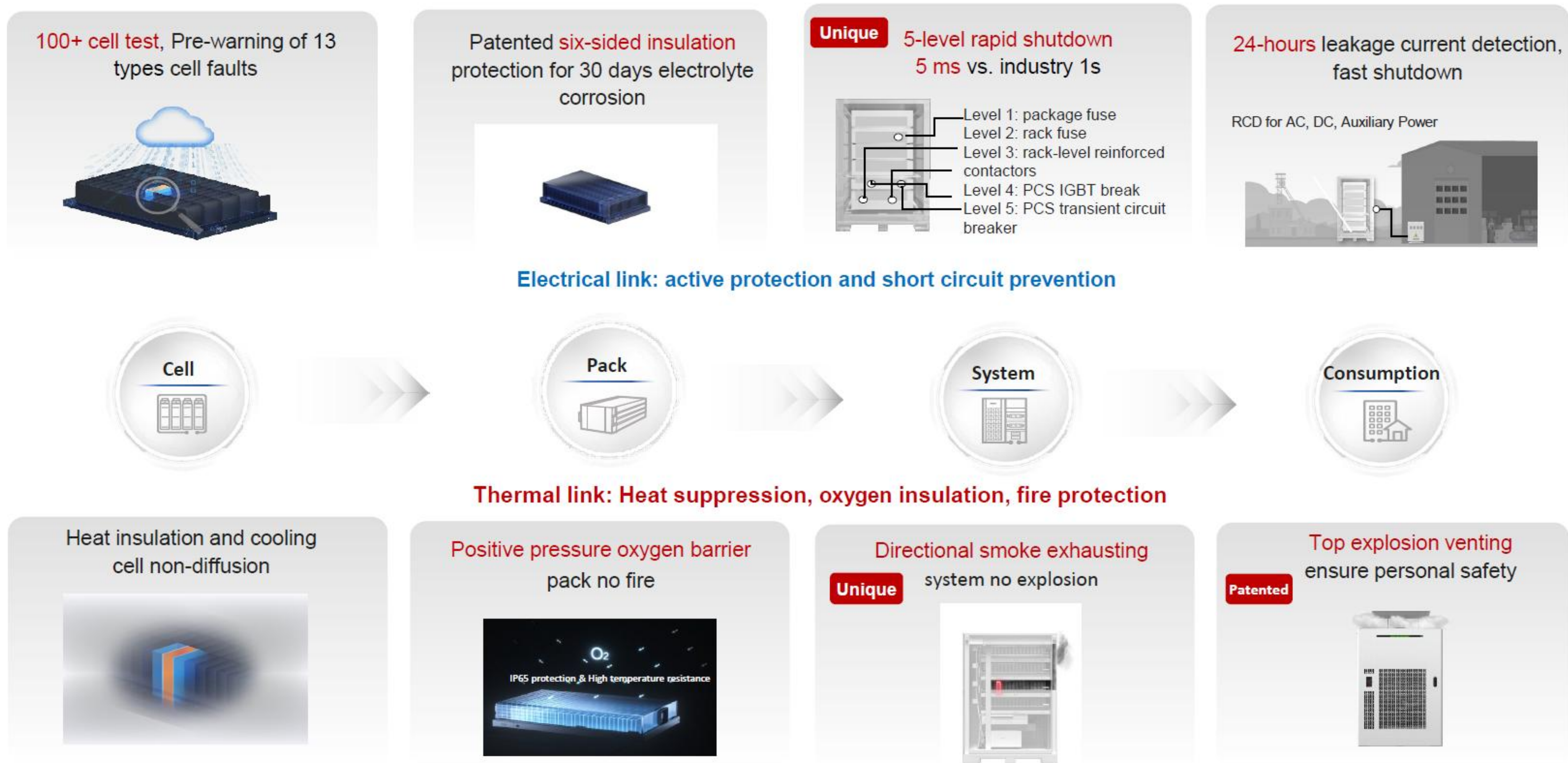
Power mgmt. architecture innovation

RTE
91.3% Highest Efficiency

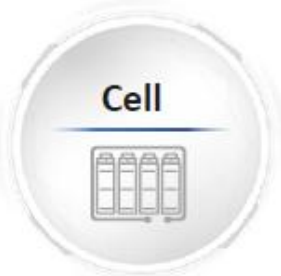
One-Fits-All

Flexible application innovation

C2C Dual-Link Safety, ensure electric & heat safety from cell to consumption



Beyond Industry Standard, Global 1st C&I ESS Safety Prime Certification by TUV



Huawei	VS	Industry
★ 100kN Crushing no fire		50kN
Needle penetrates cell no fire		Not penetrated
1.0 meter drop test no fire, no liquid leakage		No fire
1mΩ internal short circuit test		5mΩ



No thermal runaway will occur if cells are crushed



Huawei	VS	Industry
★ Thermal runaway ignition no fire, no explosion		No
72h salted water immersion no fire, no explosion		No
Electrolyte leakage test insulation layer no corrosion		No
1-50mΩ short circuit test		Only 1/30mΩ



Thermal runaway in a battery pack will not lead to a fire



Huawei	VS	Industry
★ Ignition no explosion		No
Coolant leakage test		No
Multi-points electrolyte leakage test		Single Point
PCS hydrogen explosion test		No



Explosion will not occur if the system is ignited



Huawei	VS	Industry
★ Top explosion venting test		No, or back side explosion venting
★ AC/DC/Aux. RCD test		Only AC RCD

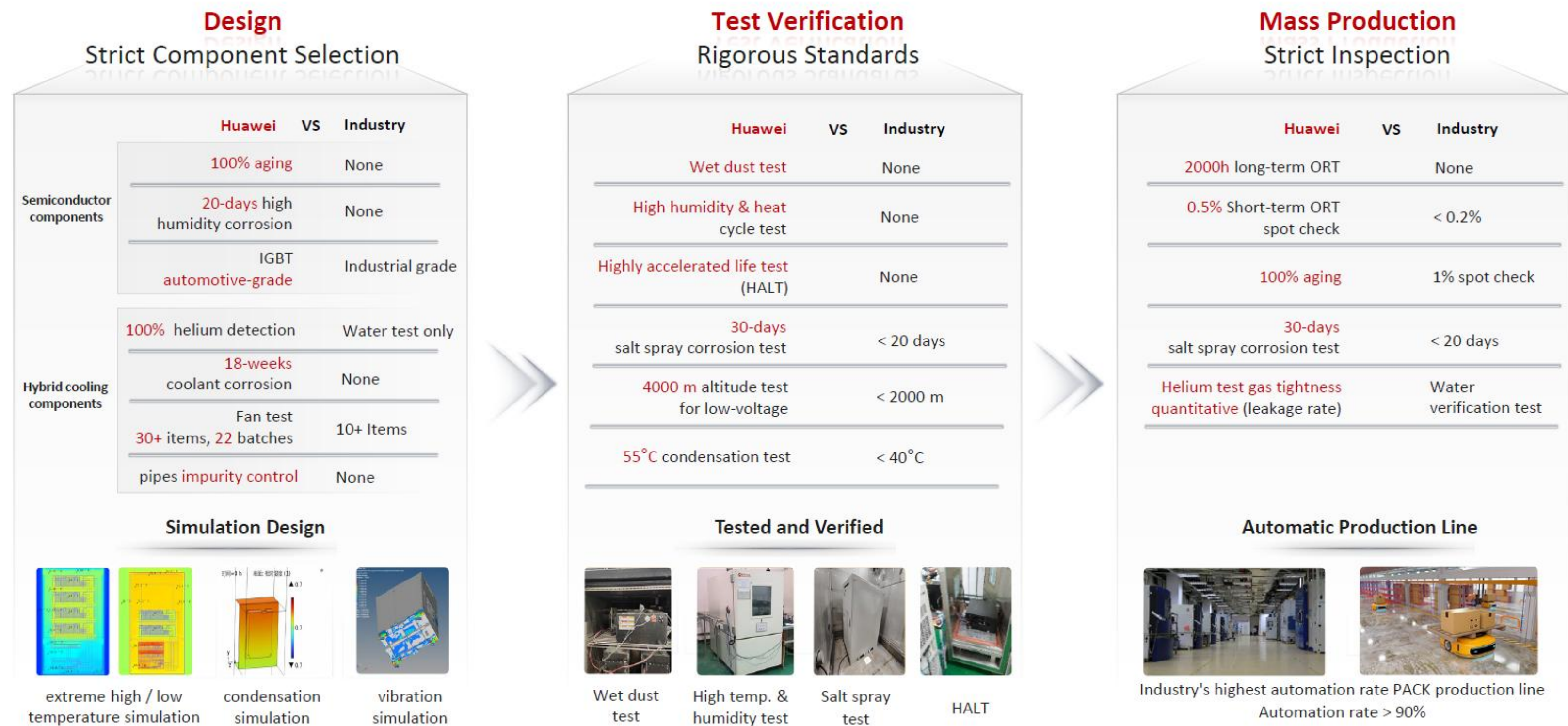


Explosion venting prevents personal injury during consumption



First C&I BESS safety certification
(Safety Prime Level)

Comprehensive Quality Control Process Ensure End-to-End Reliability



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#1 SA

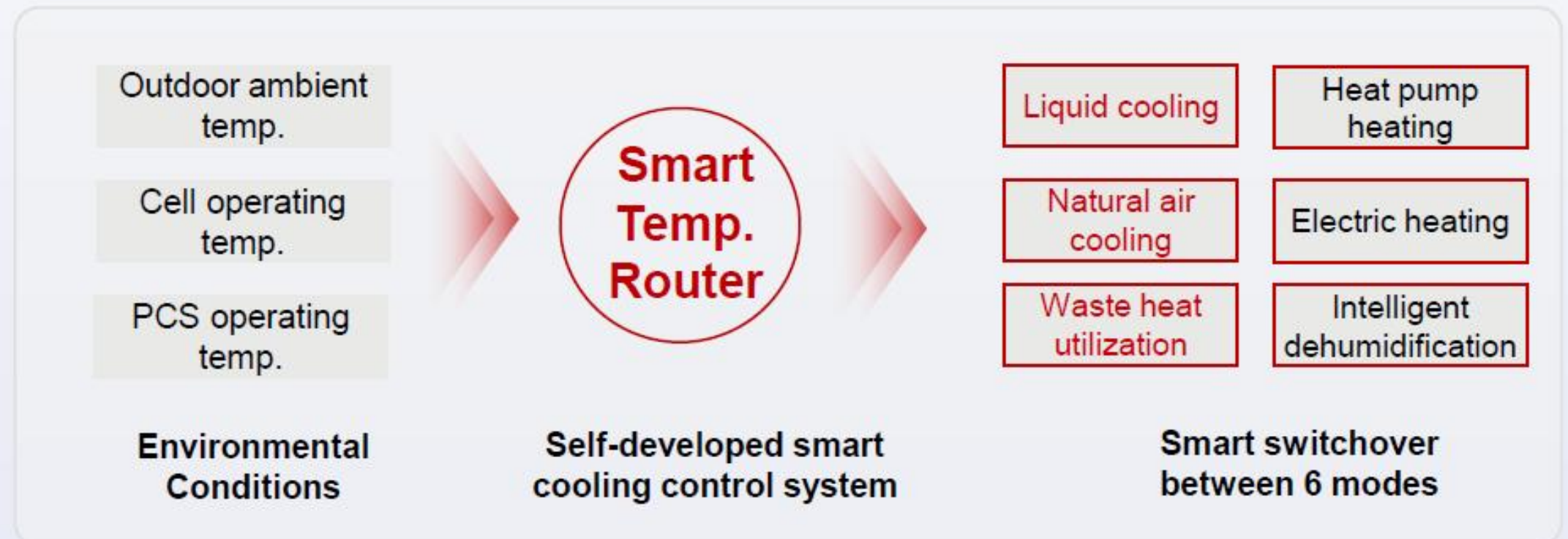
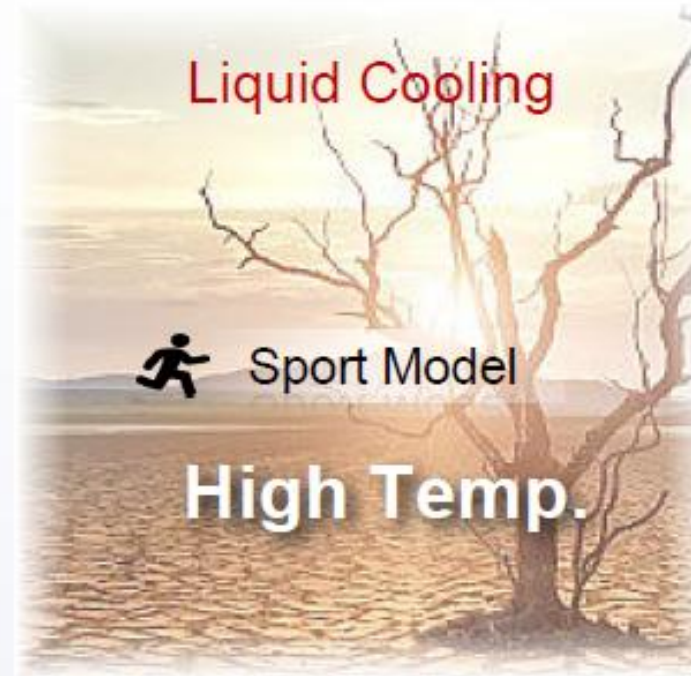
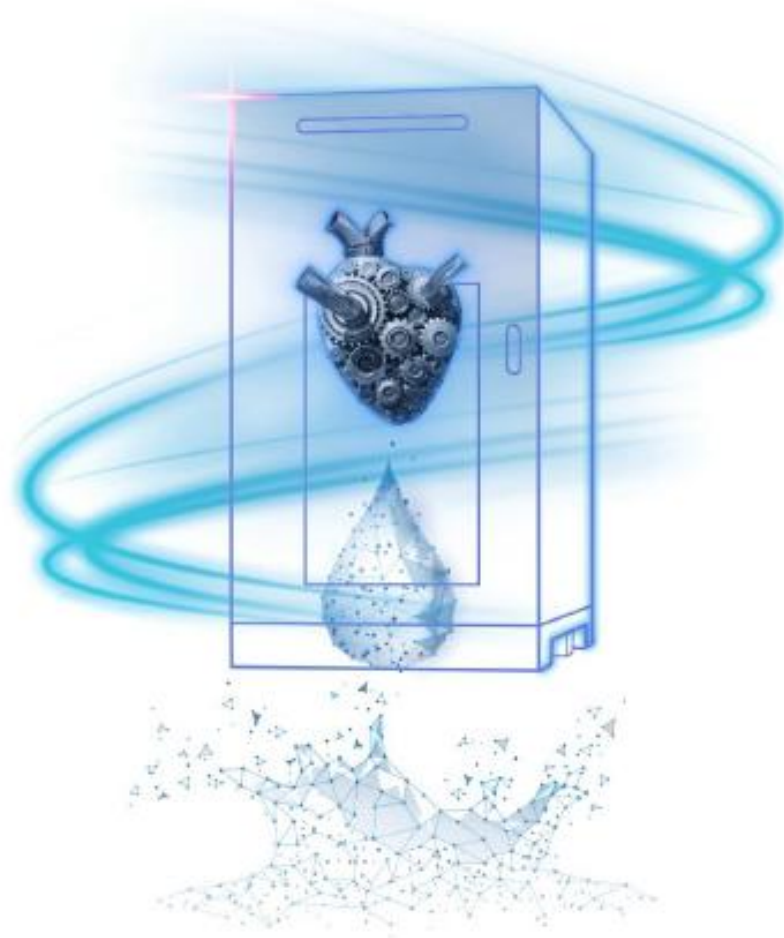


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Liquid & Air cooling, reduce 30% auxiliary energy consumption

"Heart Rate" Adaptive Regulation

intelligent switching according to the environment
and operating conditions



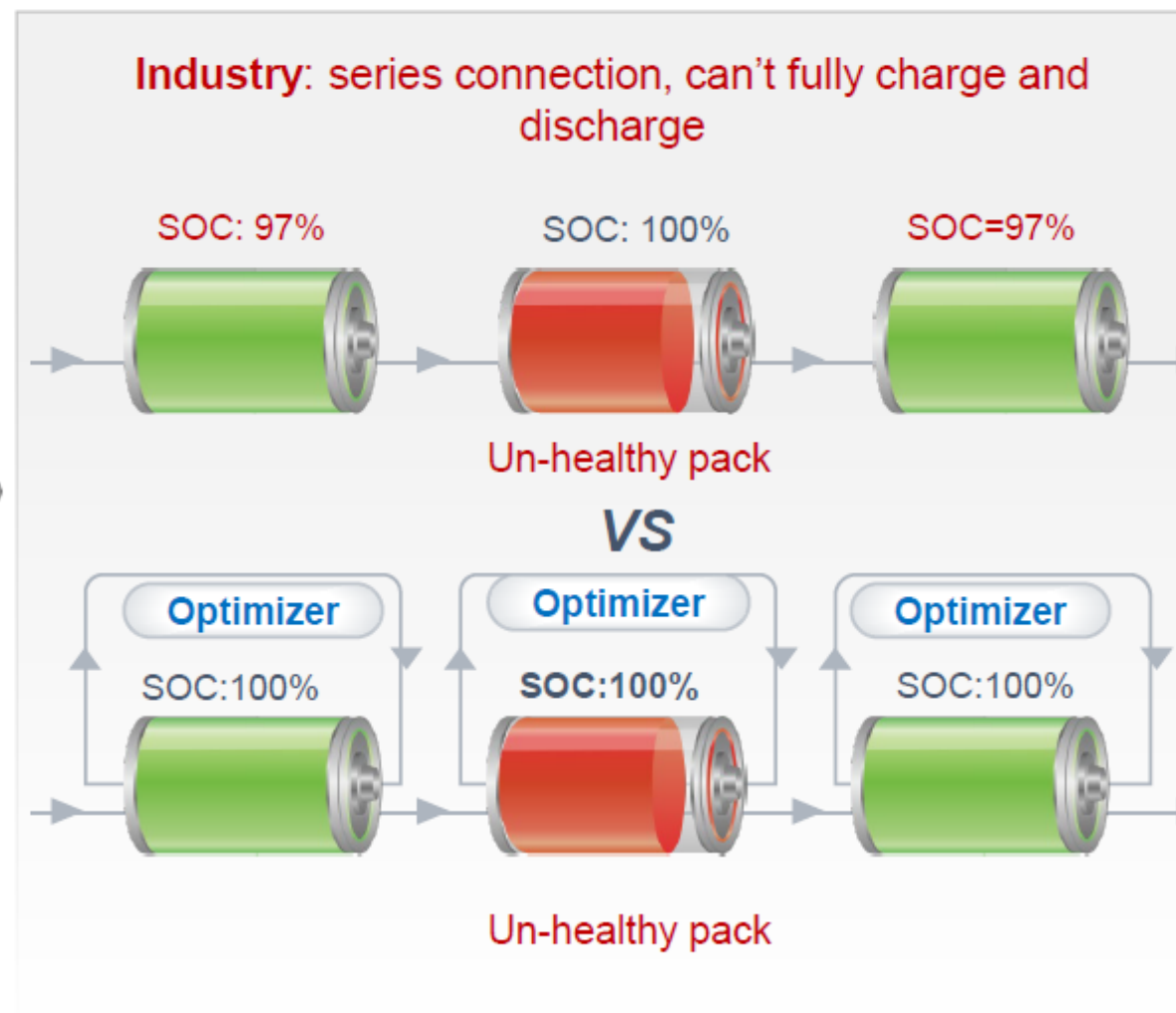
Unique Pack Optimizer Realizes 100% DOD, Revenue Improved by \$1.5K/100kWh in a Decade

Cask Principle



Volume decided by
shortest wood plate

Optimizer: Eliminate Cask Effect. Maximizes Capacity



100%

Depth of
Discharge

↑ 2%

Available
capacity

Case @China textile factory



Discharged Energy Per Cycle
(kWh)

396.8

+2.2%

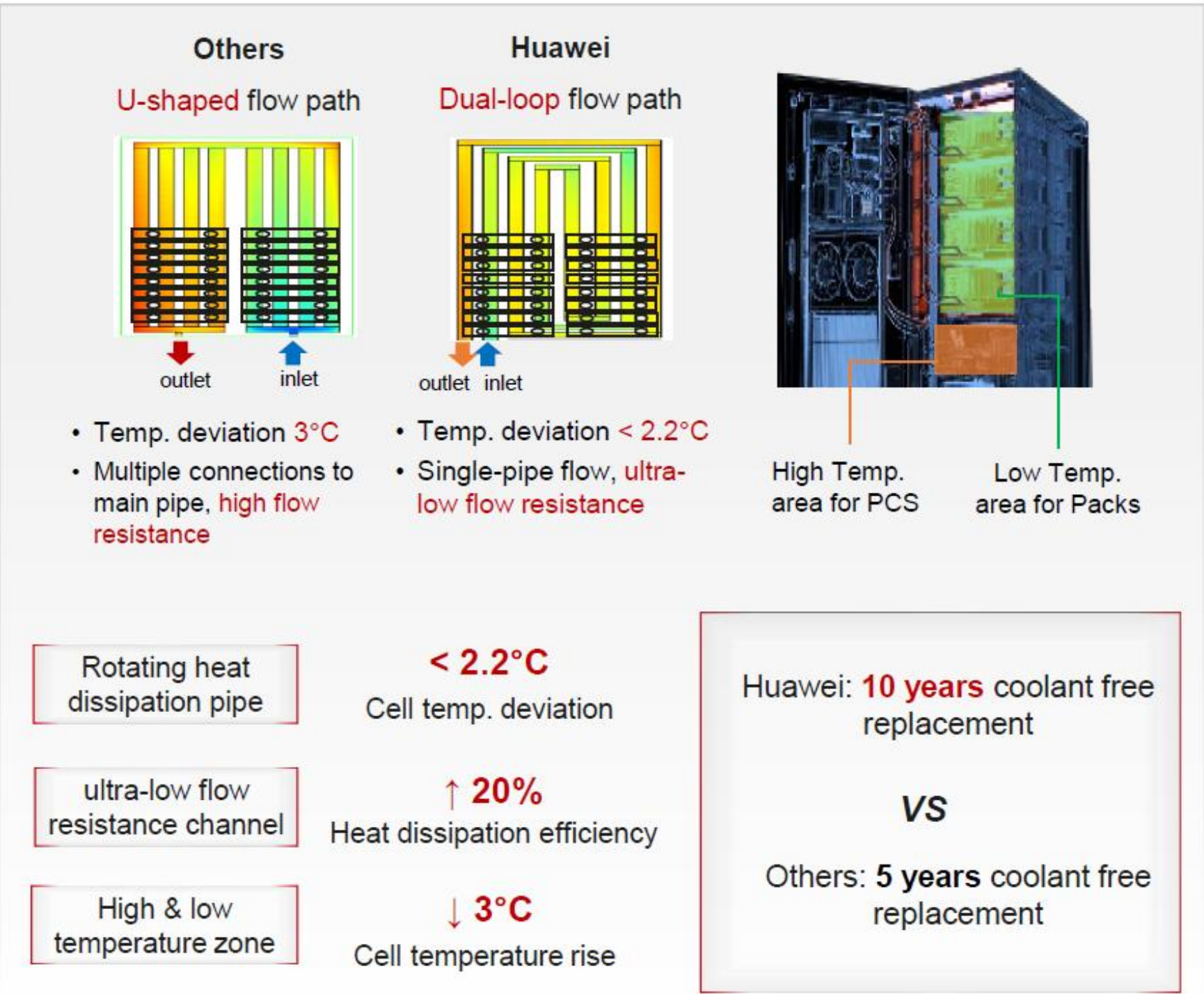
405.9

Optimizer Disabled

Optimizer Enabled

Unique Heat Dissipation Design, 5% higher SOH

Unique heat dissipation design, Longer Lifespan



5% high SOH improve Revenue by \$4K/100kWh in a decade



One Fits All: Smart PVMS Provides One Stop and Full Lifecycle Smart Management

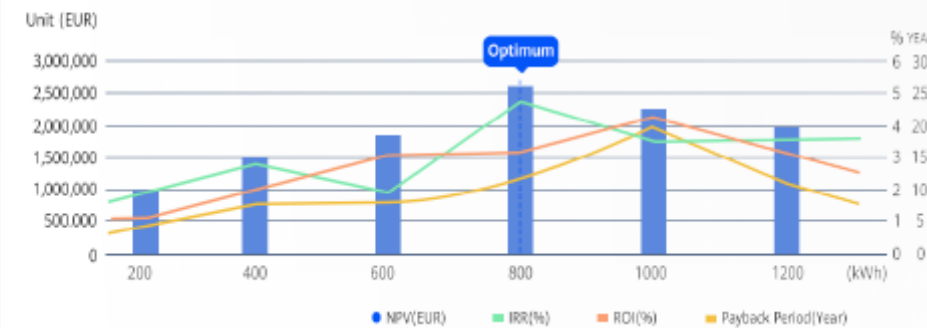
Planning

SmartDesign tool, one stop design

Automatic capacity design. Accurate benefits evaluation

ESS Capacity Benefit Comparison

Optimal ESS Capacity: 600 kWh (NPV 2,100,000 CNY ,IRR 4.5% , ROI 3.5 % , Payback Period 14 years)



<10 Mins

Design duration

Maintenance

SmartPVMS, smart management

Automatic SOC calibration, precise fault location



SOC automatic calibration,
enabled by pack optimizer



health analysis, consistency
analysis of cell, SOC/SOH

50%

Reduce O&M cost by
\$5k+/cabinet

80%

Fault location efficiency

Operation

Smart multi-mode management

Automatic energy management w/o manual setting
Smart optimization, maximizing benefits



PV and load prediction, 24h precision > 90%
Multi-model dynamic optimized by AI algorithm

10%

Increase Revenue

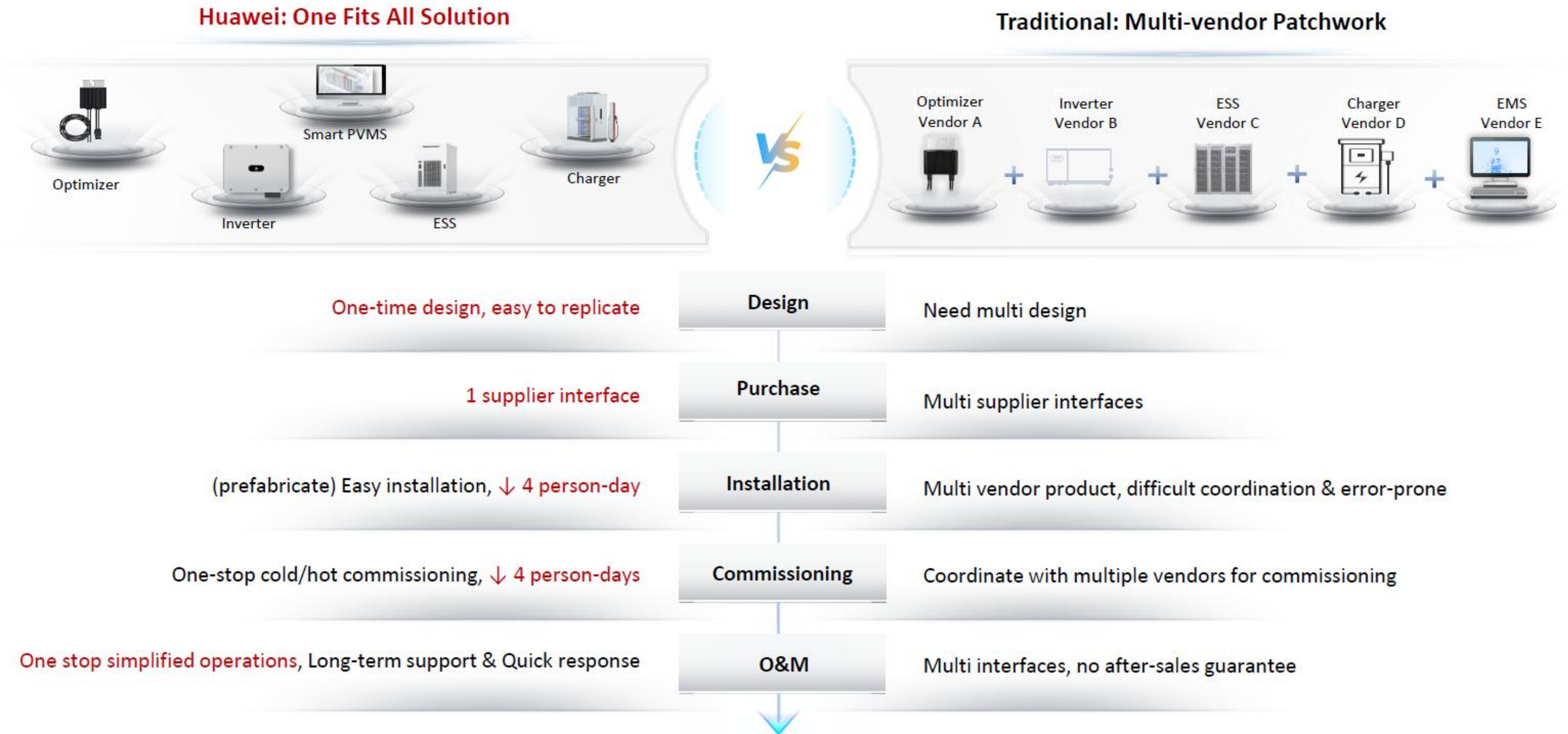
0.5 Year

ROI shorten time

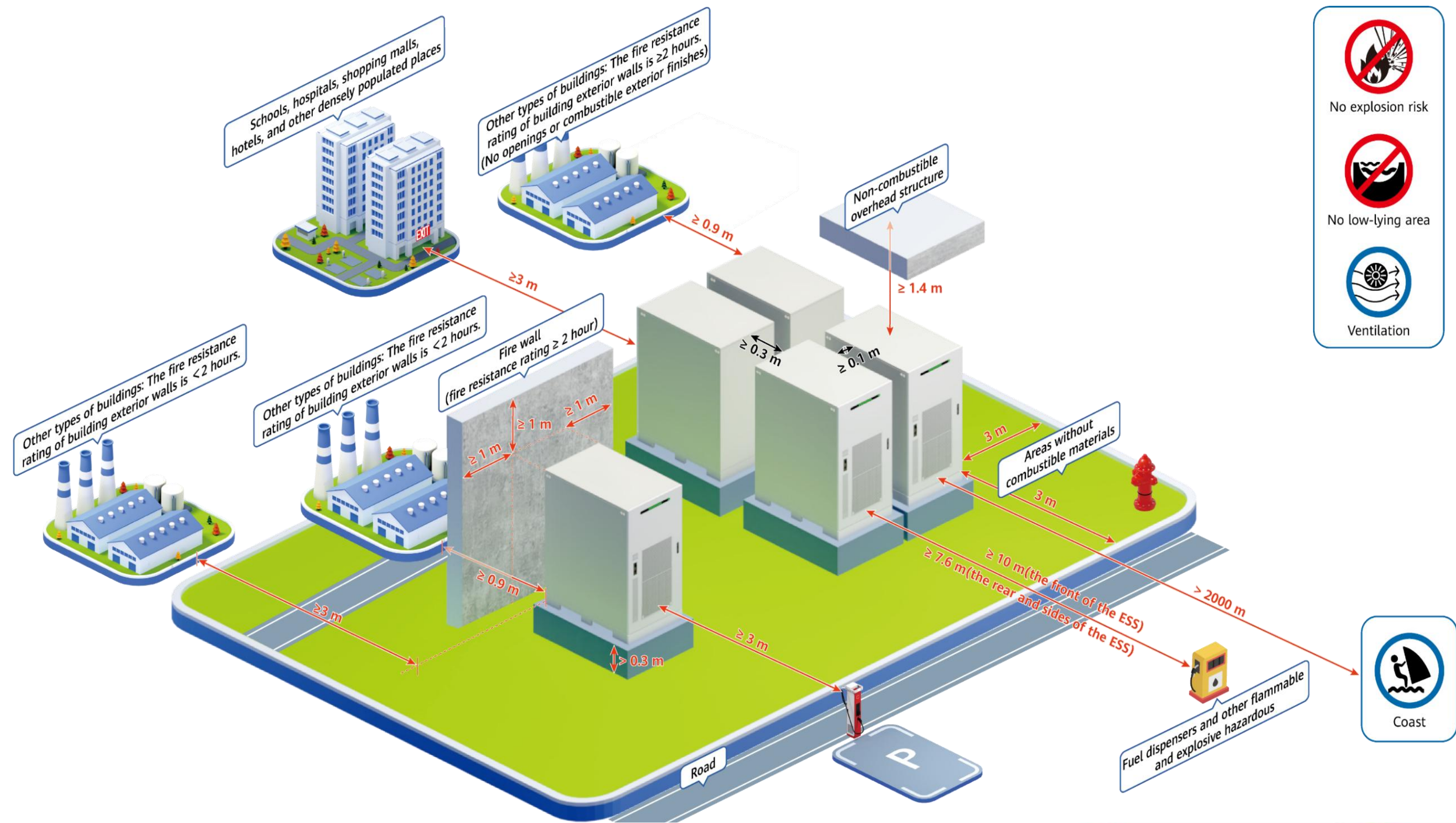
Available in 2025Q1



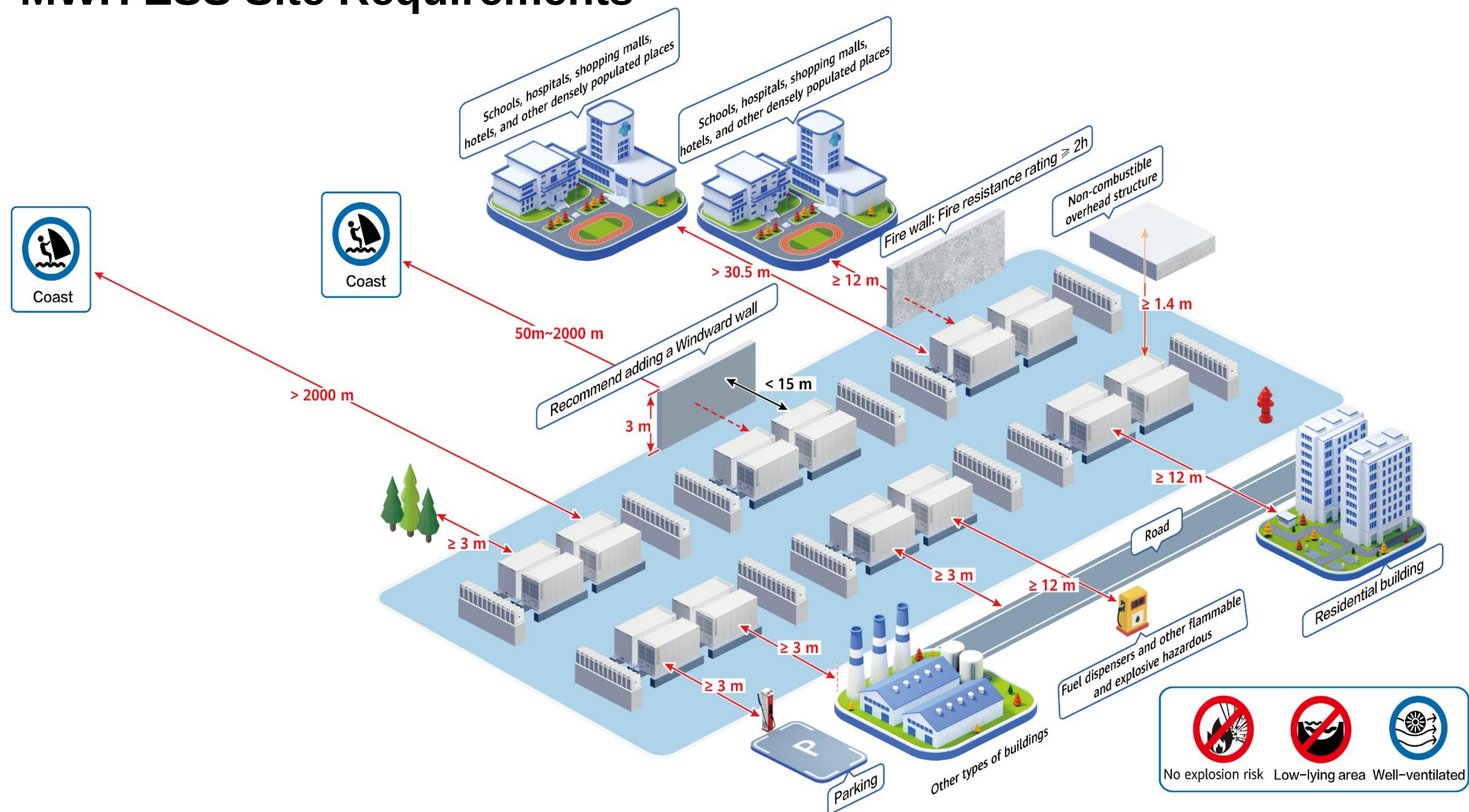
One Fits All: Easy to Design, Purchase, Install, Commission and Maintain



241kWh ESS Site Requirements



MWH ESS Site Requirements



Load Capability (Fixed Capacity Constraint) -General Constraints in all Scenarios

- ① When planning the installed capacity of the ESS, ensure that the total load capacity **does not exceed 2/3 of the rated capacity of the PCS**. (Note: The load of each phase cannot exceed 2/3 of the rated capacity of a single phase, that is, the load of each phase $< 2/3 \times P_n \times 1/3$.) Reserve certain capacity for redundancy, supporting stable on/off-grid operation. In addition, the configuration constraints of non-linear loads and impact loads shall be met. For details about the capacity configuration with load constraints, see this section.
- ② Note: When designing the capacity, consider the capacity constraints and protection settings of the customer's distribution transformer. **If there are asynchronous loads** and common non-surge loads in the system, consider the following when configuring the capacity: **$PCS \text{ total rated capacity} > A * 10 + B/(2/3)$** , where A indicates asynchronous loads and B indicates other common loads.

Category	Constraint	Remarks
Linear load	The ESS PCS supports rated linear loads (R, RL, and RC loads, PF = [-0.8 to 0.8]). Considering transient stability issues such as load fluctuation and fault ride-through, the steady-state peak value of the load capacity shall not exceed 2/3 of the rated capacity of the PCS . (Note: The load of each phase cannot exceed 2/3 of the rated capacity of a single phase, that is, the load of each phase $< 2/3 \times P_n \times 1/3$.) For off-grid scenarios involving remote power supply, the capacitive/inductive loads of the transmission cables shall be considered as part of the loads, which adhere to the 2/3 constraint.	The PCS is an electronic device. Generally, the overcurrent capability of the PCS is very weak. The nominal rated capability is almost the same as the maximum capability. During load configuration, capacity redundancy of the PCS shall be reserved for transient HVRT/LVRT faults, inrush current due to load connection, and inrush current due to transformer switch-on. Otherwise, the PCS may lack sufficient current capability to stabilize the AC side when the microgrid fluctuates transiently. In this case, the risk of triggering PCS overcurrent protection is high, and it is difficult to restore the PCS in the future.
Non-linear loads	1. Crest factor: The PCS with a transformer supports non-linear loads. The crest factor of non-linear loads is less than or equal to 2. 2. Harmonics: The total harmonic distortion (THD) of the load current shall meet the specified standards or requirements. If it exceeds the standards, harmonics mitigation for the loads shall be performed first. 3. Half-wave loads: For half-wave loads, the total even harmonic distortion shall be $< 5\%$.	Common load devices include the VFD, rectifier, switch power supply, and UPS.
Imbalanced loads	Under the constraint of the system load rate, the PCS can run for a long time with imbalanced resistive loads in a stable state, including: (1) One phase at 2/3 capacity, with the other two phases unloaded. (2) Two phases at 2/3 capacity, with one phase unloaded. Note: The single-phase rated capacity is 1/3 of the PCS rated capacity.	Three-phase imbalance: The load currents of the three phases are different. If the difference is large, the power distribution device may be overheated and the cable loss may increase. In the low-voltage power distribution network, there are a large number of single-phase loads. Therefore, the loads shall be evenly distributed to the three phases during power distribution. Common formula for calculating the imbalance: (Maximum phase current – Minimum phase current)/Maximum phase current
Motor loads	If there is a motor load, check whether the motor load meets the loading capability requirements. (1) The load of motors that use DOL starters or star-delta starters (the maximum inrush current is 10 times the rated current) shall not exceed 10% of the PCS rated power . (If the load exceeds 10% of the PCS rated power, you are advised to add VFDs.) If the PCS supplies power to load, the load of motors shall be decreased accordingly in the same proportion. If the motor load is 10 kW and other loads are 40 kW, the capacity of PCS shall be greater than 159.7 kW ($10 \text{ kW} \times 10 + 40 \text{ kW}/0.67 = 159.7 \text{ kW}$). (2) For variable-frequency motor loads, the load power cannot exceed 2/3 of the rated power of the PCS. (3) When asynchronous loads are connected in off-grid mode, oscillation issues may arise. These can typically be resolved by enabling default parameter settings through the interface. However, in rare cases where the default control parameters are insufficient to suppress oscillation, professional maintenance personnel may be required to locate the fault and adjust the parameters for suppression. (To date, over 400 units of the N-generation have been deployed, with only two instances of oscillation reported. These were resolved by increasing virtual impedance. The N+1 generation has enhanced capabilities beyond the N-generation's method of increasing virtual impedance.)	 Oscillations are likely to occur in factory, mine, and farm scenarios. Common symptoms of motor load oscillation during off-grid operation are as follows: 1. Asynchronous loads within the specifications fail to be started. 2. When the asynchronous loads are running, they produce abnormal sounds and the enclosures may exhibit noticeable shaking. 3. The lights flicker.
Connection of transformers	The instantaneous peak current (basic current plus inrush current) upon all load connection shall not exceed 1.1 times of the PCS rated current. Transformer Constraints on load transformer connection: Supports the connection of a transformer whose capacity does not exceed 50% of the total operating capacity of the PCS. Transformer on the load side: When the power of the transformer on the load side is greater than or equal to 50% of the rated power of the PCS, the switch on the PCS side of the transformer shall be always turned on.	When a transformer is connected, there is a possibility that the PCS shuts down for protection. In this case, check whether the PCS is normal. If the PCS is normal, restart the PCS. Suggestion: The transformer starts with the PCS black start to prevent overcurrent protection caused by direct transformer connection.

C&I Hybrid Cooling Grid Forming ESS safety constraints

No.	Item	Detailed Constraint (Applicable to C&I ESS products, including the LUNA2000-215/241 series and derivative models)	Safety Level
Site Selection Requirements	Compliance with local standards	The ESS site selection and installation shall comply with local ESS standards and fire protection regulations or standards.	I
	Deployment space	The ESS applies only to outdoor scenarios and must not be deployed indoors . An indoor scenario is an enclosed space surrounded by walls, floors, and ceilings, which is isolated from the outdoor natural space.	I
	Distance from hazardous chemicals	The distance between the front of the ESS and flammable and explosive hazardous sources such as fuel dispensers, oil tanks, gas tanks, and hydrogen dispensers shall be ≥ 10 m . The distances between the rear and sides of the ESS and flammable and explosive hazardous sources such as fuel dispensers, oil tanks, gas tanks, and hydrogen dispensers shall be ≥ 7.6 m .	I
	Vegetation and flammables	There shall be no vegetation or flammables within 3 m of the ESS or the ESS site. Single specimens of flammables (such as green grass, ivy, succulent plants, trees, shrubs, or cultivated ground cover) shall be exempt, provided that they do not form a means of readily transmitting fire.	I
	Overhead structure	If an overhead structure is necessary above the top of the ESS, the following conditions must be met: 1. The distance between the overhead structure and the top of the ESS shall be ≥ 1.4 m . 2. The overhead structure shall be non-combustible .	I
	Distance from densely populated buildings	The ESS shall be ≥ 3 m away from key positions such as main entrances and fresh air systems in densely populated places such as schools, hospitals, hotels, and shopping malls. The distance must not be shortened by using a fire wall. For non-key positions, refer to the clearance requirements for other types of buildings. Note: Densely populated places: outpatient buildings and wards of hospitals, teaching buildings, libraries, canteens, and dormitories of schools, nursing homes, welfare homes, nurseries, kindergartens, reading rooms of public libraries, public exhibition halls, museum exhibition halls, production workshops and dormitories of labor-intensive enterprises, tourist attractions, and religious places	II
	Clearance requirements for other types of buildings	If the building walls do not meet the 2-hour fire resistance requirement: 1. The ESS shall be ≥ 3 m away from buildings, public roads, and parking spots. 2. If a 2-hour fire-resistant fire wall is added between the ESS and the buildings, the ESS shall be ≥ 0.9 m away from the buildings, public roads, and parking spots. If the building walls meet the 2-hour fire resistance requirement: 1. If the walls are free of openings or combustible exterior decoration , the ESS shall be ≥ 0.9 m away from the buildings. 2. If the walls have openings or combustible exterior decoration : 2.1. If the ESS is ≥ 3 m away from the openings or combustible exterior decoration, the ESS shall be ≥ 0.9 m away from the buildings. 2.2. If the ESS is < 3 m away from the openings or combustible exterior decoration, the ESS shall be ≥ 3 m away from the buildings. If a 2-hour fire-resistant fire wall is added between the ESS and the buildings, the ESS shall be ≥ 0.9 m away from the buildings.	II
	Fire wall requirements	The fire walls shall have a 2-hour or higher fire resistance rating and shall extend 1 m above and 1 m beyond the physical boundary of the ESS. Examples of 2-hour fire resistance rating: concrete walls, reinforced concrete solid walls, silicate walls, and clay brick walls with a thickness of ≥ 120 mm	II
	Coastal requirements	For all projects within 2000 m away from the coast, check the corrosion level of the place where the project is located. ➤ For projects with corrosion levels C1 to C4, ESSs can be deployed properly. ➤ For projects with corrosion level C4.5 or C5, refer to the <i>C&I Hybrid Cooling Grid Forming ESS C4.5/C5 Environment Application Description</i> . ➤ For projects with corrosion level C5.5 or CX, do not sell ESSs.	II
	Fire access	Transportation to the site shall be convenient, with fire engines able to reach it via surrounding roads.	III
	Fences and walls	Outdoor open electrochemical energy storage plants shall be equipped with fences and walls.	III

The R&D department will update the document as required based on the energy storage industry progress and related research results. **Class I requirements are mandatory and non-negotiable. Class II requirements require decision-making if unmet. Class III requirements are recommended.**

All ESS products shall be installed outdoors. Rooftop, indoor, or semi-indoor installations require safety review by the joint sub-DRB.

C&I Hybrid Cooling Grid Forming ESS safety constraints

Classifieds	Subitem	Detailed Constraints										
Foundation Requirements	load bearing	The cabinet installation dimensions and load-bearing capacity requirements are met.										
	draining	Meet the local historical maximum rainfall drainage requirements.										
	heights	The foundation must be higher than the local historical maximum water level and at least 300 mm above the level ground.										
	flattened	The horizontal error of the contact surface between the equipment foundation and the cabinet is <=3 mm .										
Other requirements	Storage charging	You are advised to use the ESS in a timely manner. If the ESS is stored for a long time or is not running, recharge the power periodically. Otherwise, the ESS may be damaged. The following table lists the maximum charge intervals. Charge the ESS promptly and calibrate the SOC to 50%. <table><tr><th>Storage Temperature (T)</th><th>Maximum Charge Interval^a</th></tr><tr><td>–35°C ≤ T ≤ +30°C</td><td>15 months</td></tr><tr><td>30°C < T ≤ 40°C</td><td>11 months</td></tr><tr><td>40°C < T ≤ 60°C</td><td>7 months</td></tr><tr><td colspan="2">Note a: - The interval starts from the latest charge time labeled on the ESS packaging. - This table lists the charging intervals when the SOC is 50%. </td></tr></table>	Storage Temperature (T)	Maximum Charge Interval ^a	–35°C ≤ T ≤ +30°C	15 months	30°C < T ≤ 40°C	11 months	40°C < T ≤ 60°C	7 months	Note a: - The interval starts from the latest charge time labeled on the ESS packaging. - This table lists the charging intervals when the SOC is 50%.	
	Storage Temperature (T)	Maximum Charge Interval ^a										
	–35°C ≤ T ≤ +30°C	15 months										
	30°C < T ≤ 40°C	11 months										
40°C < T ≤ 60°C	7 months											
Note a: - The interval starts from the latest charge time labeled on the ESS packaging. - This table lists the charging intervals when the SOC is 50%.												
Insulation protection	Tools meet the insulation level and protection requirements.											
Commissioning	Fire Extinguishing Before Installation and Commissioning											
People	The personnel qualification meets the requirements of local laws and standards.											

4 Reasons for Choosing Huawei C&I Solutions



One fits all solution



Benefits



Active safety



No matter how small the probability is, a safety accident will happen!

Benefits



Choosing Huawei = Superior Safety + Reliability = Free insurance on product+solution

Higher reliability



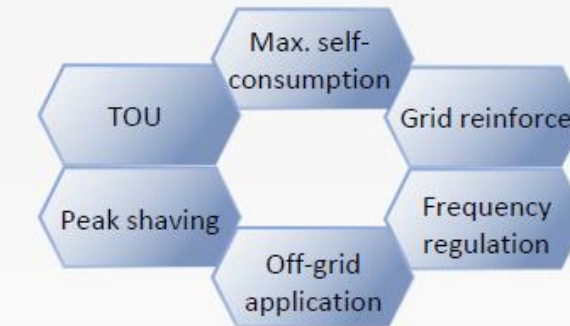
Unique 4 process: IPD, LTC, DS, ITR
(Integrated Project Delivery, Low Temp Conversion, Detailed Scheduling, Inspection Test Report)

Benefits



- Long-term reliable partners
- Less O&M, better brand reputation

Higher revenue



Smart mgmt. of multi business mode

Benefits



- The LCOE of PV ↓ 20%,
- The revenue of ESS ↑ \$60+/kWh.

C&I solution: active safety and innovative convergence, making PV+ESS+Charger ubiquitous



FusionSolar C&I Inverters - Maximum Power Model: 150KTL



SUN2000-15/17/20KTL-M2
(three-phase inverter)

MPPT/Input: 2/4

Local commissioning:

- Built-in WLAN

Communication:

- Smart Dongle-WLAN-FE (optional)
- Smart Dongle-4G (optional)
- SmartLogger3000A (optional)

Arc-fault circuit interrupter (AFCI): supported

PID recovery: SUN2000-12/15/17/20KTL-M2 supported

Optimizer: MERC-1100W/1500W-P supported

DI control port: supported



SUN2000-30/36/40KTL-M3
(three-phase inverter)

MPPT/Input: 4/8

Local commissioning:

- Built-in WLAN

Communication:

- Smart Dongle-WLAN-FE (optional)
- Smart Dongle-4G (optional)
- SmartLogger3000A (optional)

AFCI: supported

PID recovery: supported

Optimizer: supported

DI control port: supported



SUN2000-50KTL-M3
(three-phase inverter)

MPPT/Input: 4/8

Local commissioning:

- Built-in WLAN

Communication:

- Smart Dongle-WLAN-FE (optional)
- Smart Dongle-4G (optional)
- SmartLogger3000A (optional)

AFCI: supported

PID recovery: supported

Optimizer: supported

DI control port: supported



SUN2000-100/110KTL-M2
(three-phase inverter)

MPPT/Input: 10/20

Local commissioning:

- USB-Adapter2000 WLAN module

Communication:

- SmartLogger3000A (RS485/AC MBUS)
- Smart Dongle-4G (optional)

AFCI: only supported by some BOM numbers (AFCI models)

PID recovery: only supported by some BOM numbers (AFCI models)



SUN2000-150K-MG0/
SUN5000-150K-MB0
(three-phase inverter)

MPPT/Input: 7/21

Local commissioning:

- USB-Adapter2000 WLAN module

Communication:

- SmartLogger3000A (RS485/AC MBUS)
- Smart Dongle-4G (optional)

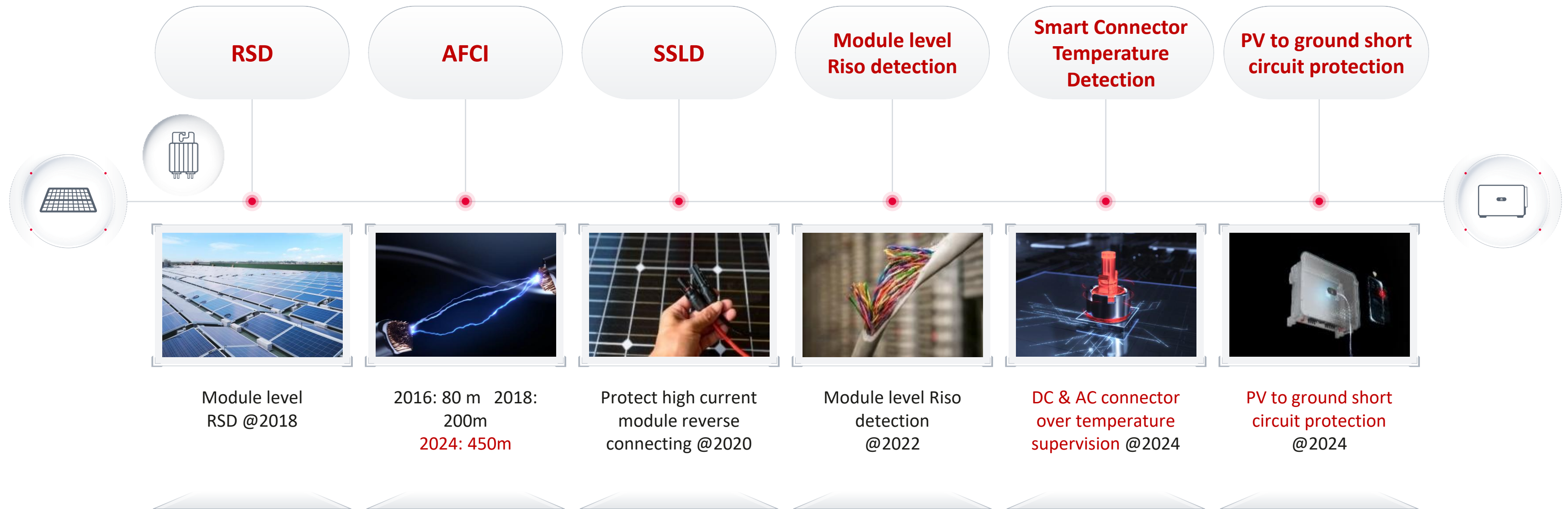
AFCI: supported

PID recovery: supported Optimizer:

SUN5000-150K-MB0 Mandatory
MERC-1100W/1500W-P

SUN2000-150K-MB0: Incompatible

Proactive Safety, E2E Safeguarding Personal and Property



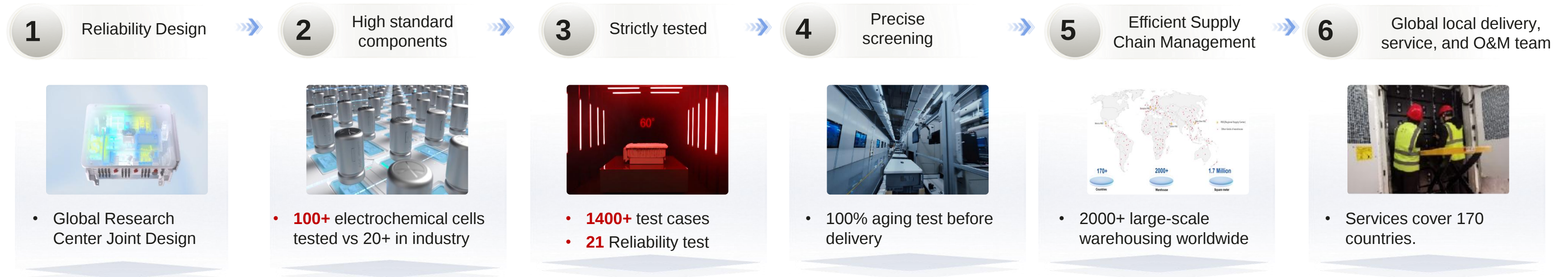
Electronic components upgrade & software algorithm enhancement

Long time reliability and quality insurance by Huawei's unique 4 processes

IPD Process

LTC Process

DS + ITR Process



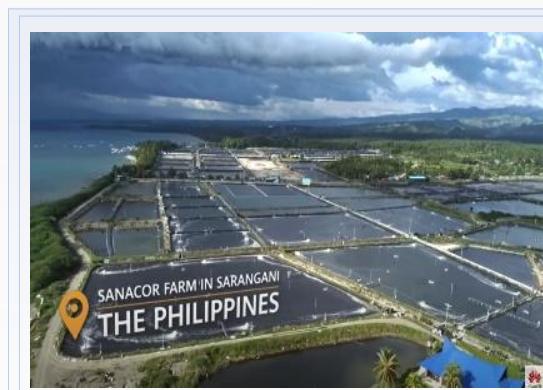
Global failure rate **< 0.5%** & availability **> 99.999%**



Off-grid power supply @ china
High altitude



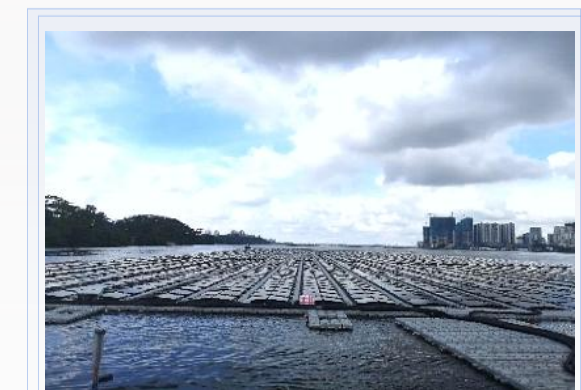
Qunli toll station @ northern china
-30°C, severe cold



Shrimp farming base @Philippines
High humidity and salty



25.8 MW PV plant @ UAE
High temperature



MW floating power station in Singapore
High humidity

Huawei C&I Solutions

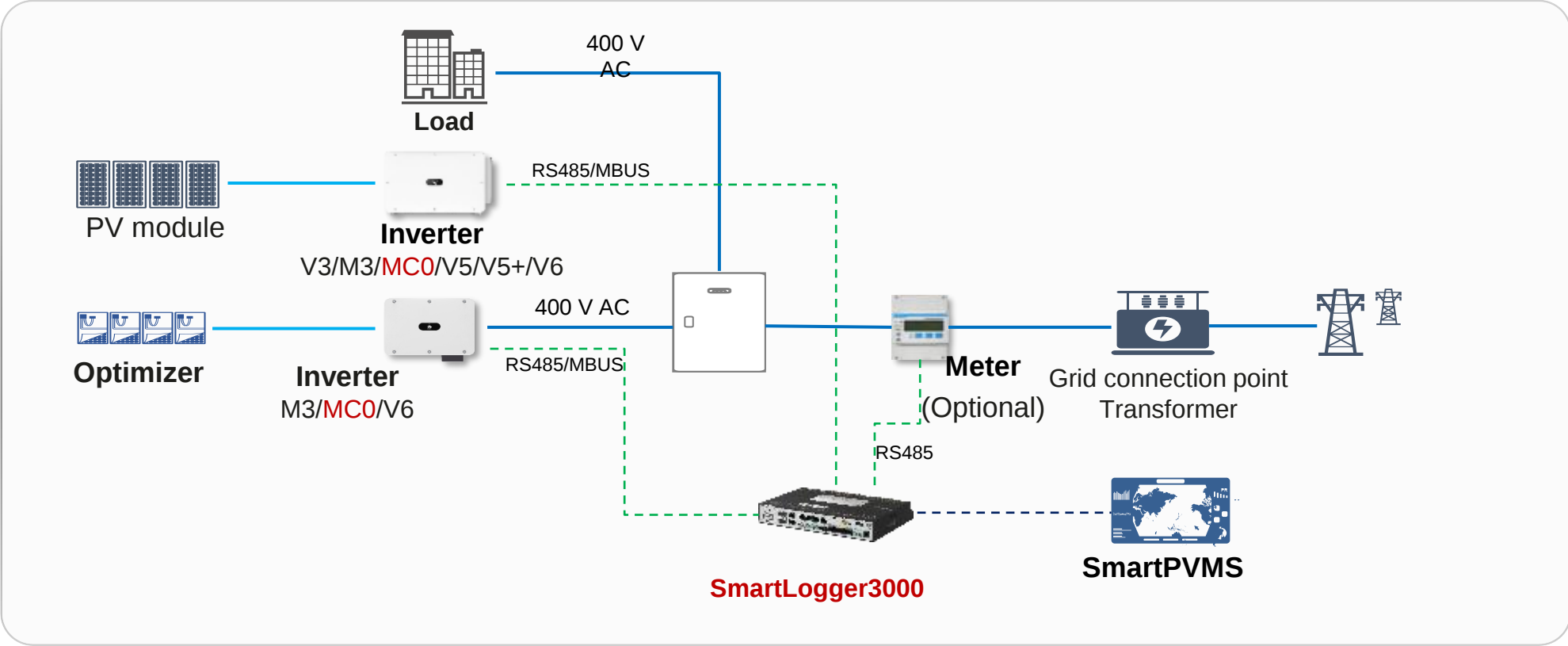


C&I Pro Solutions for LV Scenarios



On-grid PV-only Scenarios:

PV-only low-voltage on-grid (with SmartLogger)



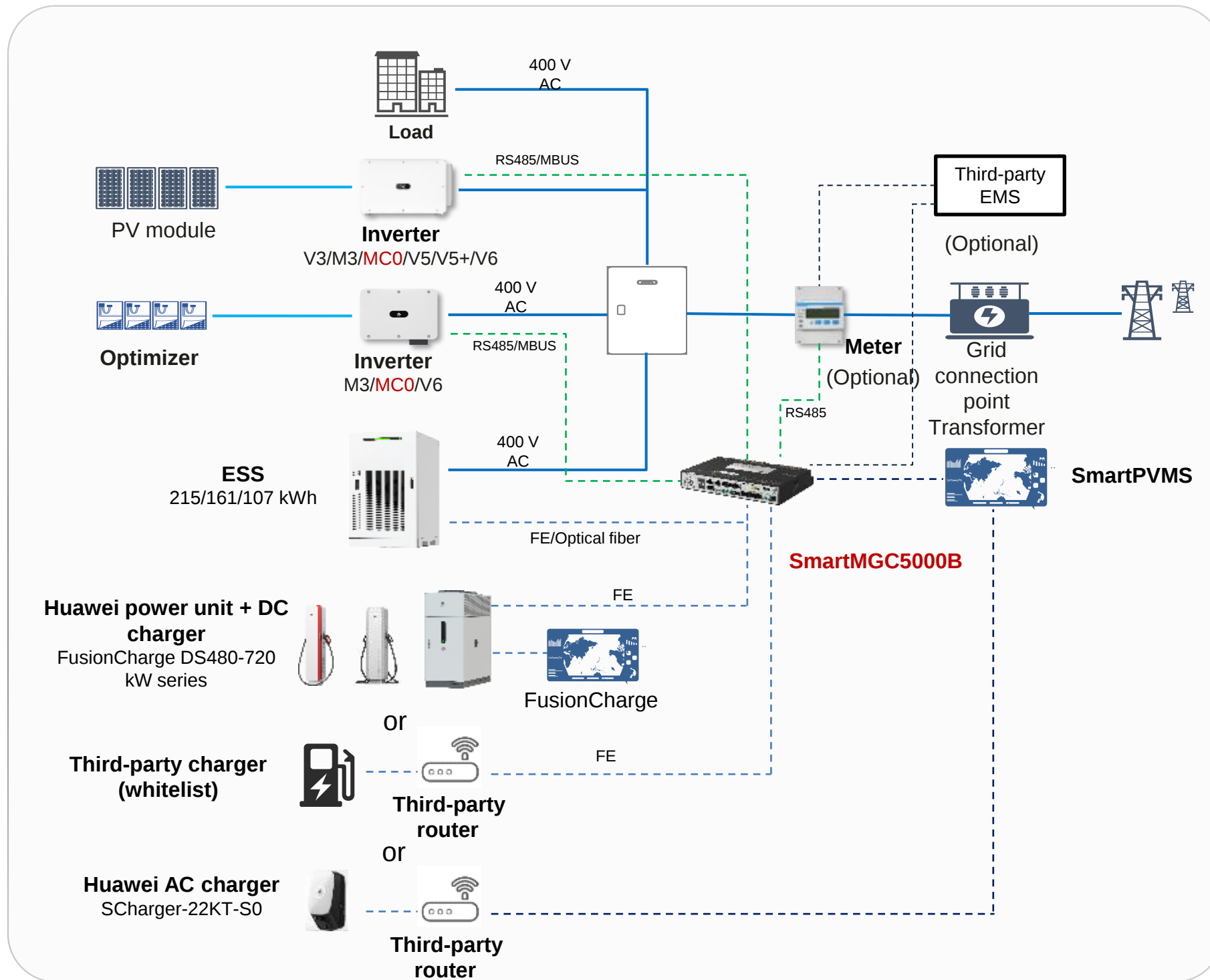
Main device configuration

Product	Model	Quantity	Remarks	Supplier	Remarks
Inverter	V3/M3/MC0/V5/V5+/V6	≤ 30	Mandatory	Huawei	
Optimizer	MERC-1100/1300-P	As required	Optional	Huawei	M3/MC0/V6, mandatory for the SUN5000 series
SmartLogger	SmartLogger3000	1	Mandatory	Huawei	
Meter	SmartPS-80AI-T0	1	Optional	Huawei	A meter is required for export control and FusionSolar monitoring
SmartPVMS	FusionSolar SmartPVMS	1	Mandatory	Huawei	

- Only single-grid connection point scheduling is supported.
- The SmartPS-80AI-T0 meter (BOM code: 20023002) includes two models: DTSU666-HW and YDS60-80.

On-grid Scenarios (215KWh+PV+Charger):

PV+ESS+Charger low-voltage on-grid (SmartMGC5000B)

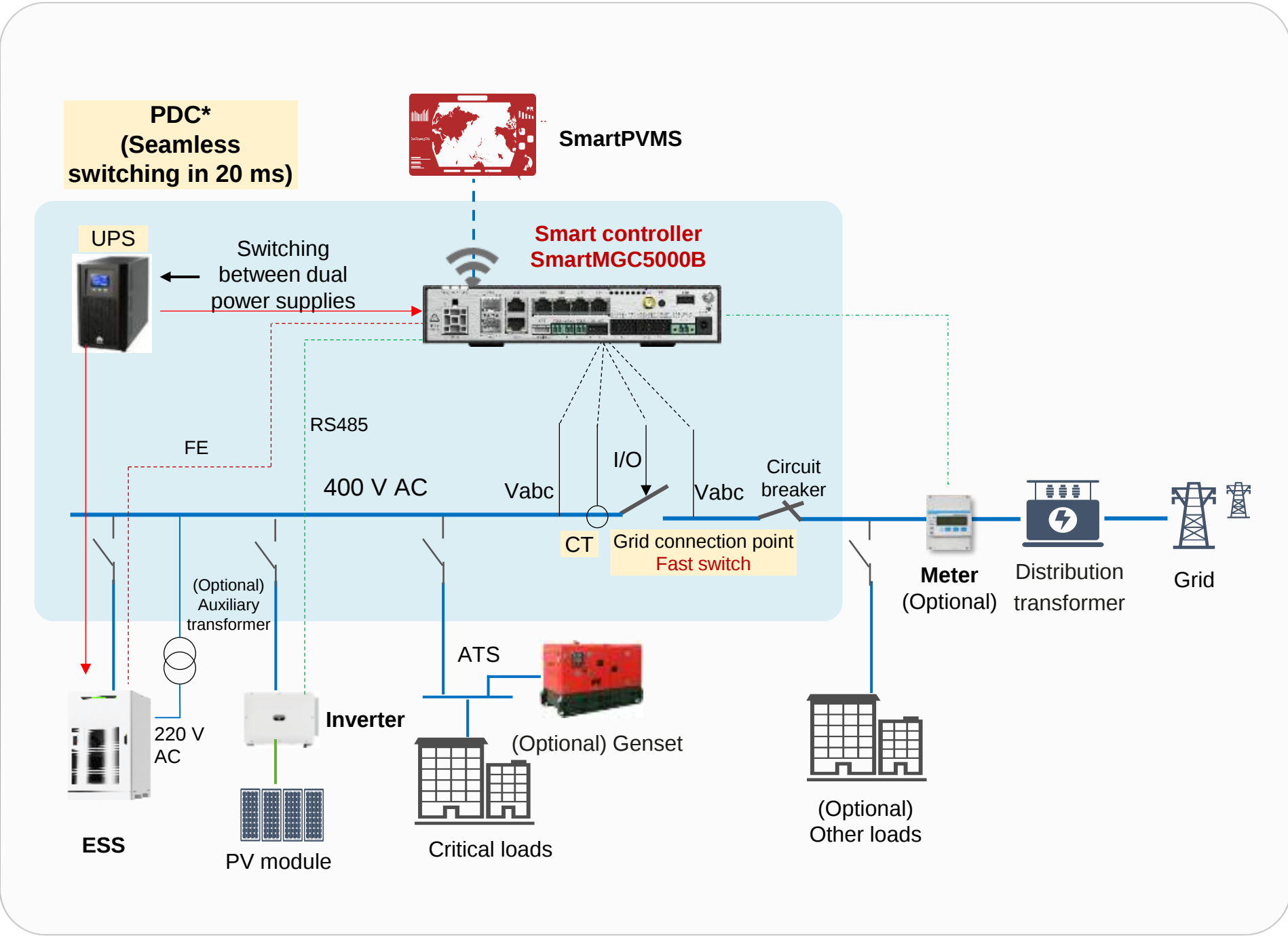


Product	Model	Quantity	Remarks	Supplier	Remarks
Inverter	V3/M3/MC0/V5/V5+/V6	≤ 40	Optional	Huawei	PV+ESS scenario
Optimizer	MERC-1100/1300-P	As required	Optional	Huawei	M3/MC0/V6
ESS	241/215/161/107 kWh	≤ 80@PV (40)+ESS(40) ≤ 50@ESS-only	Mandatory	Huawei	
Controller	SmartMGC5000B	1	Mandatory	Huawei	Supports a maximum of 50 ESSs.
Expansion module	SmartModule	1	Optional	Huawei	21–50 in ESS-only scenarios
Meter	SmartPS-80AI-T0	1	Optional	Huawei	If a V5 SmartMGC5000B is used, no meter is required (supported in Spain and Thailand after local certification).
SmartPVMS	FusionSolar SmartPVMS	1	Mandatory	Huawei	PV+ESS monitoring
Charger	Huawei DC charger: FusionCharge DS480-720 kW series	1 (power unit)	Optional	Huawei	The SmartPVMS implements monitoring but not control. The FusionCharge Charging Network is responsible for deployment and scheduling.
	Huawei AC charger: SCharger-22KT-S0	≤ 15	Optional	Huawei	Implements monitoring but not control and works with a third-party router.
	Third-party charger whitelist: MENNEKES (model: AMEDIO® Professional-22kW) and AMPERFIED GMBH (model: Connect.business-11kW)	≤ 15	Optional	Third party	Implements monitoring but not control and works with a third-party router.
Third-party EMS		1	Optional	Third party	

- Only **single transformer and single grid connection point** scheduling is supported. The V5 SmartMGC5000B is used to support BTM business models such as self-consumption, TOU, demand control, power distribution capacity expansion, and AI-based scheduling.
- A third-party EMS is required. BTM business models such as peak shaving, frequency regulation, and electricity transaction are supported. The supported business models depend on the third-party EMS capability.
- The SmartPS-80AI-T0 meter (BOM code: 20023002) includes two models: DTSU666-HW and YDS60-80.

Seamless On/Off-grid Switching (20 ms):

System networking diagram



*For details about the electrical networking diagram of the PDC, see the C&I Hybrid Cooling Grid Forming ESS Solution User Manual (Microgrid, SmartMGC5000B)
<https://support.huawei.com/enterprise/en/doc/EDOC1100504417>

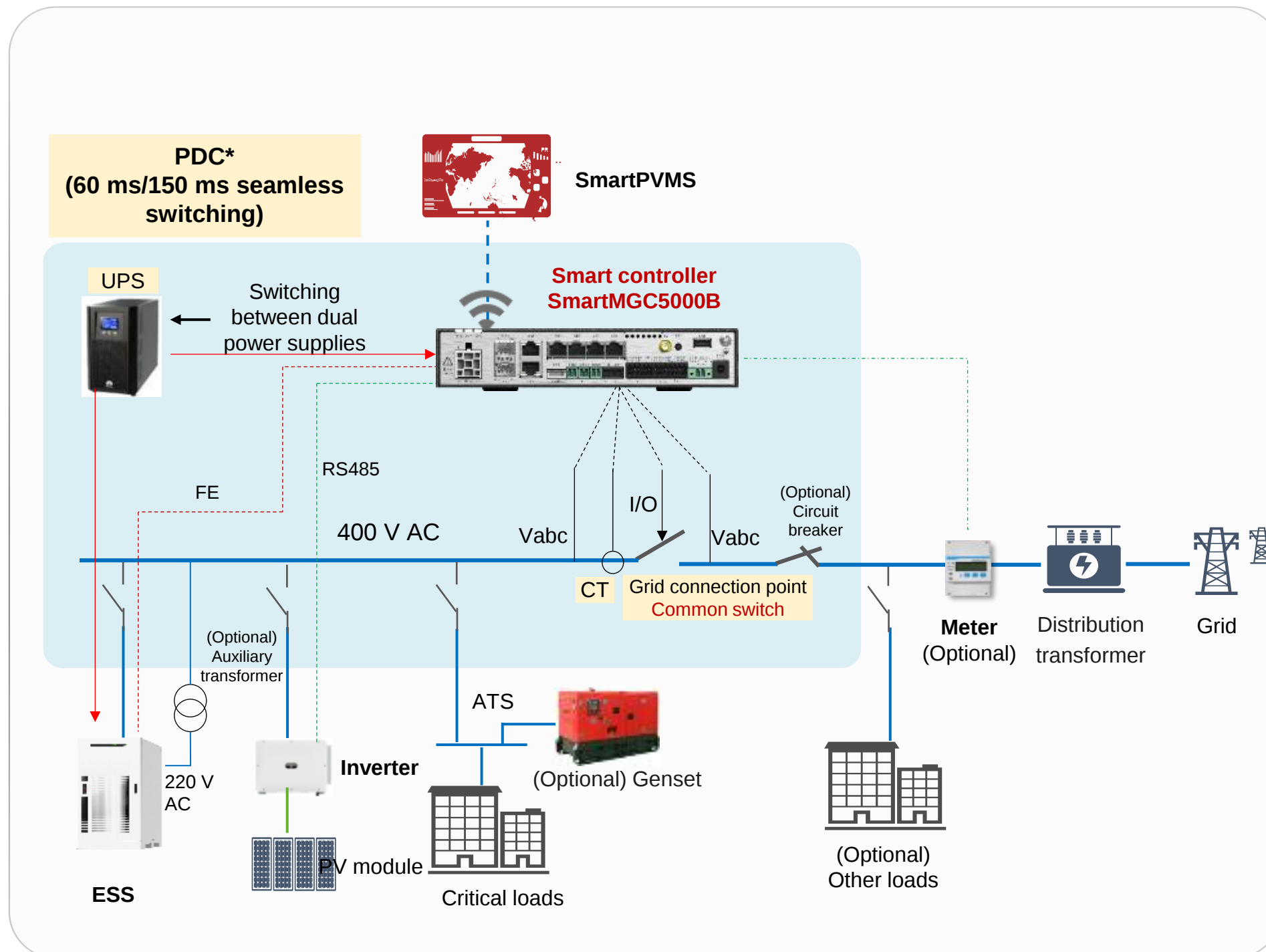
Main device configuration

Product		Model	Quantity	Remarks	Supplier	Remarks
Inverter		M3/MC0/V5/V5+/V6	≤ 30	Optional	Huawei	PV+ESS scenario
Optimizer		MERC-1100/1300-P	As required	Optional	Huawei	M3/MC0/V6
ESS		241/215/161/107 kWh	See the remark	Mandatory	Huawei	The number of ESSs is limited by the fast switch specifications. Currently, the tested fast switch (1000 A) supports a maximum of 4pcs ESSs @0.5C, 8pcs ESSs @0.25C, and 12pcs ESSs @0.125C
SmartPVMS		FusionSolar SmartPVMS	1	Mandatory	Huawei	
PDC (20 ms seamless switching)	Controller	SmartMGC5000B	1	Mandatory	Huawei	
	Meter	SmartPS-80AI-T0	1	Optional	Huawei	The meter at the grid connection point is mandatory when loads and external common loads need to be distinguished.
	CT	The current on the secondary side of the CT is 5 A. The minimum required CT accuracy class is 0.5S.	3	Mandatory	Third party	Purchased by the customer
	Fast switch	DC DO control, switch-off (including arc extinguishing) time < 15 ms	1	Mandatory	Third party	Purchased by the customer
	Circuit breaker	The fast switch does not have the short-circuit current breaking capability and shall be used with a circuit breaker. Select a circuit breaker model according to the power distribution specifications and short-circuit current.	1	Mandatory	Third party	Purchased by the customer
	UPS	1. Power > 1 kVA, online UPS, 220 V 2. The backup time is greater than or equal to 1 hour. (If the system is off-grid for a long time, the UPS backup time is greater than 48 hours.) 3. To ensure reliable power supply to the UPS, the UPS power supply shall be provided from either side of the on/off-grid switch, whichever side is available. The UPS power supply is controlled by the relay.	1	Mandatory	Third party	Purchased by the customer
	Auxiliary transformer	• Auxiliary transformer that converts the grid voltage of > 415 V to 220 V • Transformer capacity: 5 kVA x N (quantity of ESSs)	1	Optional	Third party	Purchased by the customer
	ATS	Used with gensets to implement the switching between gensets and ESSs.	1	Optional	Third party	Purchased by the customer
	Cabinet	The PDC must have sufficient space for installing the SmartMGC, meter, CT, and UPS. The cables from the inverter and ESS to the PDC shall be at least 5 m long.	1	Mandatory	Third party	Purchased by the customer
	Genset	The genset is not controlled. The genset is connected through the ATS on the load side.	/	Optional	Third party	Purchased by the customer

- Only single access point and single grid connection point scheduling is supported. The V5 SmartMGC5000B in on-grid mode supports BTM business models such as self-consumption, TOU, demand control, power distribution capacity expansion, and AI-based scheduling. Third-party EMS scheduling is not supported.
- The SmartPS-80AI-T0 meter (BOM code: 20023002) includes two models: DTSU666-HW and YDS60-80.

Seamless On/Off-grid Switching (60 ms/150 ms):

System networking diagram



Main device configuration

Product		Model	Quantity	Remarks	Supplier	Remarks
Inverter		M3/MC0/V5/V5+/V6	≤ 40	Optional	Huawei	PV+ESS scenario
Optimizer		MERC-1100/1300-P	As required	Optional	Huawei	M3/MC0/V6
ESS		241/215/161/107 kWh	≤ 40	Mandatory	Huawei	
SmartPVMS		FusionSolar SmartPVMS	1	Mandatory	Huawei	
PDC (60 ms/150 ms seamless switching)	Controller	SmartMGC5000B	1	Mandatory	Huawei	
	Meter	SmartPS-80AI-T0	1	Optional	Huawei	The meter at the grid connection point is mandatory when loads and external common loads need to be distinguished.
	CT	The current on the secondary side of the CT is 5 A. The minimum required CT accuracy class is 0.5S.	3	Mandatory	Third party	Purchased by the customer
	Common switch	ACB or MCCB+operation mechanism; switching in 60 ms, switch-off time (including arc extinguishing) < 35 ms; switching in 150 ms, switch-off time (including arc extinguishing) < 80 ms	1	Mandatory	Third party	Purchased by the customer
	UPS	1. Power > 1 kVA, online UPS, 220 V 2. The backup time is greater than or equal to 1 hour. (If the system is off-grid for a long time, the UPS backup time is greater than 48 hours.) 3. To ensure reliable power supply to the UPS, the UPS power supply shall be provided from either side of the on/off-grid switch, whichever side is available. The UPS power supply is controlled by the relay.	1	Mandatory	Third party	Purchased by the customer
	Auxiliary transformer	- Auxiliary transformer that converts the grid voltage of > 415 V to 220 V - Transformer capacity: 5 kVA x N (quantity of ESSs)	1	Optional	Third party	Purchased by the customer
	ATS	Used with gensets to implement the switching between gensets and ESSs.	1	Optional	Third party	Purchased by the customer
	Cabinet	The PDC must have sufficient space for installing the SmartMGC, meter, CT, and UPS. The cables from the inverter and ESS to the PDC shall be at least 5 m long.	1	Mandatory	Third party	Purchased by the customer
Genset		The genset is not controlled. The genset is connected through the ATS on the load side.	/	Optional	Third party	Purchased by the customer

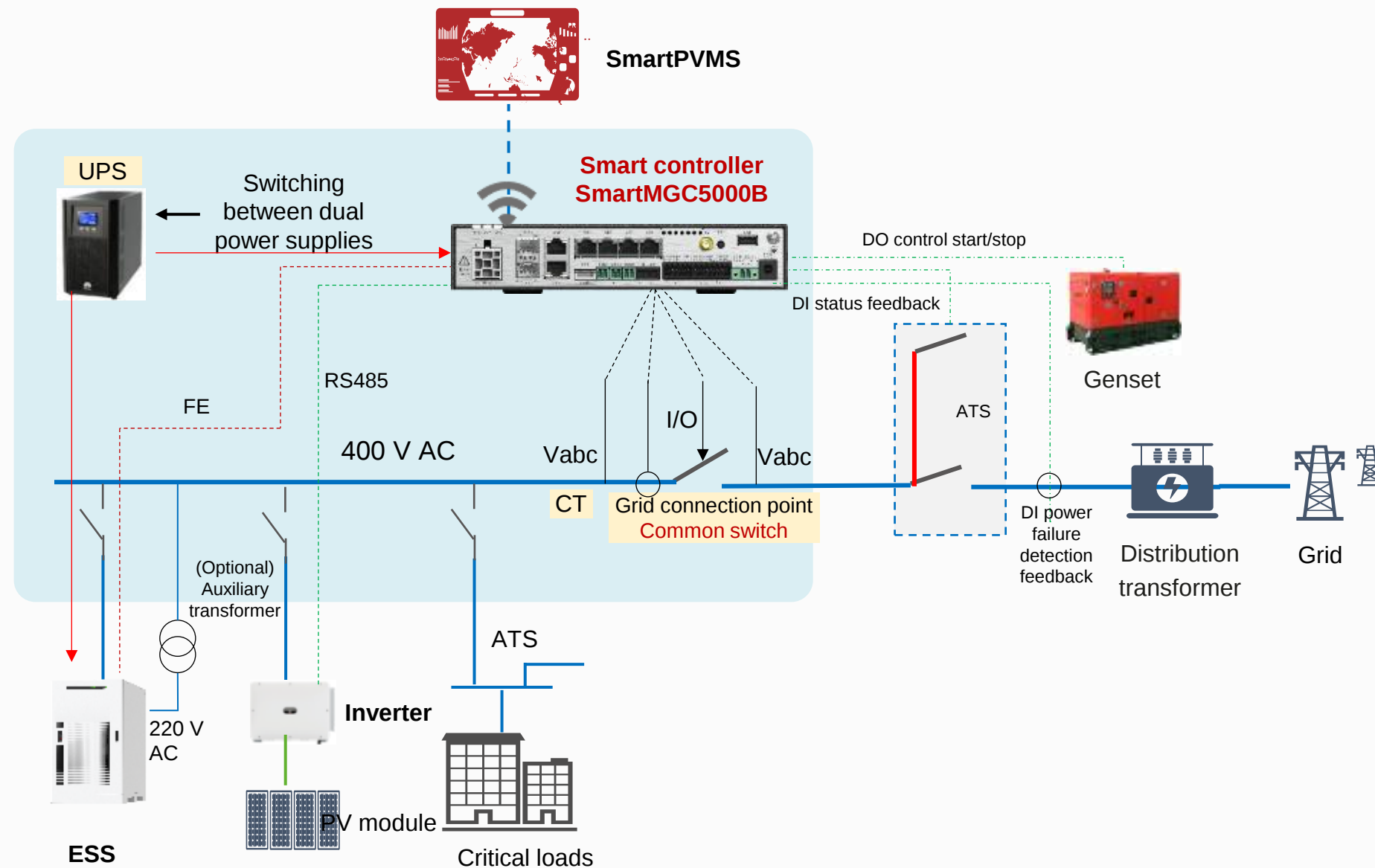
- Only **single access point** and **single grid connection point** scheduling is supported. The V5 SmartMGC5000B in on-grid mode supports BTM business models such as self-consumption, TOU, demand control, power distribution capacity expansion, and AI-based scheduling. Third-party EMS scheduling is not supported.
- The SmartPS-80AI-T0 meter (BOM code: 20023002) includes two models: DTSU666-HW and YDS60-80.

*For details about the electrical networking diagram of the PDC, see the C&I Hybrid Cooling Grid Forming ESS Solution User Manual (Microgrid, SmartMGC5000B)
<https://support.huawei.com/enterprise/en/doc/EDOC1100504417>

Seamless On/Off-grid Switching (PV+ESS+Genset parallel):

Main device configuration

System networking diagram



*For details about the electrical networking diagram of the PDC, see the C&I Hybrid Cooling Grid Forming ESS Solution User Manual (Microgrid, SmartMGC5000B)

<https://support.huawei.com/enterprise/en/doc/EDOC1100504417>

Product		Model	Quantity	Remarks	Supplier	Remarks
Inverter		M3/MC0/V5/V5+/V6	≤ 40	Optional	Huawei	PV+ESS scenario
Optimizer		MERC-1100/1300-P	As required	Optional	Huawei	M3/MC0/V6
ESS		241/215/161/107 kWh	≤ 40	Mandatory	Huawei	
SmartPVMS		FusionSolar SmartPVMS	1	Mandatory	Huawei	
PDC (60 ms/150 ms seamless switching)	Controller	SmartMGC5000B	1	Mandatory	Huawei	
	Meter	SmartPS-80AI-T0	1	Optional	Huawei	The meter at the grid connection point is mandatory when loads and external common loads need to be distinguished.
	CT	The current on the secondary side of the CT is 5 A. The minimum required CT accuracy class is 0.5S.	3	Mandatory	Third party	Purchased by the customer
	Common switch	ACB or MCCB+operation mechanism; switching in 60 ms, switch-off time (including arc extinguishing) < 35 ms; switching in 150 ms, switch-off time (including arc extinguishing) < 80 ms	1	Mandatory	Third party	Purchased by the customer
	UPS	1. Power > 1 kVA, online UPS, 220 V 2. The backup time is greater than or equal to 1 hour. (If the system is off-grid for a long time, the UPS backup time is greater than 48 hours.) 3. To ensure reliable power supply to the UPS, the UPS power supply shall be provided from either side of the on/off-grid switch, whichever side is available. The UPS power supply is controlled by the relay.	1	Mandatory	Third party	Purchased by the customer
	Auxiliary transformer	- Auxiliary transformer that converts the grid voltage of > 415 V to 220 V - Transformer capacity: 5 kVA x N (quantity of ESSs)	1	Optional	Third party	Purchased by the customer
	Cabinet	The PDC must have sufficient space for installing the SmartMGC, meter, CT, and UPS. The cables from the inverter and ESS to the PDC shall be at least 5 m long.	1	Mandatory	Third party	Purchased by the customer
Genset		1. ATS switch included, and must operate in “Mutual backup” or “Dual Power (with no priority)” mode. 2. The power capacity of the gensets > microgrid load, with sufficient spinning reserve reserved ; If necessary, the threshold for the diesel generator to charge the energy storage system can be lowered. 3. The diesel generator must support I/O start-stop control, and its steady-state operating frequency deviation should be <0.1 Hz, and voltage deviation <2%. 4. Frequency and voltage fluctuations caused by switching large loads may lead to a transition of the PV-storage system to off-grid operation. When switching loads it is necessary to consider load distribution or start additional diesel generator sets. 5. Mains power detection relay : single-phase or three-phase, supports I/O feedback of grid status to SmartMGC5000B	1	Mandatory	Third party	Purchased by the customer

- Only **single access point and single grid connection point** scheduling is supported. The V5 SmartMGC5000B in on-grid mode supports BTM business models such as self-consumption, TOU, demand control, power distribution capacity expansion, and AI-based scheduling. Third-party EMS scheduling is not supported.
- The SmartPS-80AI-T0 meter (BOM code: 20023002) includes two models: DTSU666-HW and YDS60-80.

Requirements for Main Third-Party Auxiliary Devices

1. Third-party UPS

Functions of the UPS:

- In the C&I on/off-grid scenario, the UPS is in standard configuration. The UPS provides uninterruptible power supply for the SmartMGC, battery cabinet BCU, and on/off-grid switch/load switch.
- When the system shuts down due to low electricity, the power supply is faulty, or on/off-grid switchover is performed, the UPS supplies emergency power to the monitoring system and on/off-grid switch to support remote black-start of the on/off-grid system.
- If no UPS is configured, the monitoring system may shut down unexpectedly and cannot provide functions properly when the power grid fluctuates. If the UPS power backup time is insufficient and an outage lasts for a long period, the SmartMGC5000B and other monitoring devices may shut down after the system starts running in off-grid mode. After the devices restart, manual confirmation is required to ensure that devices are restored to automatic running and control.

UPS specifications:

- (1) Capacity > 1 kVA, online UPS
- (2) Backup time: The backup time is greater than 48 hours in off-grid scenarios and greater than 1 hour in other scenarios.
- (3) Output voltage: 220 V AC
- (4) Power of devices in the supported UPS range: The power of the SmartMGC is about 15 W. **The power of each ESS cabinet: The peak power is 500 W/cabinet, the shutdown power is ≥ 15 W/cabinet, and the steady-state power is about 30–100 W/cabinet.** And the power of the on/off-grid switch/load switch is determined according to the specifications in the configuration device manual.
- (5) UPS usage requirements: The UPS can run automatically and continuously with a long backup time. In the off-grid scenario, the hybrid power supply or the power supply devices of the same type can be used.



BYE LUNA2000-(107-241) Cabinet (5 x ESS)

一次方案图 SINGLE LINE DIAGRAM					
	PE TMY-5x40				
开关柜编号 SWITCH CABINET NUMBER	AA1				
柜体尺寸 DIMENSION	900x1000x2100				
断路器型号 CIRCUIT BREAKER	QF1:NA5-1600N 1600 MF3 A220	UFB1~2:BYEM6-63 2P C25	QF2:NM8N-1600S TM 1000 3P	QF3:NM8N-1600S TM 1000 3P	1QF1~5:NM8N-250S TM250 3P
		1FB1~6:BYEM6-63 2P C6			
电流互感器 CURRENT TRANSFORMER	1500/5				
额定功率 RATED POWER					
计算电流 CALCULATED CURRENT					
电缆规格 CABLE SPECIFICATION					
用途 FEEDER NAME	Grid 市电进线	Auxiliary power supply 辅助供电	LOAD 负载	PV 光伏进线	PCS 储能进线
备注 REMARK					
二次原理图 SCHEMATIC DIAGRAM					
施工编号 SERIES NUMBER					

Requirements for Main Third-Party Auxiliary Devices

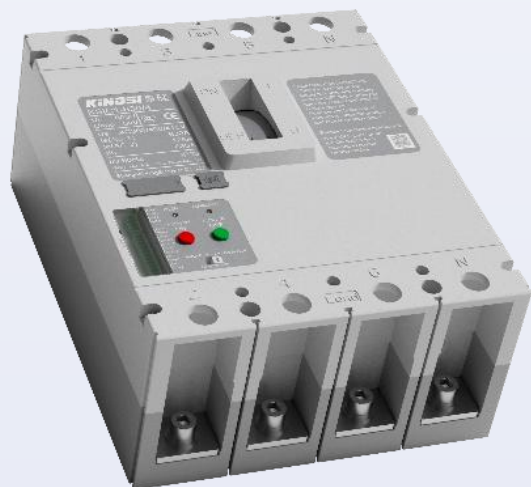
2. Third-party on/off-grid switch and load switch

In the C&I on/off-grid switching scenario, you need to set or specify the on/off-grid switch to ensure that there is a clear isolation breakpoint between the on/off-grid system and the power grid.

In the C&I off-grid scenario, the load switch needs to be set to perform load shedding.

- (1) 20ms seamless on/off-grid switching: Rapid switch*, supporting DC DO control, I/O control, and switching time to meet the use requirements; (Note: **Rapid switch need to be tested together. If the customer selects a third-party fast switch that meets technical requirements but has not been tested, Huawei can cooperate with the customer in commissioning. For details, contact Huawei engineers.**)
- (2) 60ms/150ms seamless on/off-grid switching : ACBs are recommended as the on/off-grid switches. (If the requirement on the switching time is not high, the MCCB with the operation mechanism can also be used.) The I/O control shall be supported, and the switching time shall meet the requirements.
- (3) Automatic seamed on/off-grid switching: The switch supports remote switch-on and switch-off. A UPS is configured for the switch control loop to remotely control the switch when utility grid supply is unavailable. The switch status auxiliary contact is connected to the SmartMGC5000B.
- (4) Manual seamed on/off-grid switching: The switch status auxiliary contact is connected to the SmartMGC5000B.
- (5) Off-grid scenario: The load switch can be remotely turned on or off.
- (6) Neutral grounding switch: The current-carrying capacity should be consistent with that of the N line.

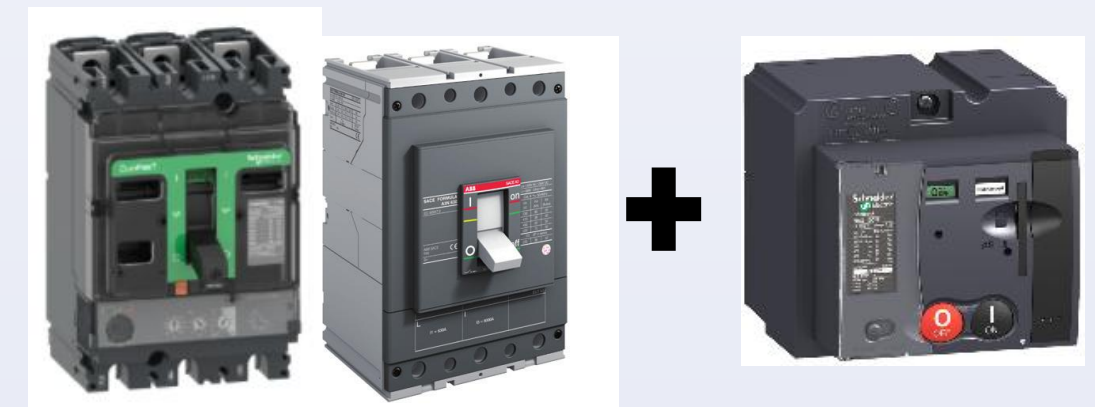
Rapid switch



ACB



MCCB + Motor mechanism



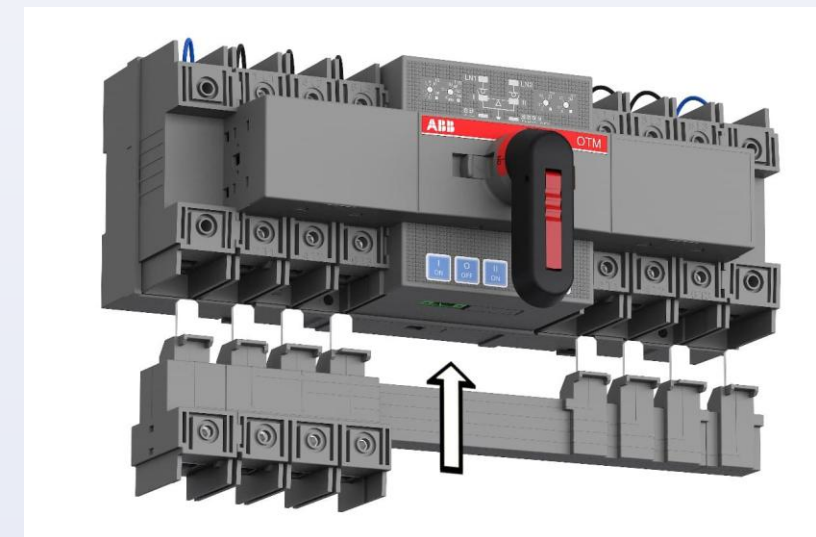
Requirements for Main Third-Party Auxiliary Devices

3. ATS for the genset+ESS system

ATS: For scenarios involving parallel operation of solar, storage, and diesel systems, the ATS operating mode should be set to "**mutual backup**" (note that it should not be set to automatic switching or primary-backup mode).

Power failure monitoring relay: a voltage relay commonly used in the industrial control industry. It can detect overvoltage or undervoltage and send DO signals for control linkage.

ATS

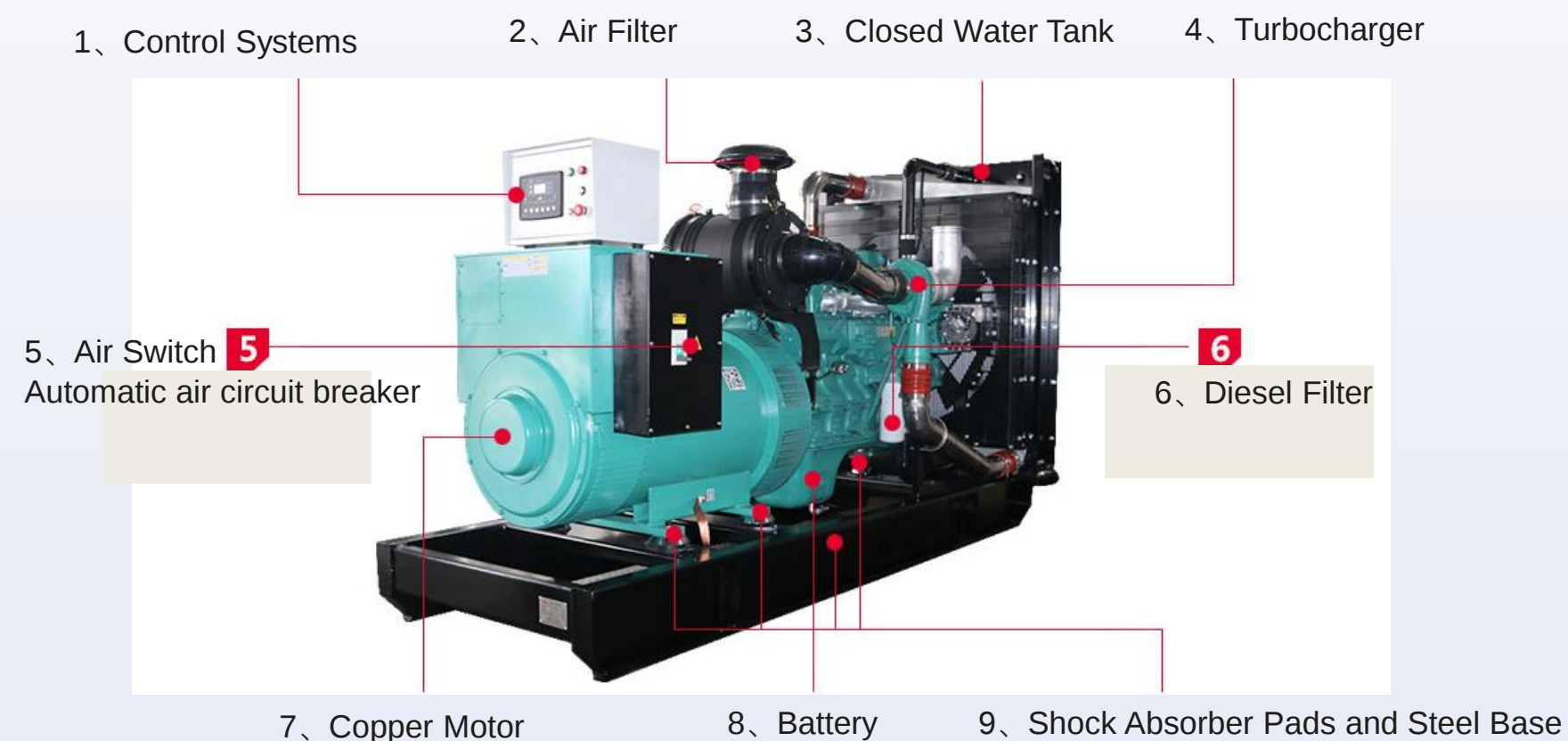
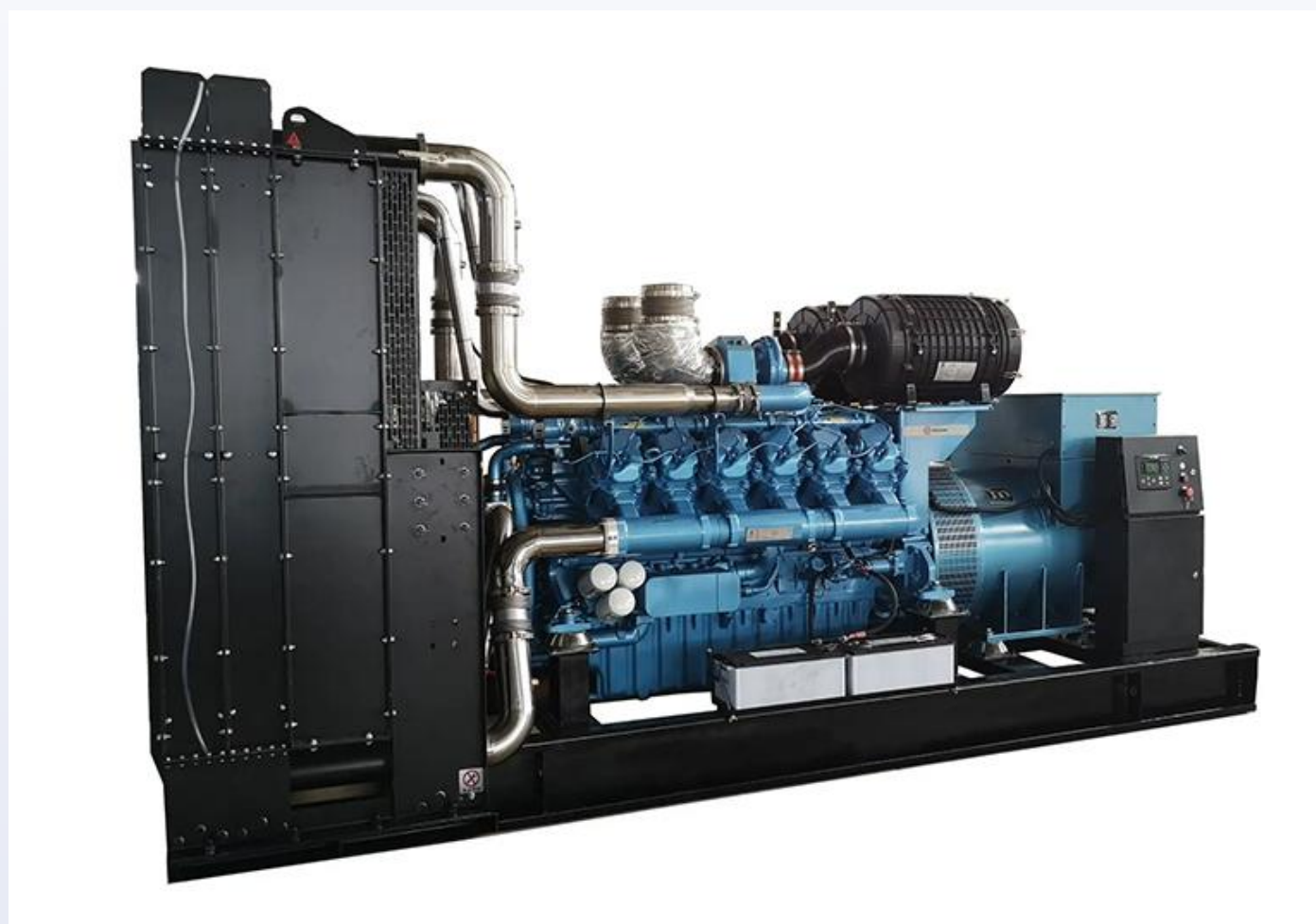


Requirements for Main Third-Party Auxiliary Devices

4、Genset

Diesel Generator: In scenarios where solar, storage, and diesel generators operate in parallel, when the off-grid energy storage SOC is insufficient, the diesel generator will be started to operate in grid-connected mode.

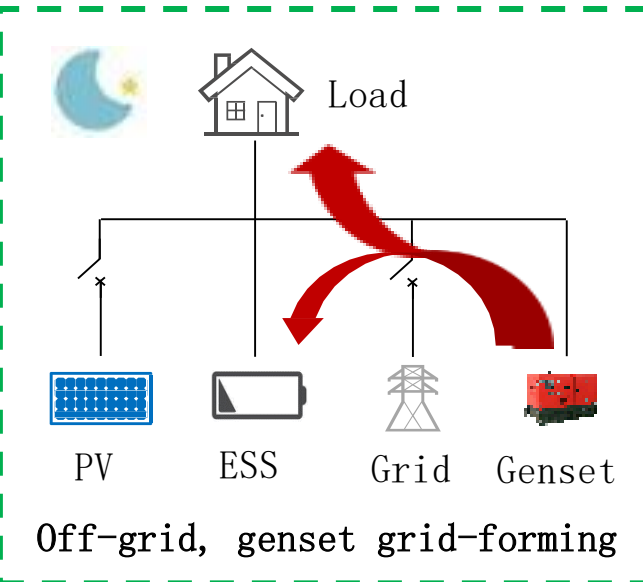
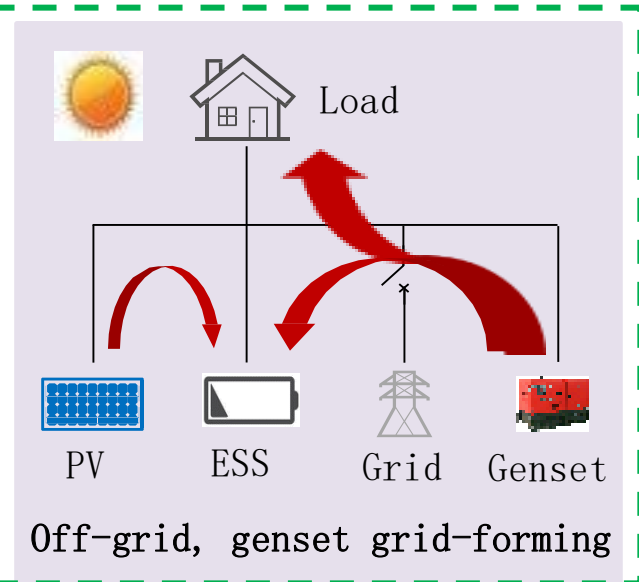
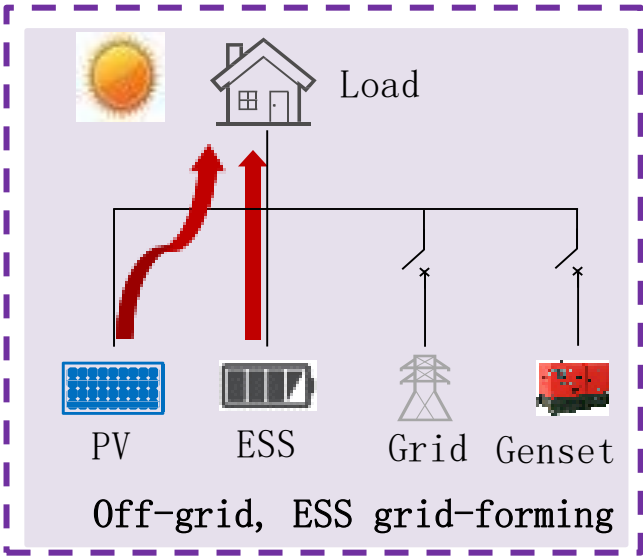
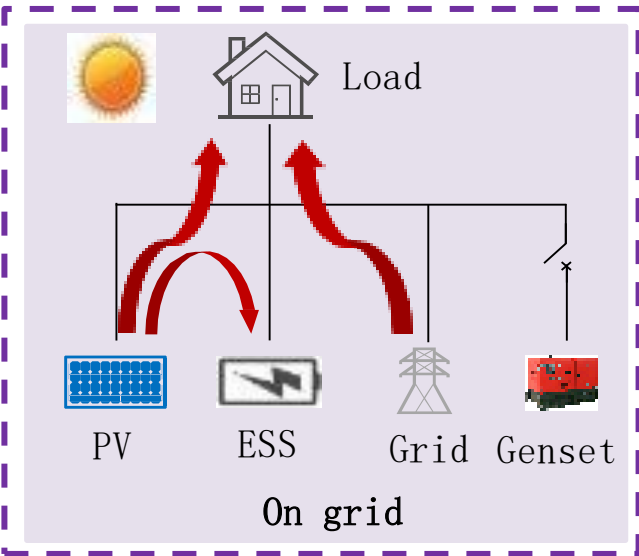
1. The capacity of the diesel generator should be greater than the load, and a spinning reserve should be reserved according to the situation. For specific details, please consult the diesel generator manufacturer.
2. The diesel generator must support I/O start-stop control, and its steady-state operating frequency deviation should be less than 0.1 Hz, and voltage deviation should be less than 2%.



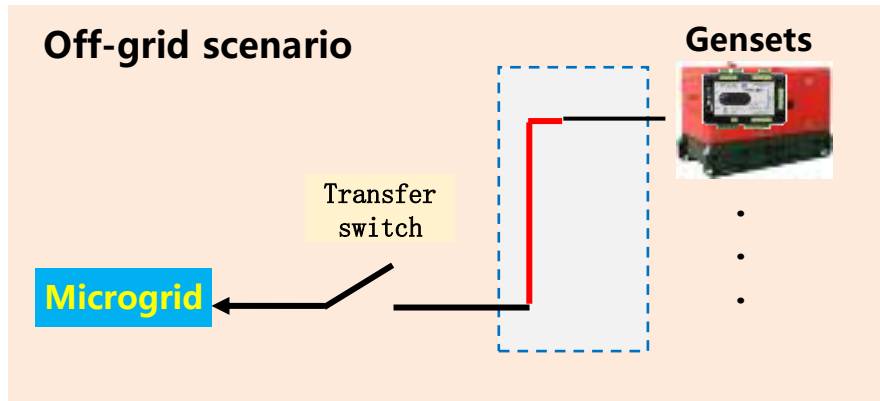
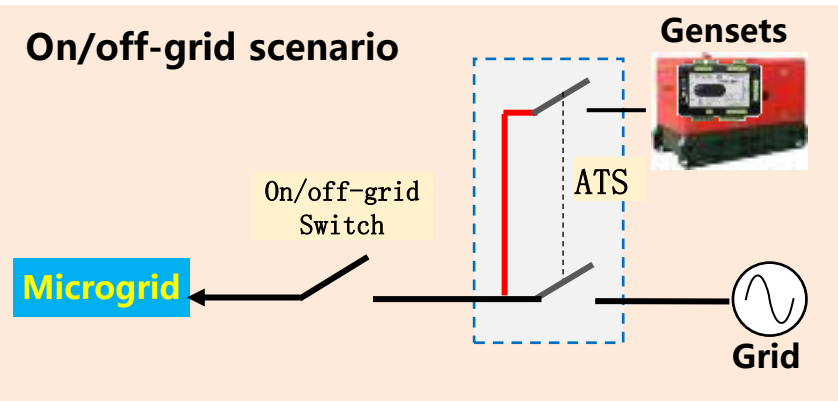
Solution Feature: PV-storage-genset systems in parallel configuration

1、Energy flow of PV-storage-genset system

- ① When there is grid power, operate in grid-connected mode;
- ② When the grid power is out, switch to off-grid operation using energy storage;
- ③ If the SOC of the off-grid energy storage is insufficient, start the diesel generator to supply power;
- ④ After the diesel generator starts, both solar PV and the diesel generator can be used to charge the energy storage, with solar PV taking priority.



2、Off-grid main power source switching control logic



Off-grid, ESS grid-forming

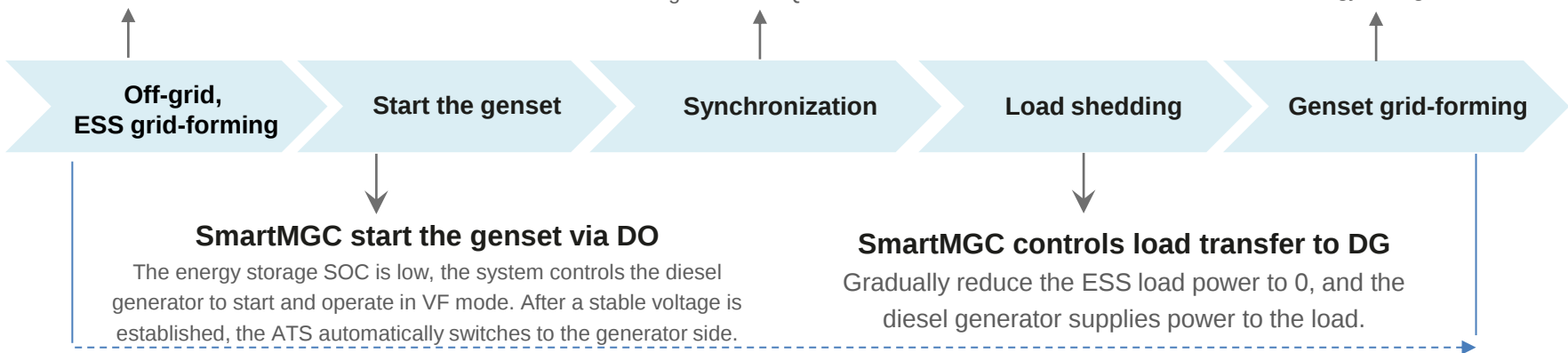
Energy storage VSG supplies power to the load. When the SOC is insufficient, it controls the start of the diesel generator.

Adjusting ESS for synchronous with genset

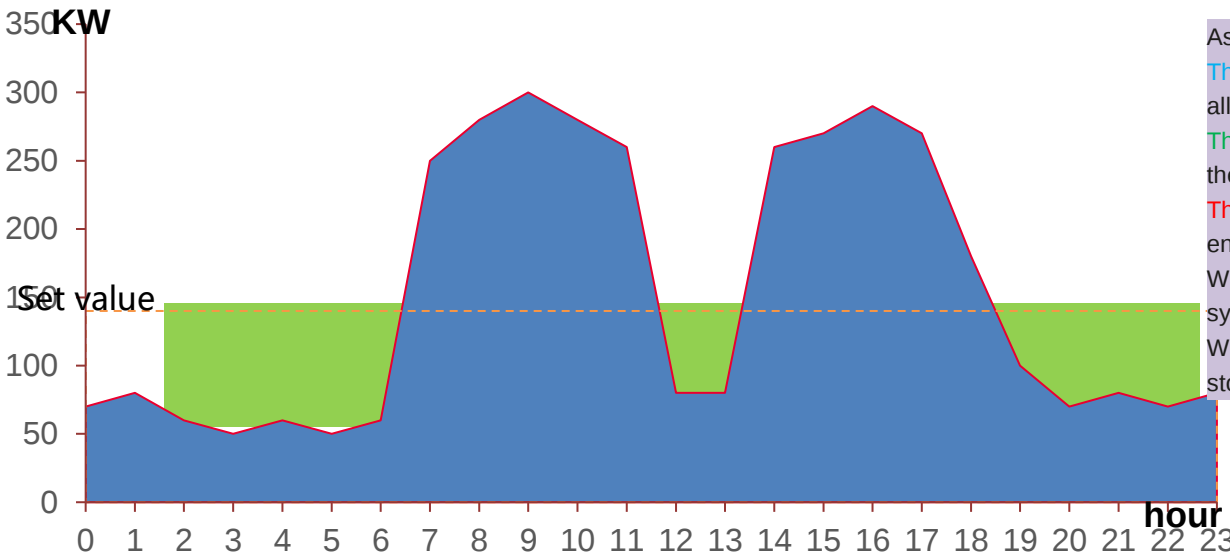
Adjust the frequency and voltage of the PV and storage subarray. After completing high-precision synchronization for grid connection, close the on/off-grid switching switch, and switch the energy storage PCS to PQ mode.

Off-grid, genset grid-forming

Dynamic adjustment of energy storage charging power: When the load power of the diesel generator is below the set threshold, charge the energy storage.



3. Example diagram of control logic for energy storage charging from diesel generator in parallel operation scenario of diesel and energy storage



As shown in the left figure:

The blue dashed line represents the upper limit power setting for allowing the energy storage system to charge from the diesel generator.

The green area below the dashed line indicates the range within which the energy storage system can charge from the diesel generator.

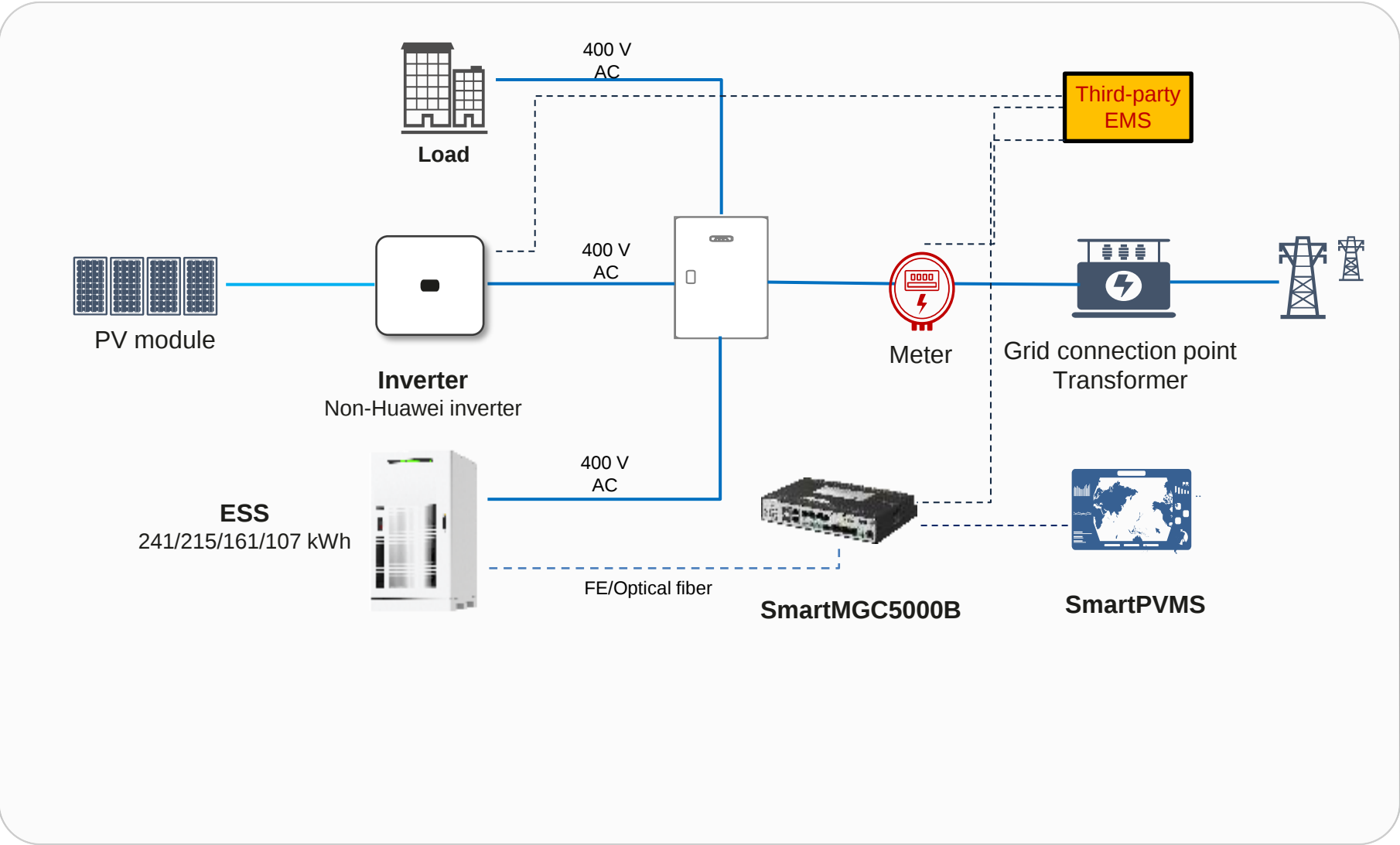
The red area above the dashed line indicates the range within which the energy storage system cannot charge from the diesel generator.

When the load within the grid exceeds the set value, the energy storage system is prohibited from charging.

When the load within the grid is less than the set value, the energy storage system can charge.

PV+ESS On-grid Scenarios (with Non-Huawei C&I Inverter):

PV+ESS low-voltage on-grid (SmartMGC5000B)



Product	Model	Quantity	Remarks	Supplier	Remarks
Inverter	Non-V3/M3/MC0/V5/V5+/V6 inverter	/	Mandatory	Huawei /Third party	
ESS	241/215/161/107 kWh	≤ 40@PV+ESS	Mandatory	Huawei	
SmartLogger	SmartMGC5000B	1	Mandatory	Huawei	
Meter	/	1	Mandatory	Third party	
SmartPVMS	FusionSolar SmartPVMS	/	Mandatory	Huawei	ESS monitoring
Third-party EMS	/	1	Mandatory	Third party	

- A third-party EMS is required. BTM business models such as self-consumption, TOU, demand control, power distribution capacity expansion, AI-based scheduling, peak shaving, frequency regulation, and electricity transaction are supported. The supported business models depend on the third-party EMS capability.
- The SmartPS-80AI-T0 meter (BOM code: 20023002) includes two models: DTSU666-HW and YDS60-80.

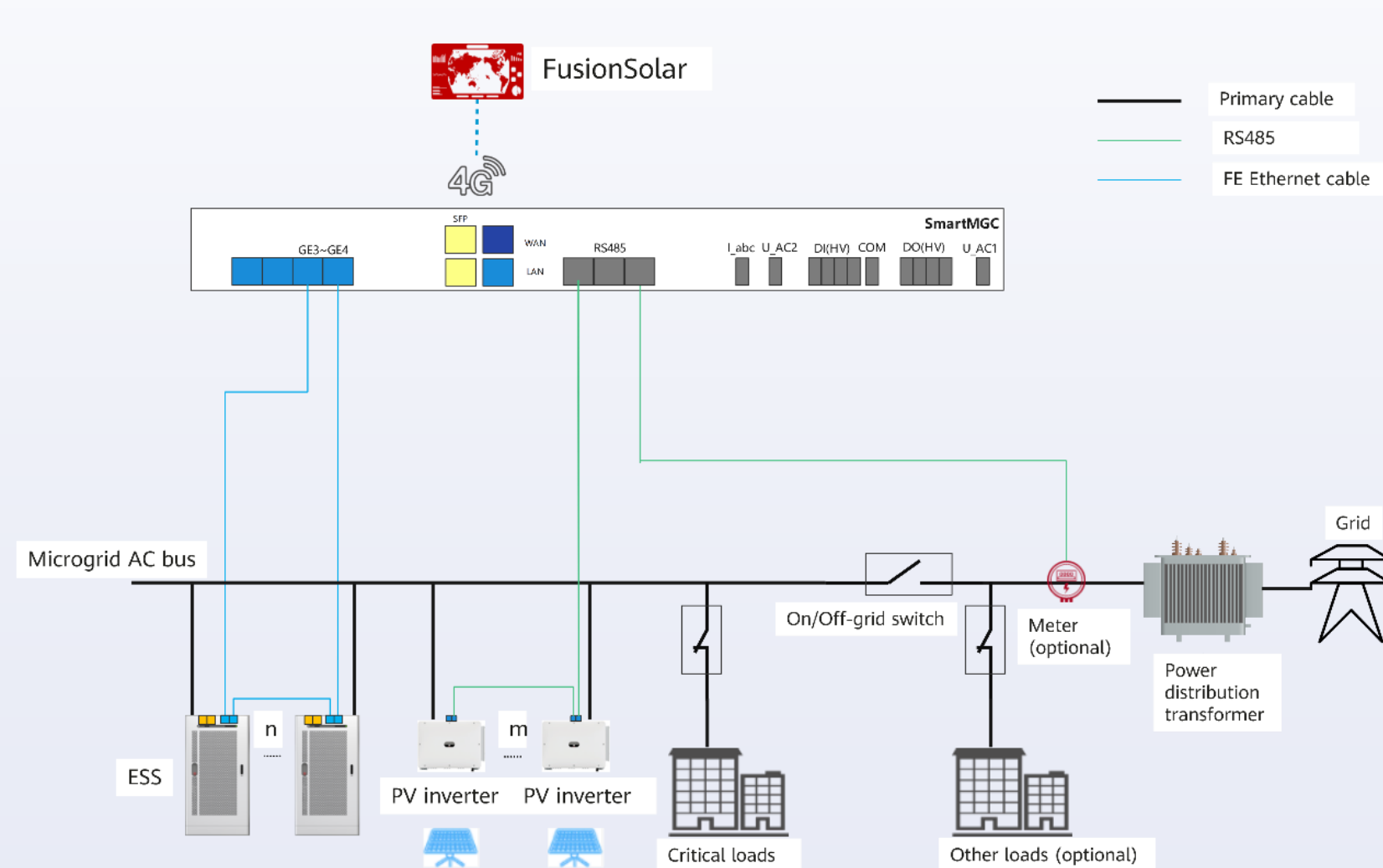
Communication Networking - Southbound Networking Mode 1 of the SmartMGC5000B: 20 ESSs

In actual networking, select a networking mode based on the number of ESSs in an array.

- ① This solution **does not support inverter communications over MBUS**. If necessary, submit a requirement to the RAT.
- ② The SmartLogger directly collects the POI power information from the POI meter (optional).
- ③ The on/off-grid switch and load switch control signals include the switch-on command, switch-off command, and off/on status.

Typical scenario 1: SmartMGC5000B+ESS networking over an FE ring network

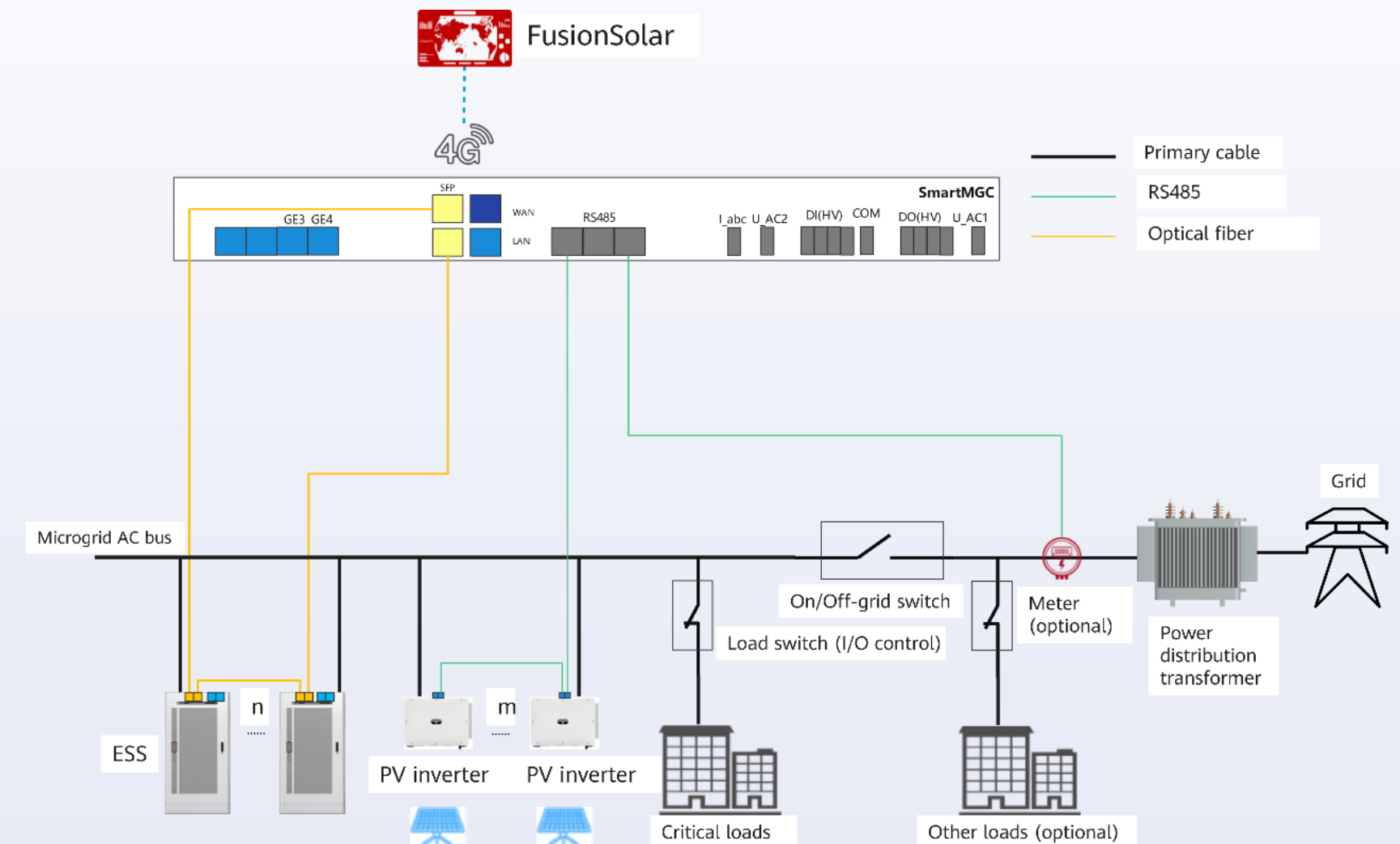
- A single FE ring network supports a maximum of 20 ESSs, and the distance between any two nodes is **less than 100 m**.
- In a single SmartMGC5000B ring network, the GE3 and GE4 ports of the SmartMGC5000B need to be connected.



Typical scenario 2: SmartMGC5000B+ESS fiber ring networking

In this scenario, the SmartMGC5000B is configured.

- One fiber ring network supports a maximum of 20 ESSs.



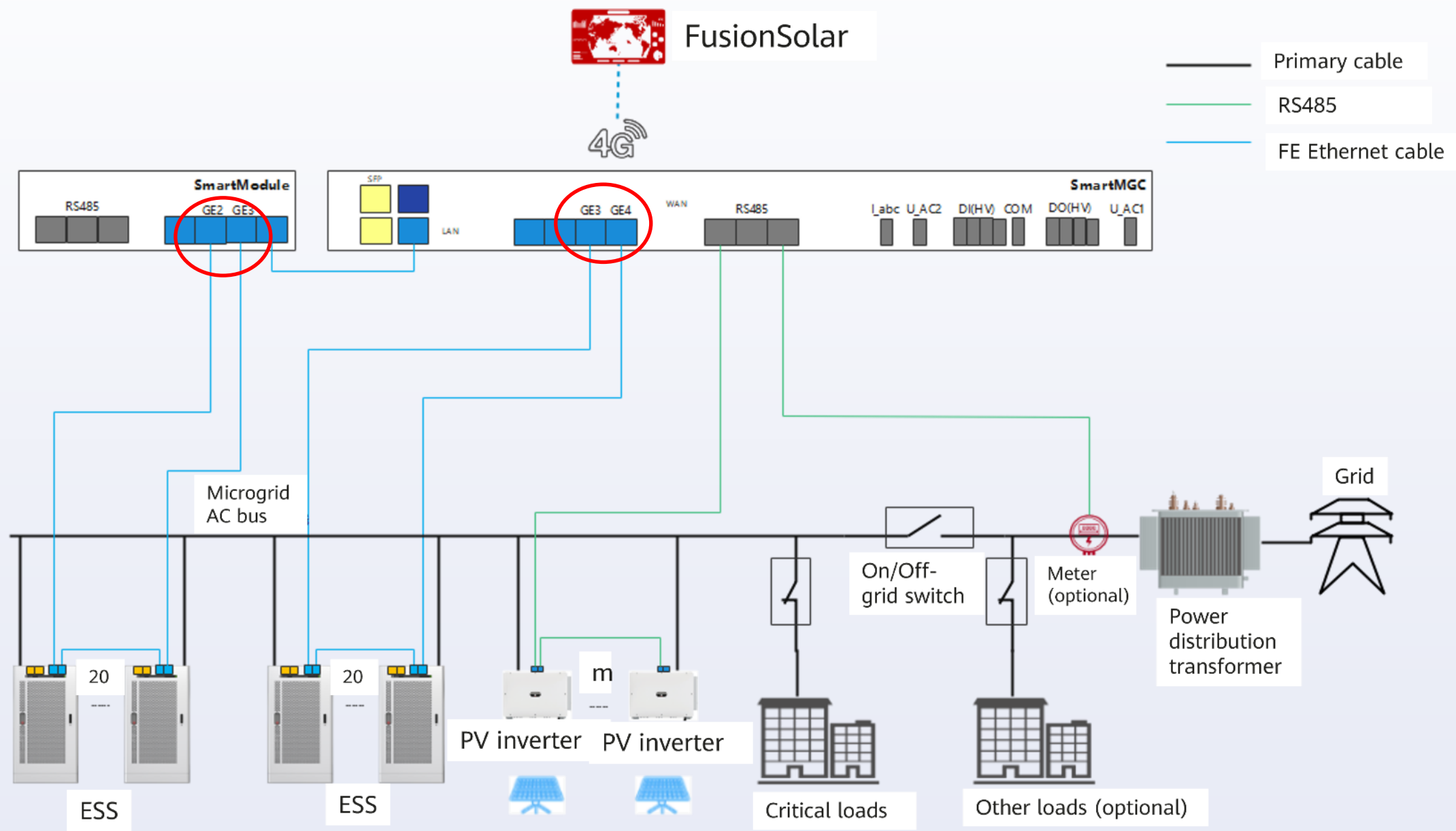
Communication Networking - Southbound Networking Mode 2 of the SmartMGC5000B: 40 ESSs

Typical scenario 3: SmartMGC5000B+ESS FE ring networking

- ❑ A single FE ring network supports a maximum of 20 ESSs, and the distance between any two nodes is **less than 100 m**.
- ❑ A single SmartMGC5000B can be expanded with the SmartModule to connect a maximum of 40 ESSs and 40 inverters.
- ❑ For ring network communication under the SmartMGC5000B, the GE3 and GE4 ports need to be connected.
- ❑ For ring network communication under the SmartModule, the GE2 and GE3 ports need to be connected.

In actual networking, select a networking mode based on the number of ESSs in an array.

- ① This solution **does not support inverter communications over MBUS**.
- ② The SmartLogger directly collects the POI power information from the POI meter (optional).

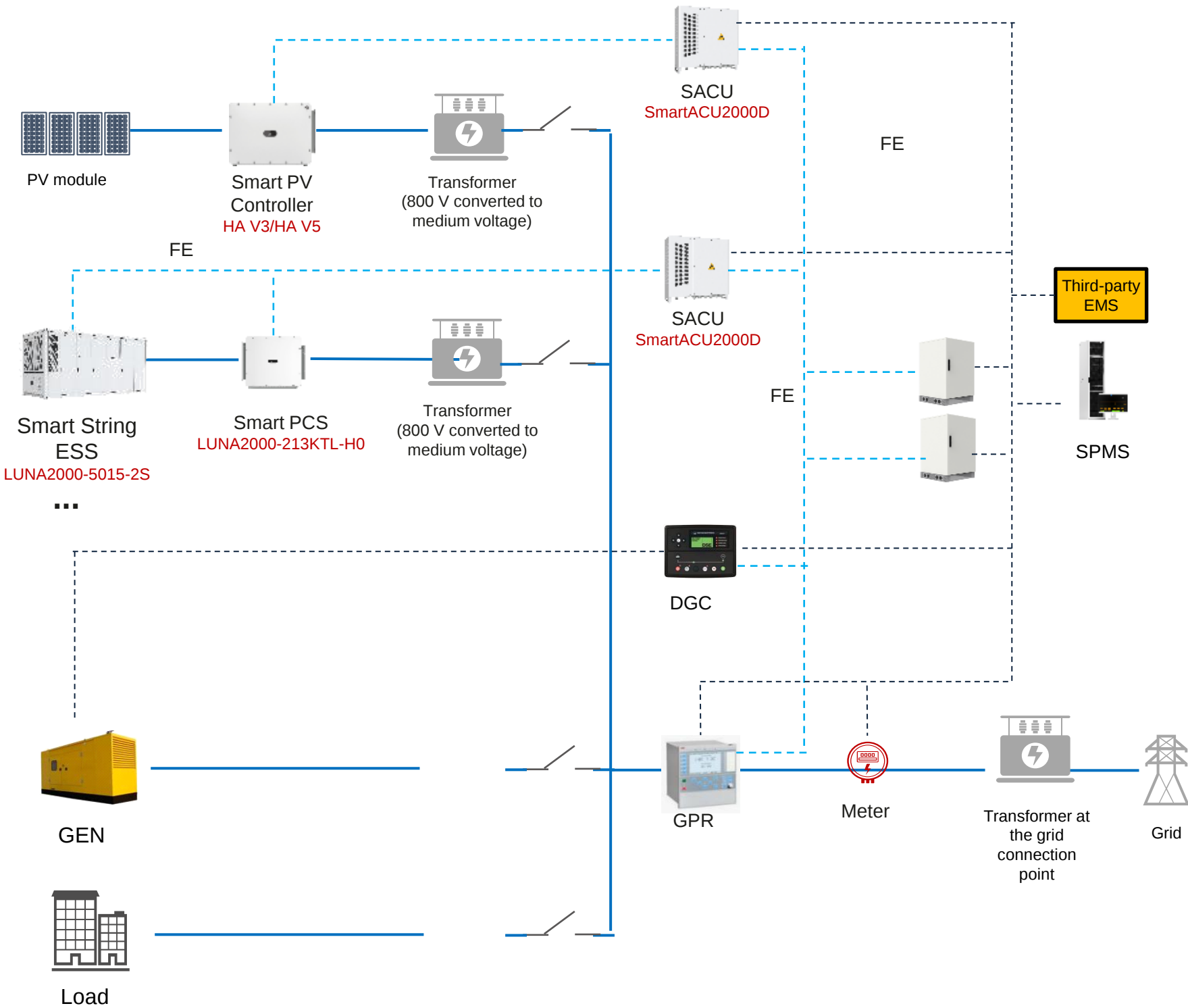


C&I Max Solutions for MV Scenarios



On/Off-grid (5 MWh ESS + Utility Inverter):

Medium-voltage coupling in PV (utility) + ESS scenarios

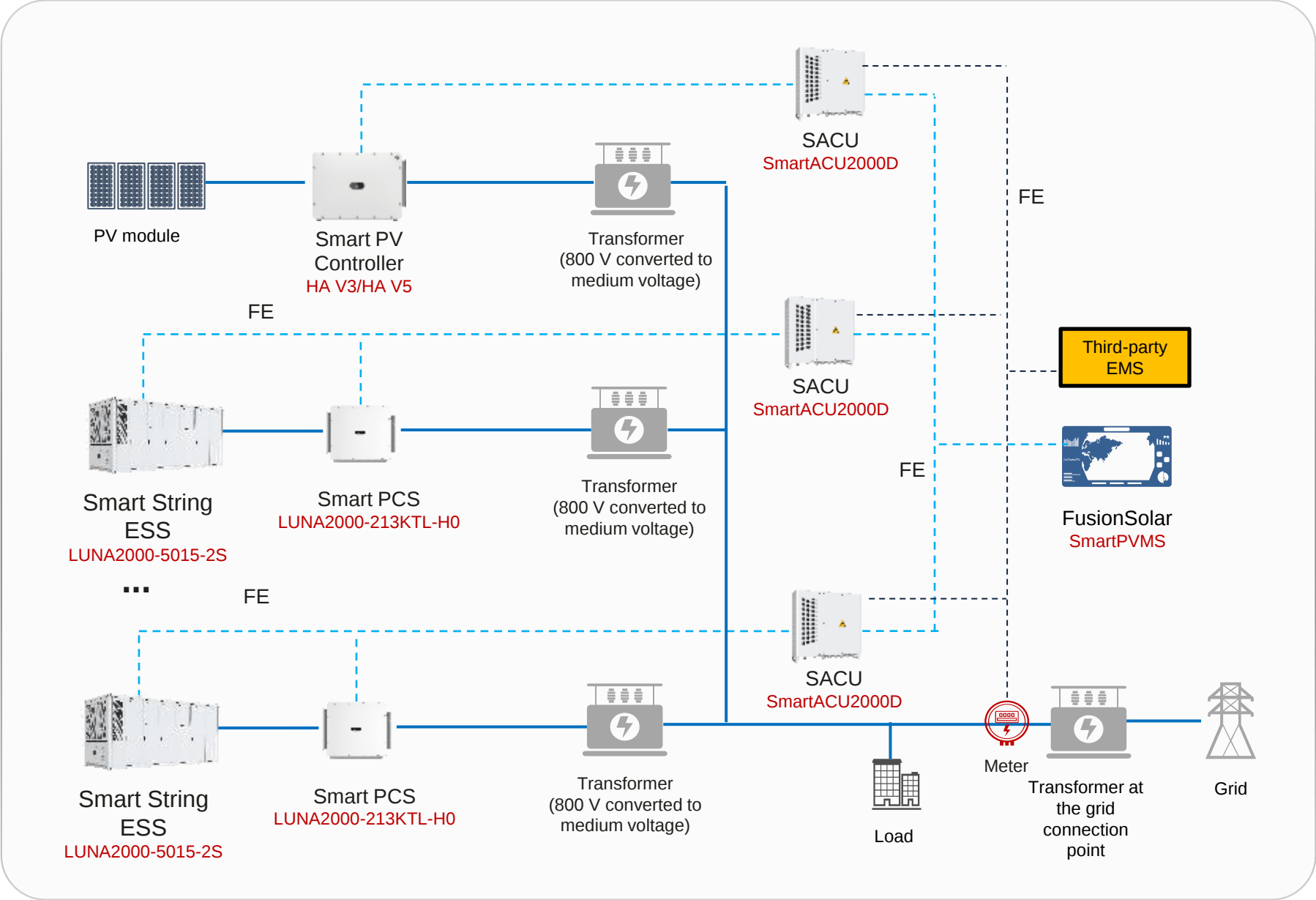


Main device configuration

Product	Model	Quantity	Remarks	Supplier	Remarks
Inverter	SUN2000-330KTL-H2 / 506KTL	≤ 30 pcs (single array)	Mandatory	Huawei	Restricted by the transformer capacity
ESS	LUNA2000-5015-2S	5 MWh model: ≤ 7 (0.25C), ≤ 3 (0.5C) (single array)	Mandatory	Huawei	Restricted by the transformer capacity
PCS	213KTL-H0	≤ 42 (single array)	Mandatory	Huawei	Restricted by the transformer capacity
SACU-D	SmartACU2000D-D11	Configured by array. Independent PV arrays and ESS arrays	Mandatory	Huawei	
Transformer	800 V converted to medium voltage	Configured by array. Independent PV arrays and ESS arrays	Mandatory	Huawei /Third party	Generally, the transformer capacity is < 9 MW.
Meter	/	1	Mandatory	Third party	
SPMS	Smart Plant Management System	1	Mandatory	Huawei	ESS monitoring
Third-party EMS	/	1	Mandatory	Third party	Energy scheduling

On-grid (5 MWh ESS + Utility Inverter):

Medium-voltage coupling in PV (utility) + ESS scenarios



Main device configuration

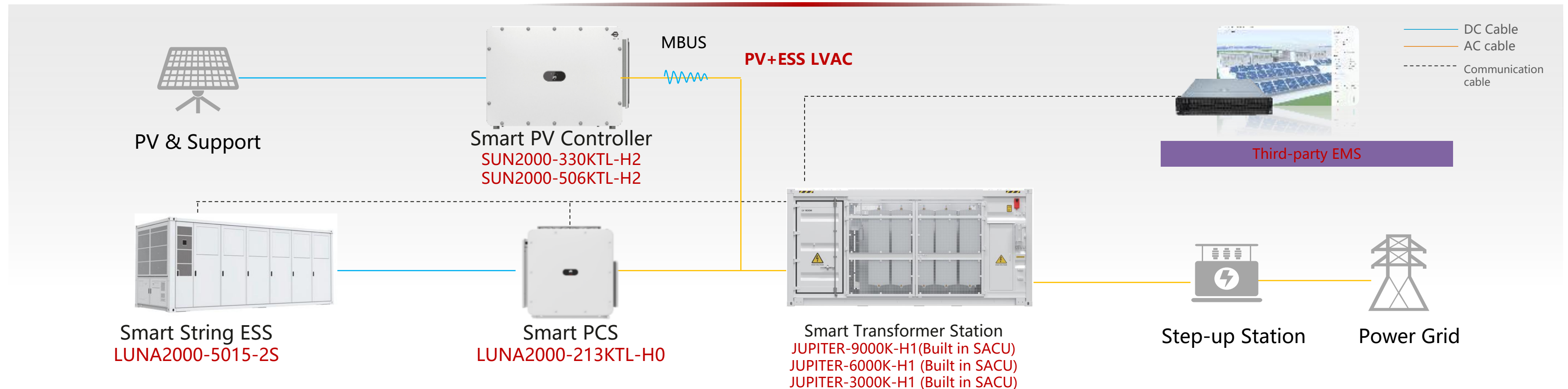
Product	Model	Quantity	Remarks	Supplier	Remarks
Inverter	SUN2000-330KTL-H2 / 506KTL	≤ 30 pcs (single array), ≤ 10 MW (single plant)	Mandatory	Huawei	Restricted by the transformer capacity and capacity allowed for SmartPVMS connection
ESS	LUNA2000-5015-2S	≤ 3 (single plant)	Mandatory	Huawei	Restricted by the transformer capacity and capacity allowed for SmartPVMS connection
PCS	213KTL-H0	≤ 36 (single plant)	Mandatory	Huawei	
SACU-D	SmartACU2000D-D11	Configured by array. Independent PV arrays and ESS arrays	Mandatory	Huawei	
Transformer	800 V converted to medium voltage	Configured by array. Independent PV arrays and ESS arrays	Mandatory	Huawei /Third party	Generally, the transformer capacity is < 9 MW.
Meter	/	1	Mandatory	Third party	
SmartPVMS	FusionSolar SmartPVMS	1	Mandatory	Huawei	ESS monitoring
Third-party EMS	/	1	Optional	Third party	Energy scheduling

- Scheduling of multi-grid connection points depends on the third-party EMS capability.
- A third-party EMS is required. Business models such as self-consumption, TOU, demand control, power distribution capacity expansion, AI-based scheduling, peak shaving, frequency regulation, and electricity transaction are supported. The supported business models depend on the third-party EMS capability.
- One SACU-D manages multiple ESSs, PCSs, and one STS to form an array.
(1) In an ESS array, the ESSs form a ring network through Ethernet ports or optical ports to communicate with the SACU-D. Each ESS ring network can connect to a maximum of eight ESSs, and one array supports a maximum of one ESS ring network.
(2) The PCSs form a ring network through Ethernet ports to communicate with the SACU-D. Each PCS ring network can connect to a maximum of 16 PCSs, and one array supports a maximum of three PCS ring networks (48 PCSs).

Mapping for C&I **Low-voltage AC coupling Solution: PV+ ESS On-grid Only**

The low-voltage PV+ESS coupling solution is suitable for scenarios where the ESS ratio is not high in PV+ESS plants, such as large-scale PV plants with some ESSs and small- and medium-sized PV+ESS plants for self-consumption.

- Compared with the medium-voltage coupling solution, this solution can reduce CAPEX, **improve ESS charging efficiency, and reduce dependency on the EMS;**
- Compared with the DC coupling solution, this solution can narrow the gap between CAPEX and system efficiency, **eliminate the safety issues of DC power distribution, and provide higher system availability.**



Application scenario: PV+ESS achieve smooth output, joint power supply, and ancillary services in the electricity market.



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