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pv magazine webinars

Unlocking BESS potential in the EU: Driving grid resilience and innovation

28 April 2025
10:00 am – 11:00 pm | CEST, Berlin
9:00 am – 10:00 am | BST, London

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Welcome!

pv magazine webinars

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. 👀 💡

BESS market landscape, emerging applications and grid connection solutions

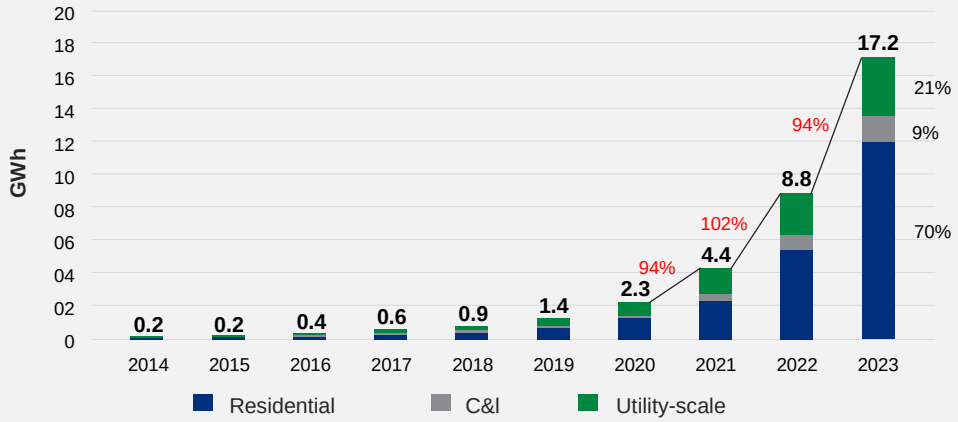
Hamid Bardideh

Solution Manager, HyperStrong International

28 April, 2025

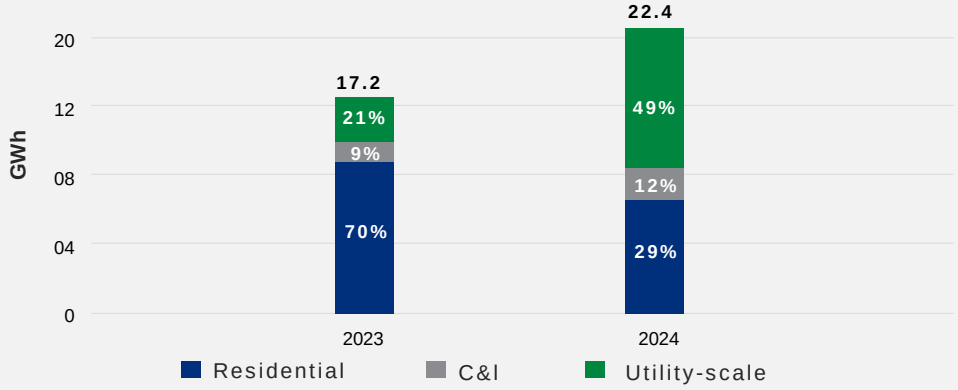
EU Market Overview | Current deployment trends (2014-2024)

Europe Annual Battery Storage Installed Capacity 2014-2023



Reference: SolarPower Europe 2024, European Market Outlook for Battery Storage 2024-2028

Large-scale energy storage capacity exceeds household energy storage for the first time in 2024



Reference: Hunt-key energy Storage Website

Highlights Until the End of 2023

In 2023, **17.2GWh** installed capacity added, **115x** larger than a decade ago in 2014, with only 150 MWh.

2023 was a milestone, the third year in row doubling the market:

- Rapid growth happened as a response to the Ukraine war.
- Policy support initially targeted residential investment.
- This leaded to Residential investors to hit 70%.

The Energy Trilemma

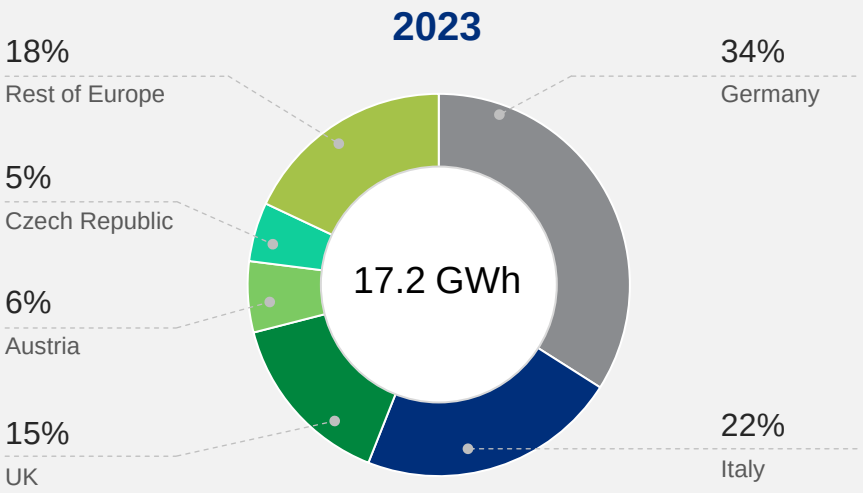
Highlights for 2024

- A significant shift toward Utility-scale BESS market, rising from 21% in 2023 to 49% in 2024.
- A sharp decline in Residential BESS market, from 70% in 2023 to 39% in 2024.

Note on BESS Data Quality Issues: Lacking national data collection from most EU countries leads to inaccuracy in data estimation.

EU Market Overview | Regional Variations

Top 5 European annual battery storage market shares 2023



Reference: SolarPower Europe 2024, European Market Outlook for Battery Storage 2024-2028

Growth of Battery Energy Storage Systems (BESS) in Europe (2023-2024)

Country	Residential Growth (%)	Commercial & Industrial Growth(%)	Utility Scale Growth (%)
Germany	15%	10%	30%
Italy	20%	12%	35%
United Kingdom	8%	7%	25%
France	18%	14%	40%
Spain	22%	9%	28%
Netherlands	14%	11%	20%

Regional Highlights 2023:

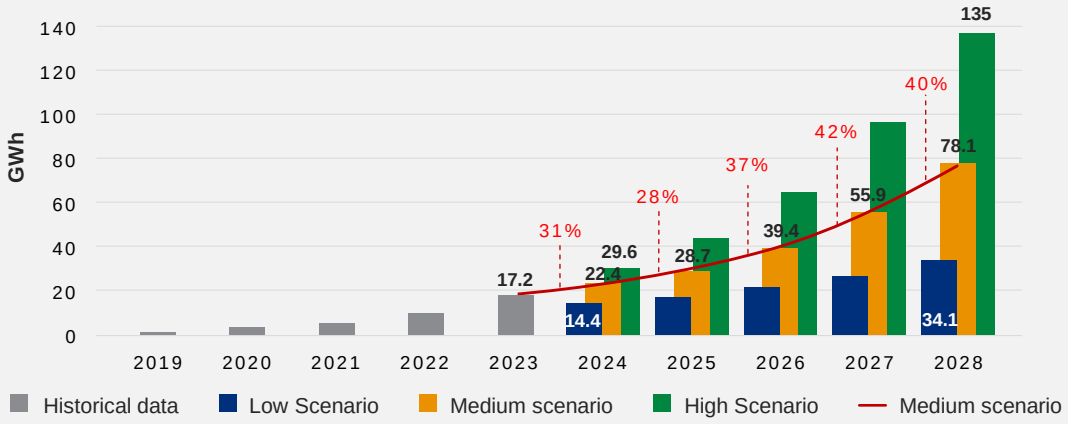
- Germany, Italy, and the UK were the main market players, followed by Austria and the Czech Republic.
- The rest of Europe accounted for just 18% of the market share:
  - Lack of a profitable Market Mechanism.
  - Lack of strong Regulatory support.

Regional Trend 2023-2024:

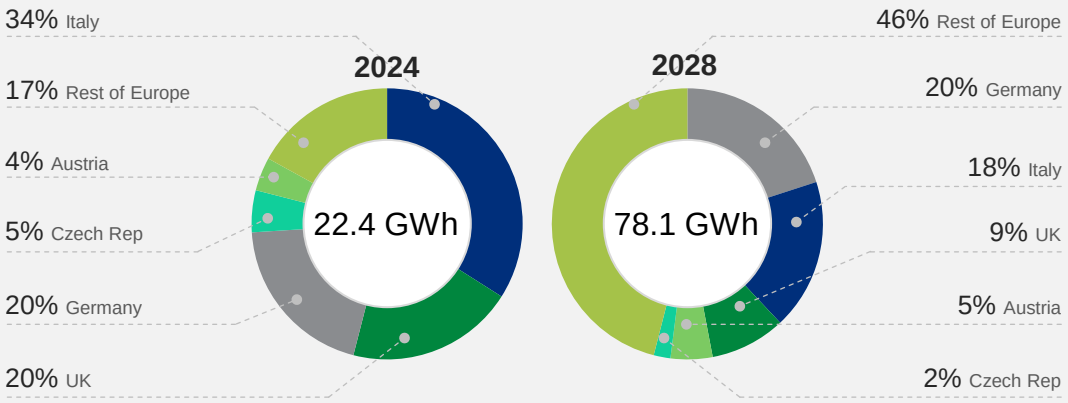
- All countries: a Significant rise of utility-scale.
- France: the largest growth of utility-scale systems, with 40%.
- Spain: the highest growth in residential installations, with 22%.
- The UK : the slowest growth across the sectors in total.

EU Market Overview | Future growth projections I

Europe Annual Battery Storage Installed Capacity Scenarios 2024-2028



Reference: SolarPower Europe 2024. European Market Outlook for Battery Storage 2024-2028



Reference: SolarPower Europe 2024. European Market Outlook for Battery Storage 2024-2028

BESS Future Trend Prediction

Projection of Annual Installed Capacity: slower but steady +30-40% growth.

Projection of accumulated installed BESS: a sevenfold increase to reach from **36GWh** from 2024 to **260GWh** by 2028.

Market Segment Projection by 2028:

- Utility-Scale: a prominent, steady upward trend.
- C&I: a moderate increase jump of 13%.
- Residential: a decline to 29% annually.

Key Expectations for Future Regional Markets

UK market, almost saturated and expected a sharp decline.

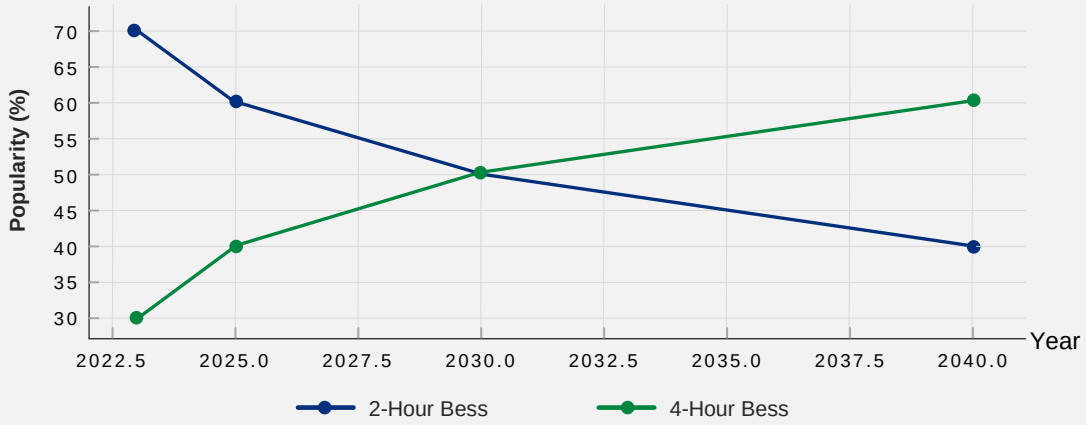
Germany, expected to maintain its steady investment.

Italy, expected to decline but still high investment potential.

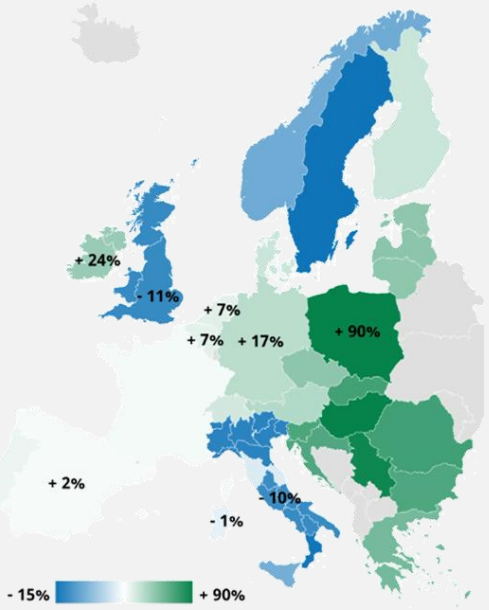
Rest of Europe, expected to start flourishing.

EU Market Overview | Future growth projections II

Projected Popularity of BESS Storage: 2-Hour vs.4-Hour+ (2023-2040)



4 hour BESS revenue changes y-o-y 2023 vs 24



Source: Timera Energy, ENTSOE, Epex;
Percentage difference between Day-Ahead revenues for 4hr BESS computed colours represent YoY % increase, while blue colours represent YoY%
reduction in Day-Ahead revenues for 4hr BESS.

Forecast for Extended Duration of BESS

Current dominance of 2-hours duration BESS in the market.

Long-term trend shifting towards longer-duration (4-8 hours) BESS:

- Market requirements.
- Peak shaving and grid flexibility.
- Cost reduction driven by technological advancements.

4-Hour BESS Revenue Change (2023-2024)

Short-term revenue trends driven by regional policies.

Poland experienced the highest revenue increase, with a **90%**, followed by Hungry and Serbia.

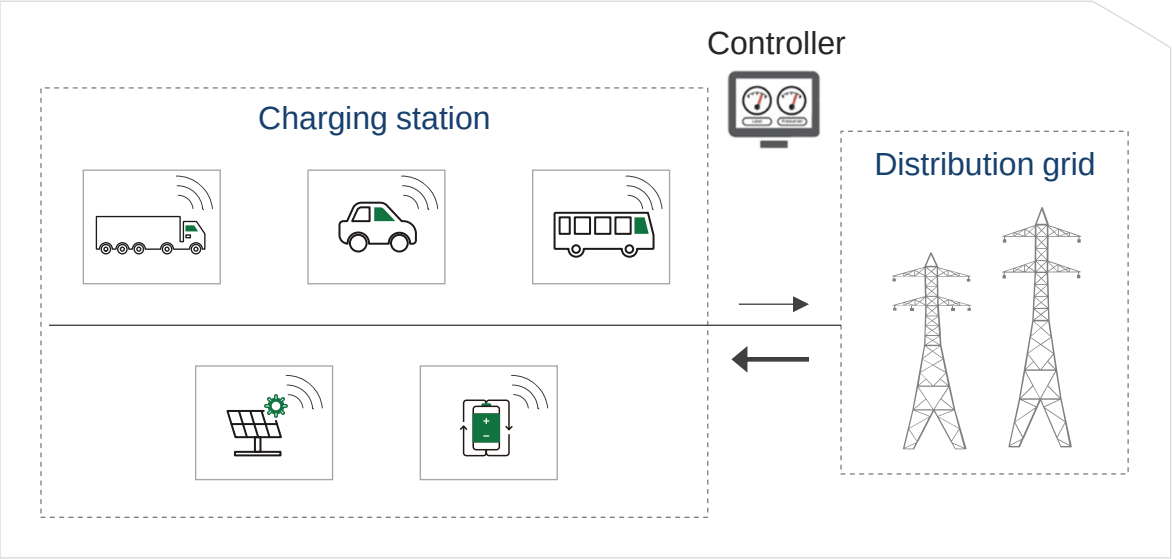
While UK and Italy saw a negative trend with -11% and -10% respectively.

Emerging Applications | BTM* Applications: C&I*, Residential and EV Charging integration

Commercial and industrial (C&I)

Residential

EV charging and ntegration



BTM (C&I, Residential and EV Charging Integration)

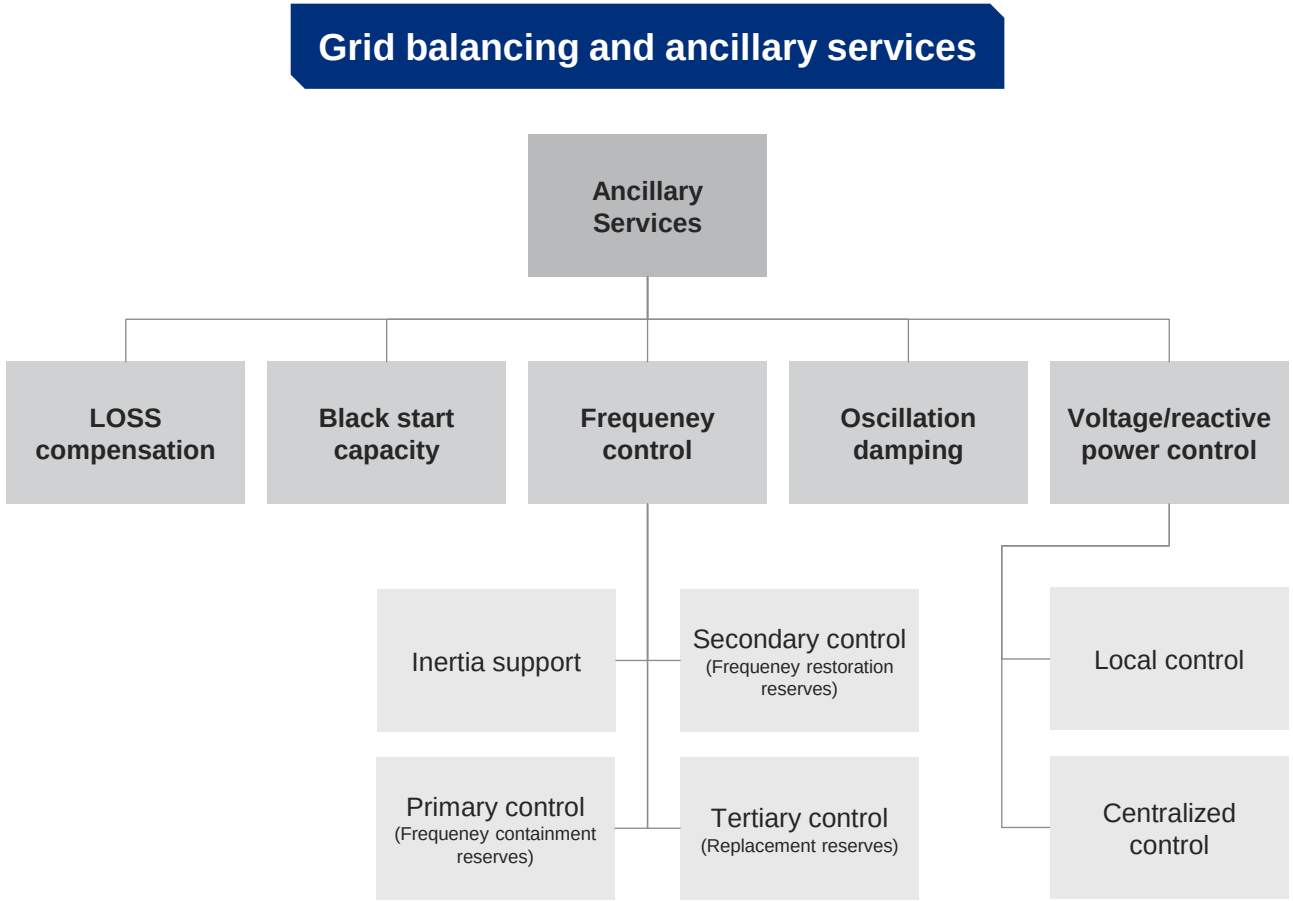
Back-up Power | Demand Response | Load Shifting | Peak-Shaving | Retail Arbitrage

Notes: These are categorized under the **"Energy Management"** rather than **"Power Management"**

Due to their smaller size in Europe, their participation to the ancillary services are yet limited.

*BTM stands for "Behind the Metering"
*C&I stands for "Commercial and Industrial"

Emerging Applications | FTM* Applications: Grid balancing and Ancillary services



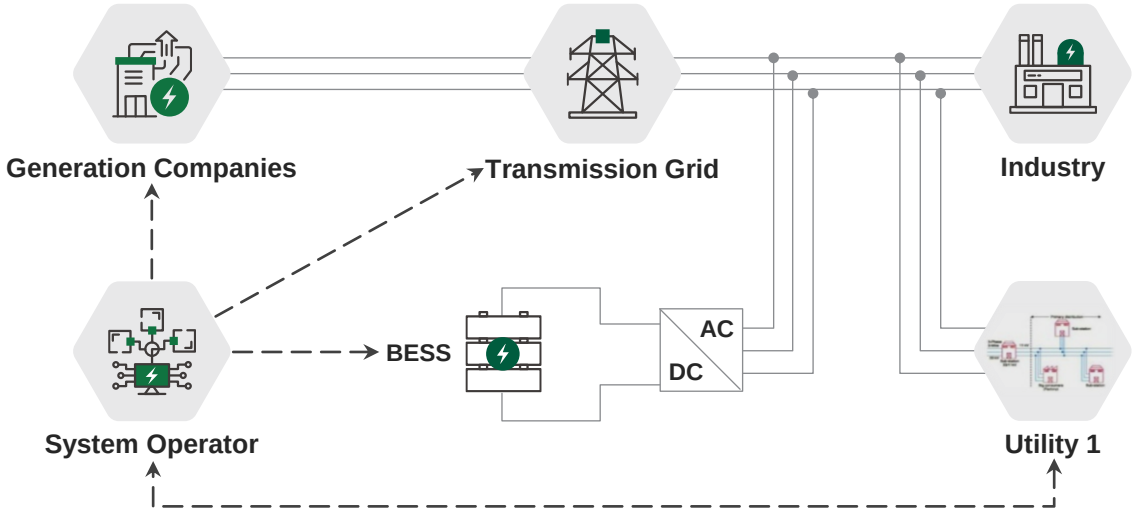
- **Ancillary services:** support services that ensure grid reliability, stability, and security while balancing supply and demand.
- Frequency Control
- Reactive Power Control
- Oscillation Damping and Stability
- Black Start
- Loss Compensation

V Brahmendra Kumar and K Palanisamy, A Review of Energy Storage Participation for Ancillary Services in a Microgrid Environment, Inventions 2020, 5(4), 63

*FTM Stands for "Front the Metering"

Emerging Applications | FTM Applications: Congestion management and Whole-sale arbitrage

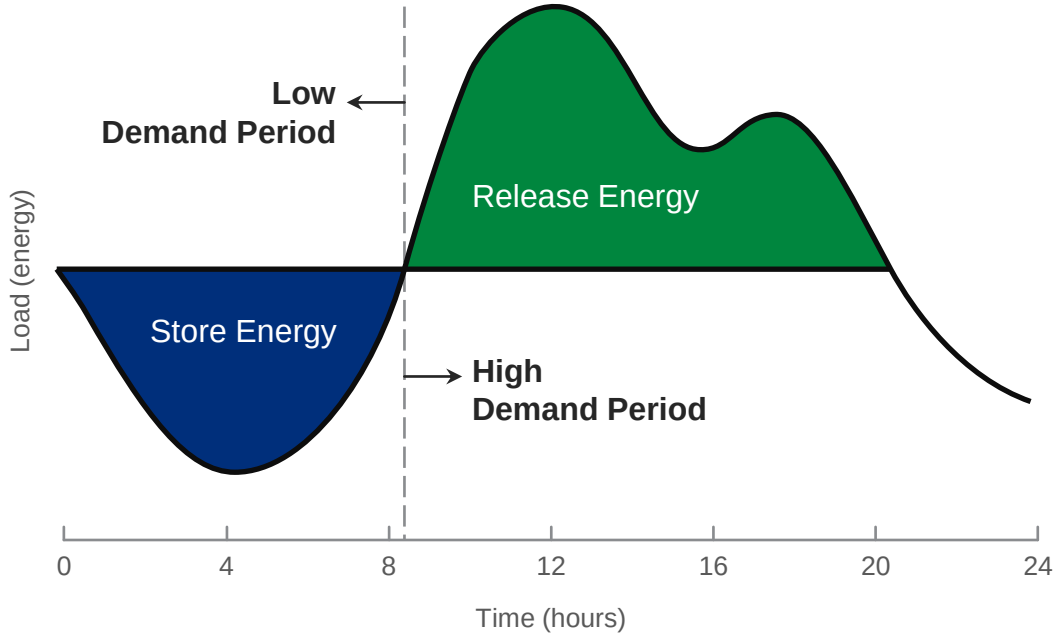
Congestion management



Rajagopal Peesapatii, Vinod Kumar Yadav,nanwardeep Singh,Santosh Ghosh, Optimal scheduling of BESS for congestion management considering reliability and OTS, Volume 38, June 2024, 101227

- **Transmission Deferral**: Postponing or avoiding the construction of new transmission lines by providing flexibility
- **Redispatching**: Shifting generation resources from areas with excess power generation to areas facing congestion, increasing grid stability

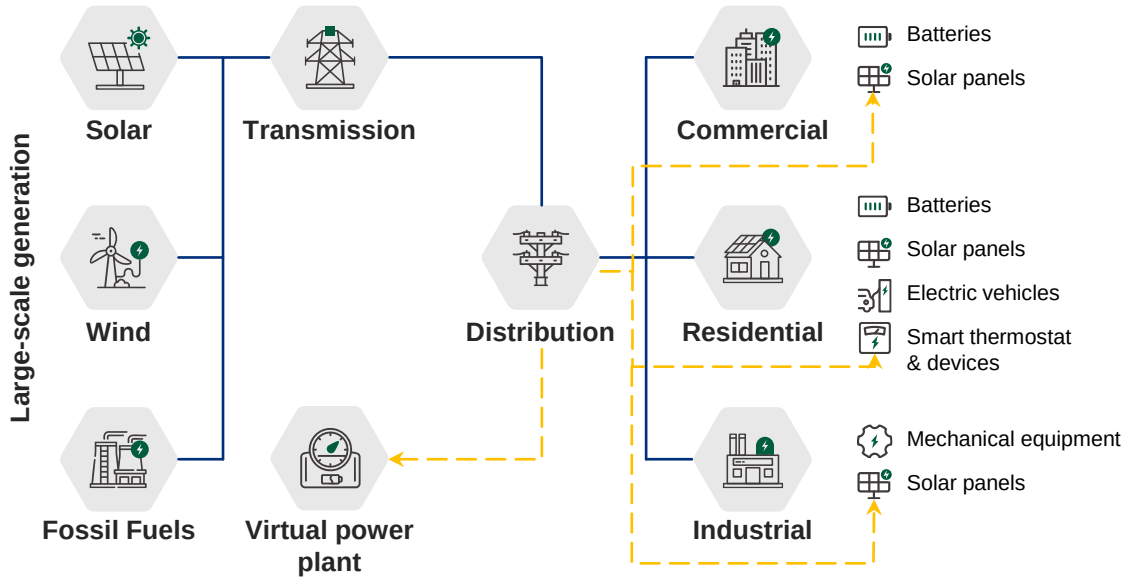
Whole-sale arbitrage (spot Market)



- **Whole-sale Arbitrage:** The practice of participating in spot-market by taking advantage of price differences across regions or time periods.

Emerging Applications | Virtual Power Plants (VPPs) and Microgrids

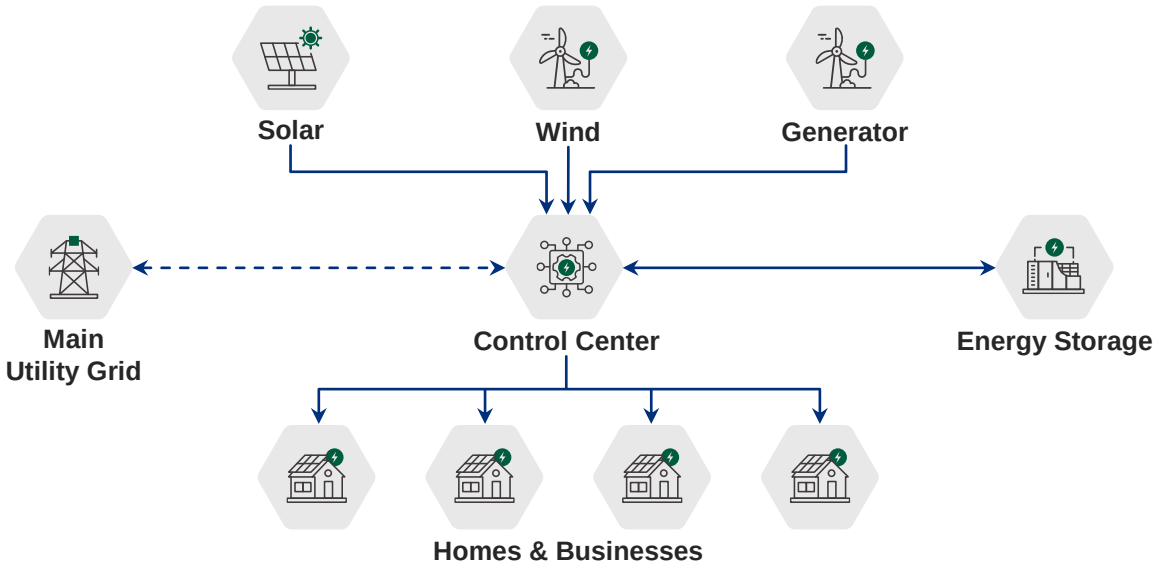
Virtual Power Plants (VPPs)



Reference: DAKOTAELECTRIC Association Website

- **Virtual Power Plant :** An aggregation of decentralized, small-scale energy resources, such as PVs, wind turbines, batteries, and flexible consumers (like electric vehicles), operating as a single, unified power plant

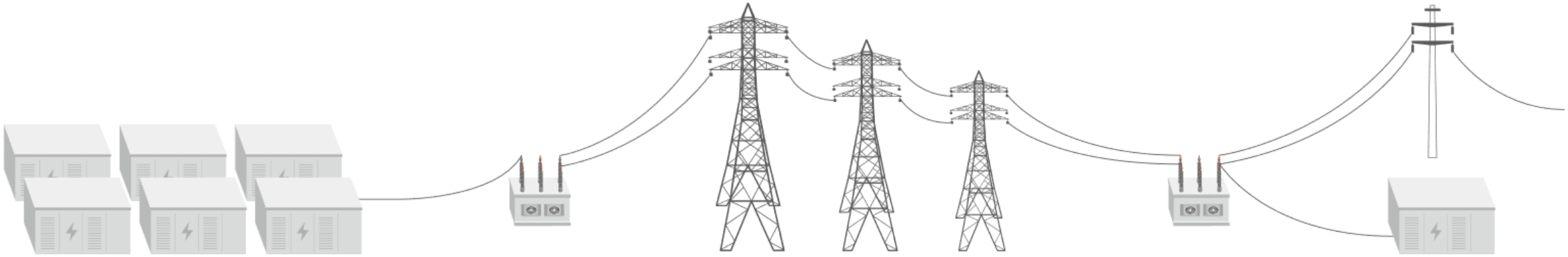
Microgrids



Reference: Mayfield Renewable website

- **Microgrid:** It is a localized network of energy sources (e.g., PVs, wind turbines, or BESS) and energy consumers that can operate independently or in parallel with larger grid.
- They can operate both as grid-connected and off-grid.

Emerging Applications | How BESS is helping to overcome interconnection bottlenecks



Grid-level Storage

Bulk Energy Services:

- Capacity or resource adequacy
- Solar firming and renewables shifting
- Energy arbitrage
- Curtailment mitigation

Ancillary Services:

- Frequency response
- Ramping or spinning reserve
- Voltage support
- Frequency regulation

Transmission Services:

- Transmission upgrade deferral
- Transmission congestionrelief

Distribution-level Storage

Distribution Services:

- Distribution upgrade deferral
- Volt-VAR control

Reference: Lightsource BP Website

BESS can help address the challenges of increasing renewable integration and support faster permitting and deployment in grid connection applications by delivering services at the following levels:

Bulk Energy Services | **Ancillary Services** | **Transmission Services** | **Distribution Services**

HYPER STRONG

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Welcome to visit us at the smart E Europe at B1.519 on May 7-9

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HyperStrong’s value proposition: A technical outlook

Dr. Stefano G. Alberici

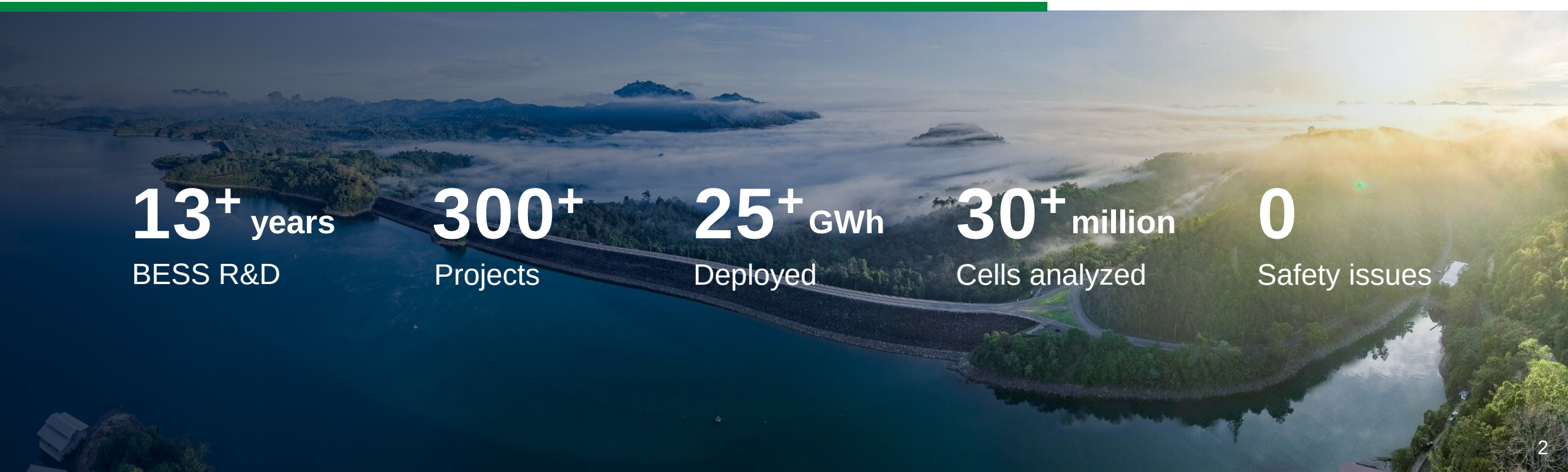
VP Technology EMEA / Country Manager South Europe

28 April, 2025

We dedicated ourselves to BESS for more than a decade since 2011

Since 2011

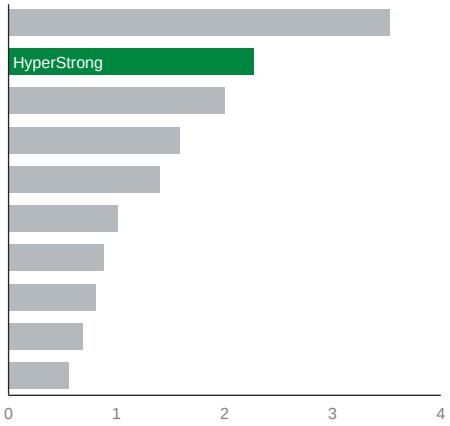
Global Leader in Energy Technology Innovation



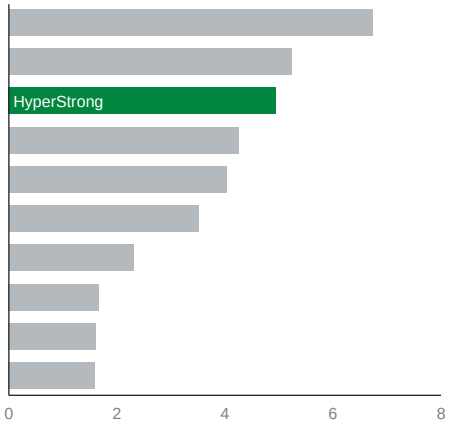
Global leading position with ranking as TOP 3 BESS Integrator

TOP 3
BESS Integrator Globally
Source: S&P Global Commodity Insights

Global BESS capacity installed in 2023 by top 10 integrators (GW)



Global BESS capacity installed in 2023 by top 10 integrators (GWh)



TIER1
Energy Storage Provider

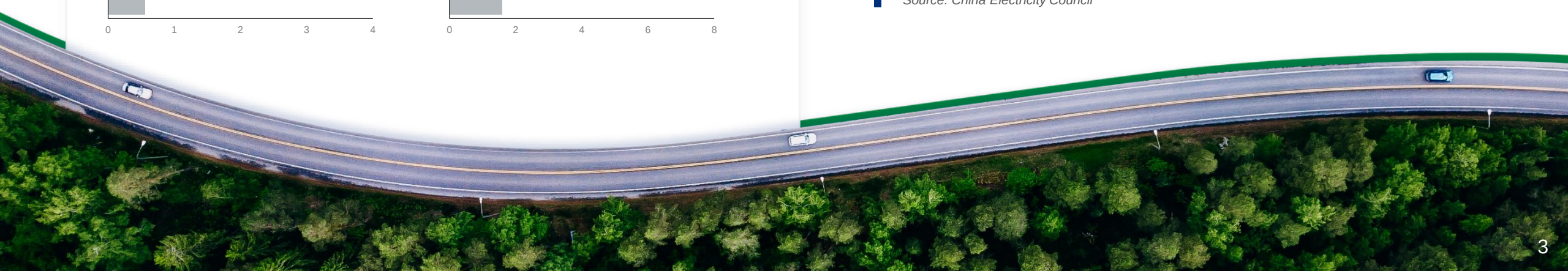
Source: BloombergNEF

NO. 1
BESS Integrator in China (mainland) in terms of cumulative installed and contracted capacity as of July 2024

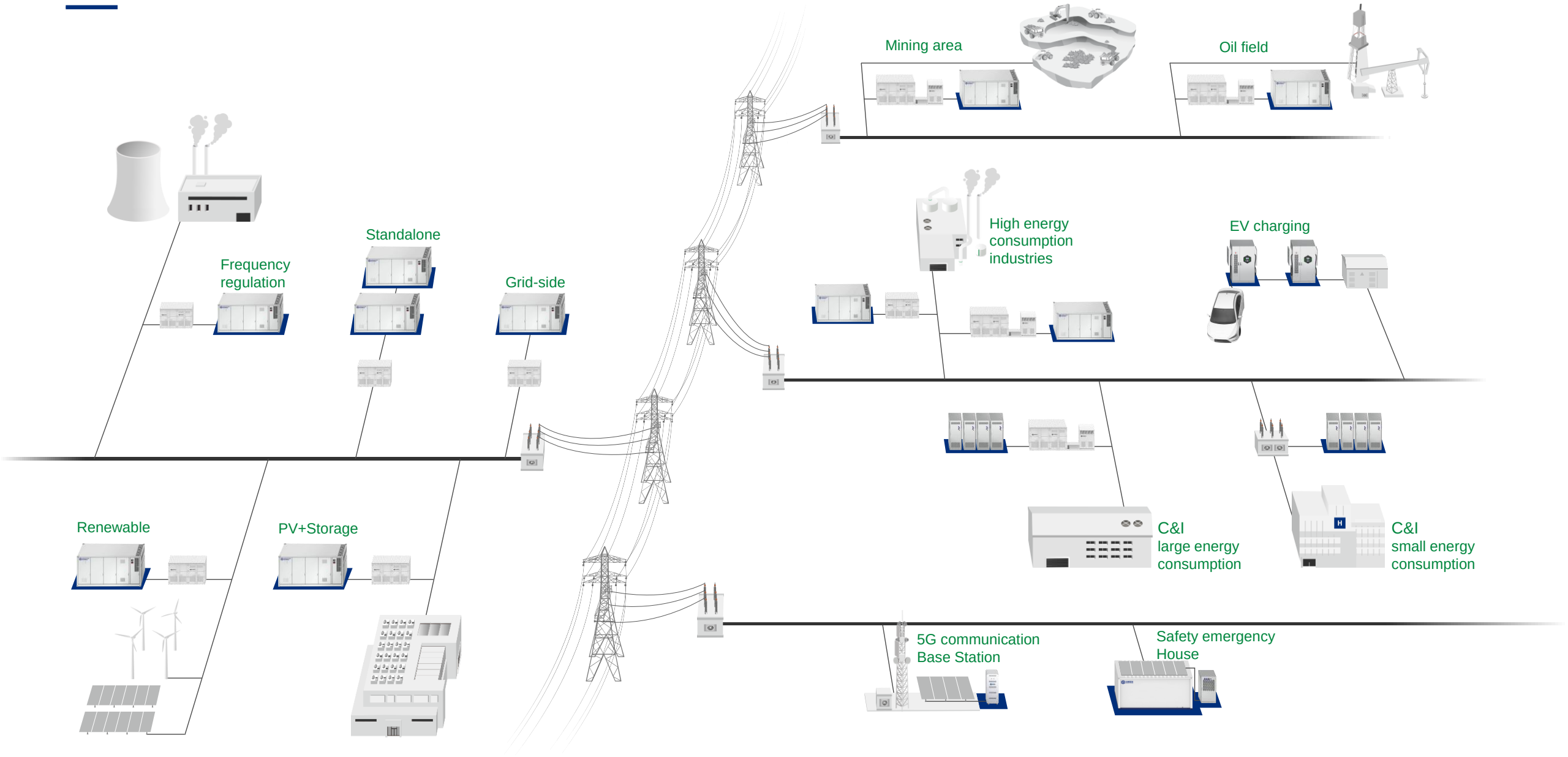
Source: S&P Global Commodity Insights

NO. 1
BESS Integrator in terms of cumulative installed capacity in China as of end of 2024

Source: China Electricity Council

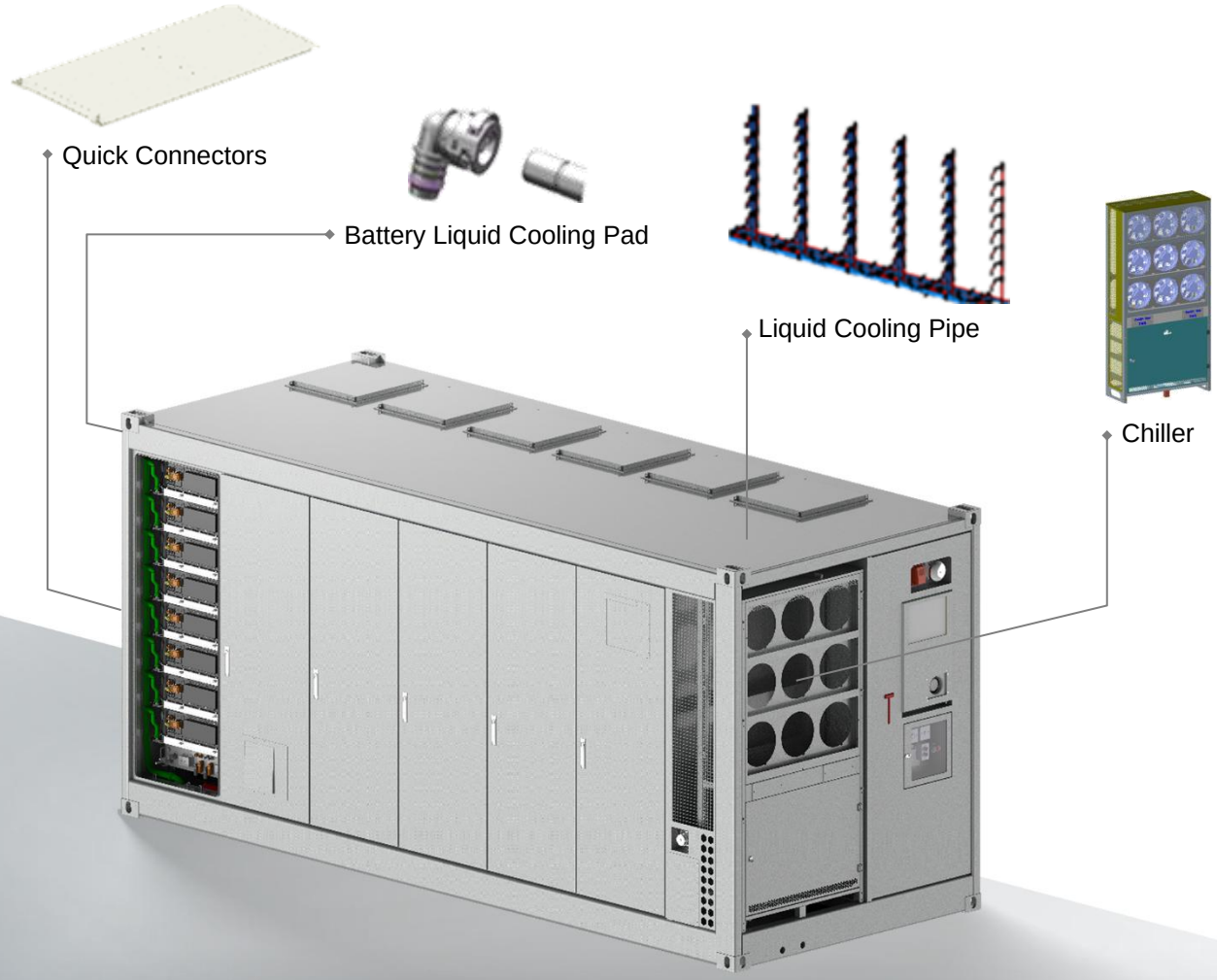


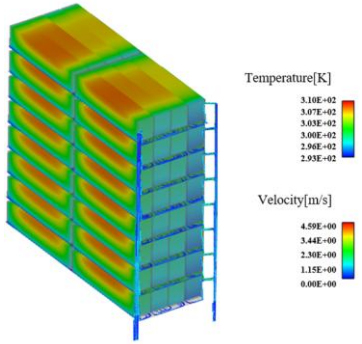
Solutions for all application scenarios



Product Introduction | Liquid-cooling ESS

Thermal management system



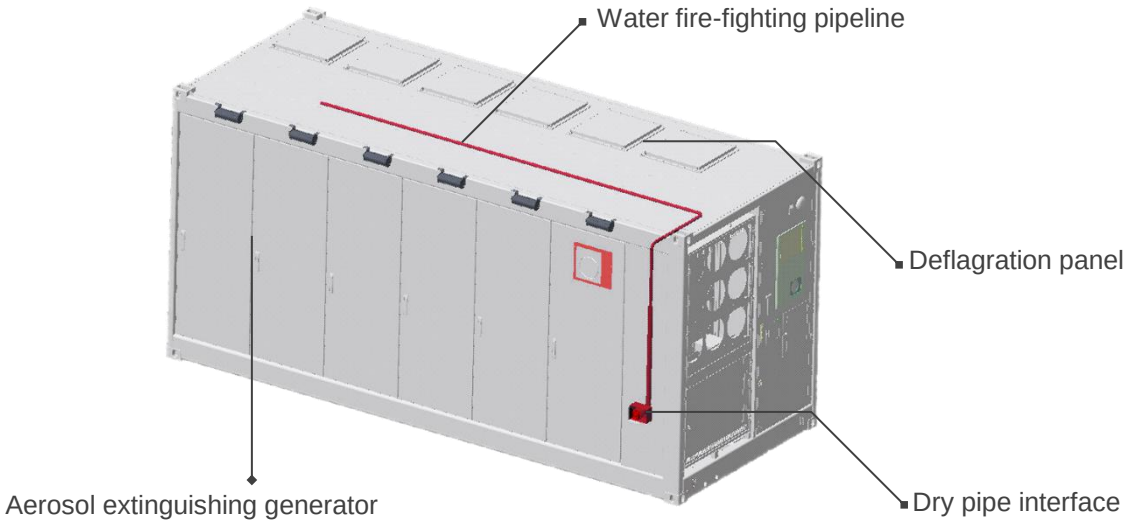


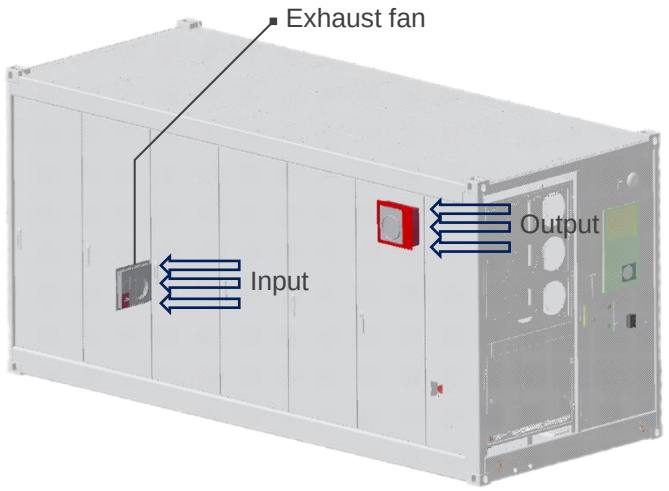
- Temperature difference control brings long life: the system flow is evenly distributed.
- Under 0.5P continuous operation, the maximum temperature of the system is 38℃.
- The temperature difference between **racks < 1℃**, and the temperature difference of **a single system less than 3℃.**
- Environmental adaptation: Except for the parts of the machine unit that are connected to the outside, the whole is protected to IP55, effectively applicable to high salt fog, sandstorm and other harsh conditions.
- Thermal management system is environmentally friendly, with a noise level ≤75dB at 1 meter.

Energy Storage System Solution

Fire suppression system

- Detection & control system
- Aerosol plus dry-pipe fire suppression system
- Venting system & Deflagration panel design

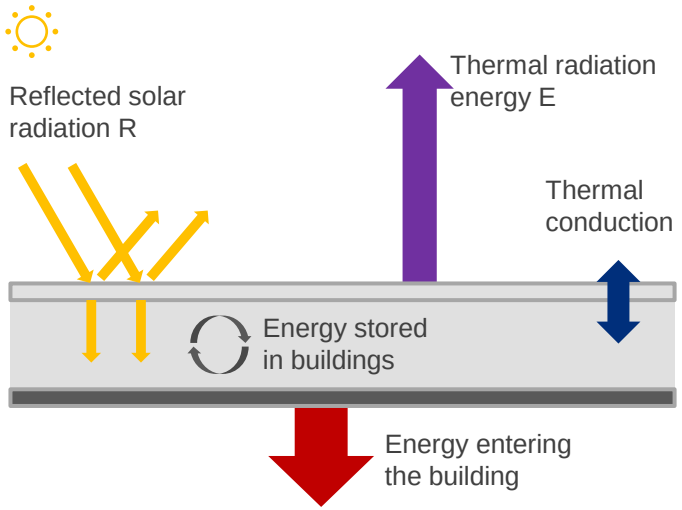




HyperStrong's Thermal Load Management I

Nanometer ceramic reflective thermal insulation and cooling coating

- High reflectivity: Solar reflectivity up to 85-88%, decrease in container surface temperature by 10~15°C.
- Environment friendly: No hazardous waste and gas.



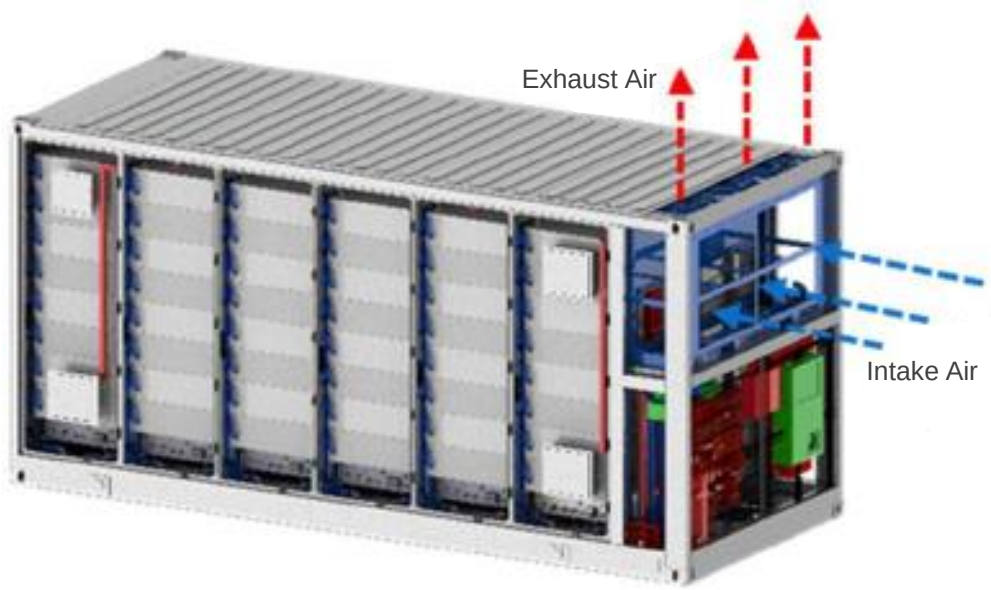
No electricity consume

No refrigeration media

Release heat intocosmic space

Integrated liquid cooling design with Upward air exhaust

- Integrated liquid cooling design, ensures safety, high efficiency, reliability and long lifespan.
- Upward air exhaust, avoid heat island effect, improve system efficiency.

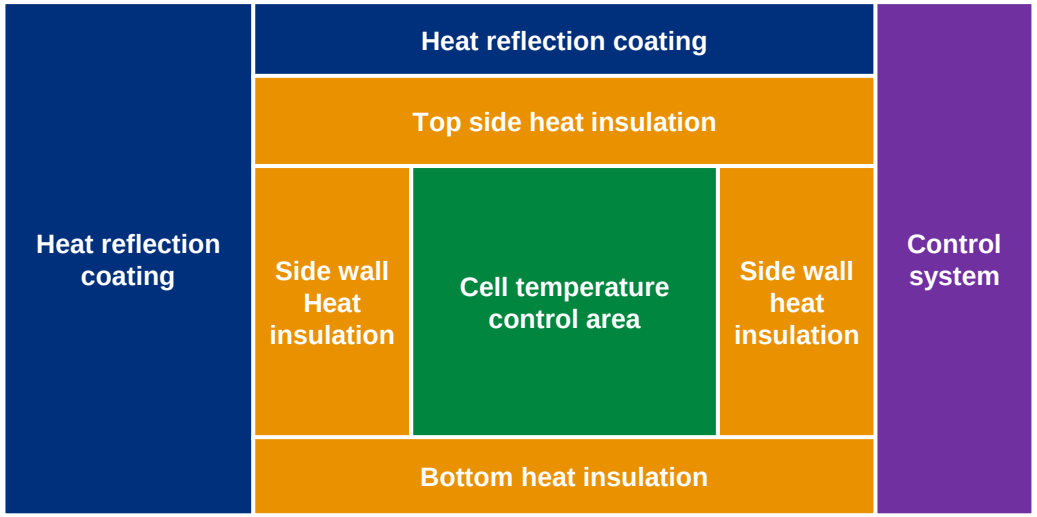


HyperStrong's Thermal Load Management II

Full range temperature and environment control

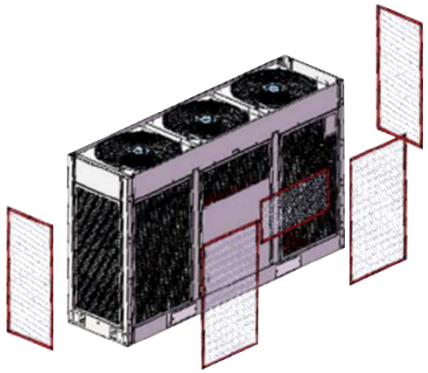
- Multi-layer reflective and heat-insulating design ensure the battery system is free from external environmental influences.

Battery Heating insulation Design



Sand proof KIT and predictive warning

- The liquid cooling unit is equipped with a removable high temperature resistant, long life metal filter, which effectively prevents sand and dust from entering and enables later maintenance.
- The liquid cooling unit has automatic pressure detection and early warning function, and can inteligently remind operation and maintenance cleaning after the dirty filter is blocked.



HyperStrong’s Thermal Load Management III

Heat Island Effect

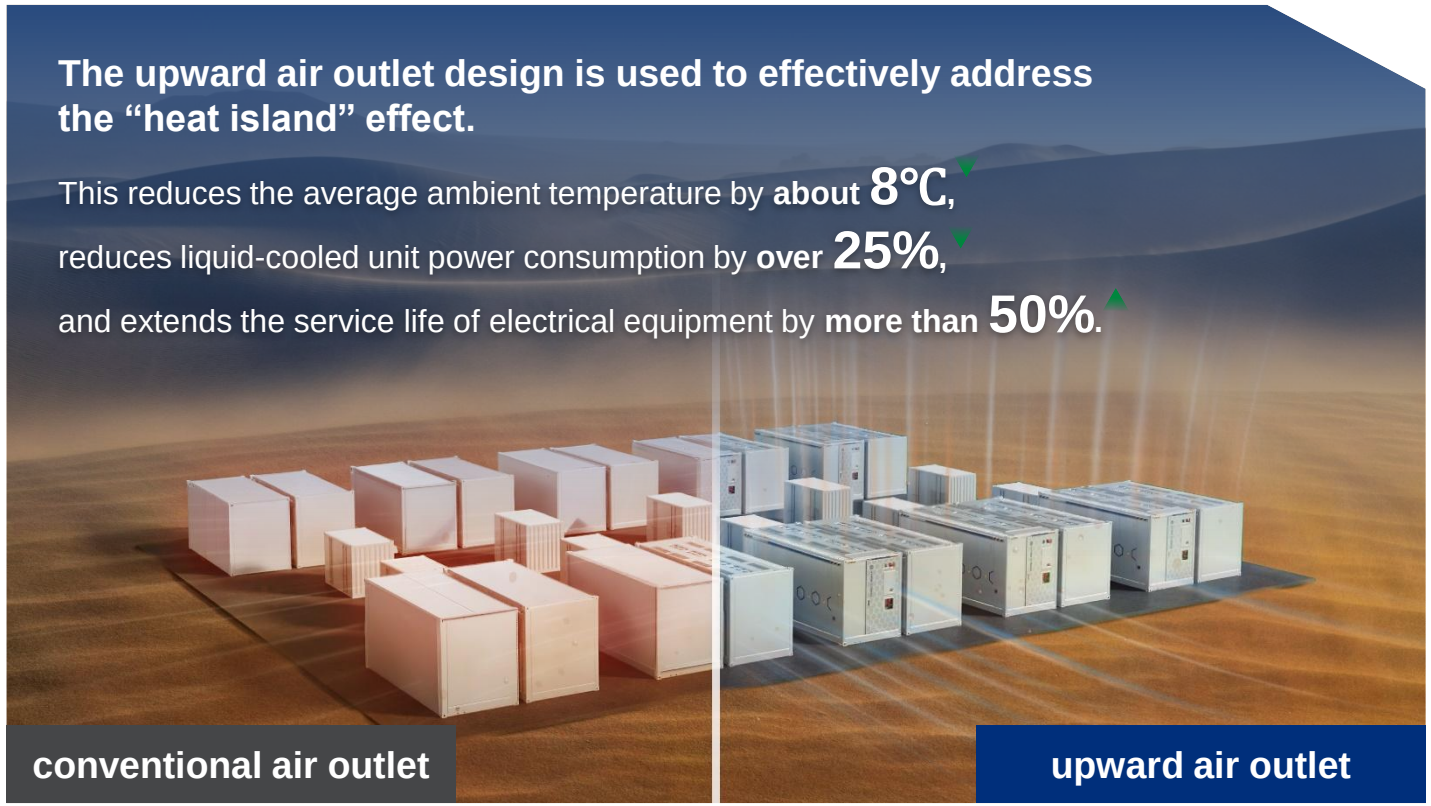
The Urban Heat Island Effect (UHIE) is when an area's temperature is higher than its surroundings, measured as the temperature difference (heat island intensity) between two representative measurement points.

Negative Impact

In energy storage stations, the compact layout includes many heat-generating components like liquid cooling units, transformers, and PCS. The overlapping temperature control systems cause localized high temperatures and hot air recirculation.

Advantages of our products

From the start of product design, we address this by combining liquid cooling with the upward air outlet. This prevents interference between key cooling components and effectively eliminates the station-wide heat island effect.



Key Design Points:
Battery compartment upward air outlet design.

Advantages:
Reduce surrounding temperature, improve system efficiency and equipment lifetime.
Optimize the station layout and increase the energy density of the whole station.

HyperStrong’s Thermal Load Management IV

Kashgar
65MW/260MWh

Sandy & Extreme temperature difference -30.0~40.0℃

Bayingol
75MW/150MWh

Sandy & Extreme temperature difference -25.0~43.2℃

Ush
175MW/700MWh

Sandy & Extreme temperature difference -26.6~35.5℃

Golmud
100MW/200MWh

Sandy & Extreme temperature difference -33.6~35.5℃

Mulei
125MW/500MWh

Sandy & Extreme temperature difference -29.8~37.9℃

Altay
100MW/400MWh

Sandy & Extreme temperature difference -17.0~26.0℃

Utility-Scale ESS Roadmap

8MWh
7MWh
6MWh
5MWh
4MWh

SOP Timeline

HyperBlock II

20HC

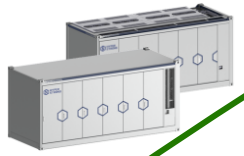
3.72MWh-DC Ver.
CATL 280Ah

Sep 2023

Y2023

Y2024

HyperBlock III



20HC

5MWh-DC Ver.
5MWh-AC Ver.
CATL&EVE 314Ah

Upgrade Point
AC integrated
Greater capacity
Long-lifespan
High-Efficient
Low Capex

Sep 2024 / Mar 2025

Y2025

HyperBlock M

40HC

12.5MWh-DC Ver.
HS587Ah-2h&4h
12.8MWh-AC Ver.
HS 601Ah -4h

Upgrade Point
Super Modular
Mega-Efficient
Ultimate safety System
Super long lifespan
Minimal maintenance
AI-driven
Grid-Forming

Dec 2025 / Jun 2026

Y2026

Y2027

HyperBlock M Plus

40HC

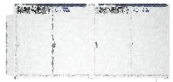
14.X MWh-AC Ver.
650Ah+ -4h/8h

Upgrade Direction
Semi-solid Cell
Active safety Cell and System
New architecture of TMS
2250Vdc System
HV-Cascaded&Grid-Forming

Nov 2027

Y2028

HyperBlock MX



X.X MWh-AC Ver.
1XXXAh -4h/8h

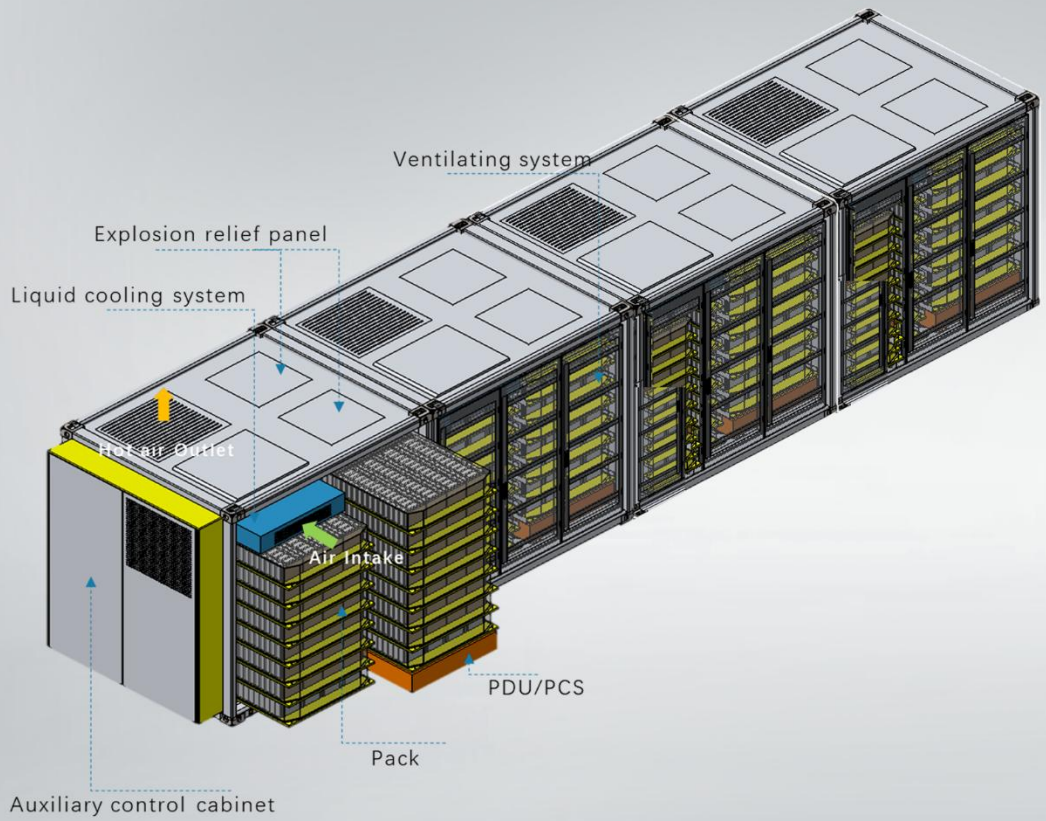
Upgrade Direction
All-solid-state Cell
Sodium-ion Cell
Bionic self-healing Tech
… …

Y2029

HyperBlock M

HyperStrong 4~8h Utility-Scale Energy Storage Solution

3.2MW/12.8MWh AC/DC Integrated ESS



Product Features

Ultra-high safety

"6 Categories - 18 Levels" comprehensive active and passive safety protection design, setting the industry standard for safety

AI-based technology enables thermal runaway early warning 7 days in advance under various operating conditions

The maximum thermal runaway loss is halved from 20HC to 10HC

Ultra-high efficiency

AC ver. RTE≥93@4h, 690Vac

DC ver. RTE≥94%@2h, 1500Vdc;RTE≥96%@4h, 1500Vdc

Liquid cooling unit outlet is located at the top to reduce the heat island effect, reduce the cooling power consumption, and reduce the environmental noise

Ultra-high available capacity

Capacity availability rate >98% within 6 months after FAT

＞10000cls@SoH70%, 0.5P, ensuring a service life of more than 25 years

Ultra-high integration, ultra-high savings

12.8MWh AC/DC Integrated Cabinet Design + "Slider-style" Control Cabinet Design, the entire station area and land capital investment are reduced by 36.8% (compared to 5MWh-DC) and 26.3% (compared to 5MWh-AC)

Ultra-high flexibility

Supports "field-shaped" parallel arrangement

Supports applications from 2h to 8h

Supports maritime, land, and railway transportation

Provide DC cabinet and AC/DC integrated cabinet

Flexible supplement, low replacement cost

Main Product

HyperBlock III - 5MWh Liquid-cooling ESS

Highly integrated

- Up to 5MWh capacity, 34.5% increase in energy density
- Adopting the integrated design of battery rack, PDU, and string PCS
- Compared with the traditional BESS system, the footprint is reduced by more than 5m², and the commissioning time by more than 4h
- Single-side opening design enables back-to-back container installation to optimize space utilization and reduce O&M workload

Safe and reliable

- The Battery dispatching mechanism optimizes battery degradation and controls cell temperature difference within 3℃
- Both pack and system meet UN38.3 vibration and safety requirements, as well as more than 10 other global certifications
- "Intelligent O&M Key V2.0", an intelligent and user-friendly software designed by HyperStrong for the whole life cycle and all application scenarios
- Ensures more than 20 years of safe and stable operation

Outstanding adaptability

- IP Rating: Container IP55 and Pack IP65
- Intelligent thermal management system guarantees system optimal performance
- Extensive environmental options and intelligent fault preventions ensures continuous system operation

Highly secure

- Multi-dimensional sensors enable intelligent sensing of potential thermal runaway
- Multi-level intelligent AI control, unit-level UL9540A,UL9540 and cabin-level aerosols ensure the overall safety of the BESS

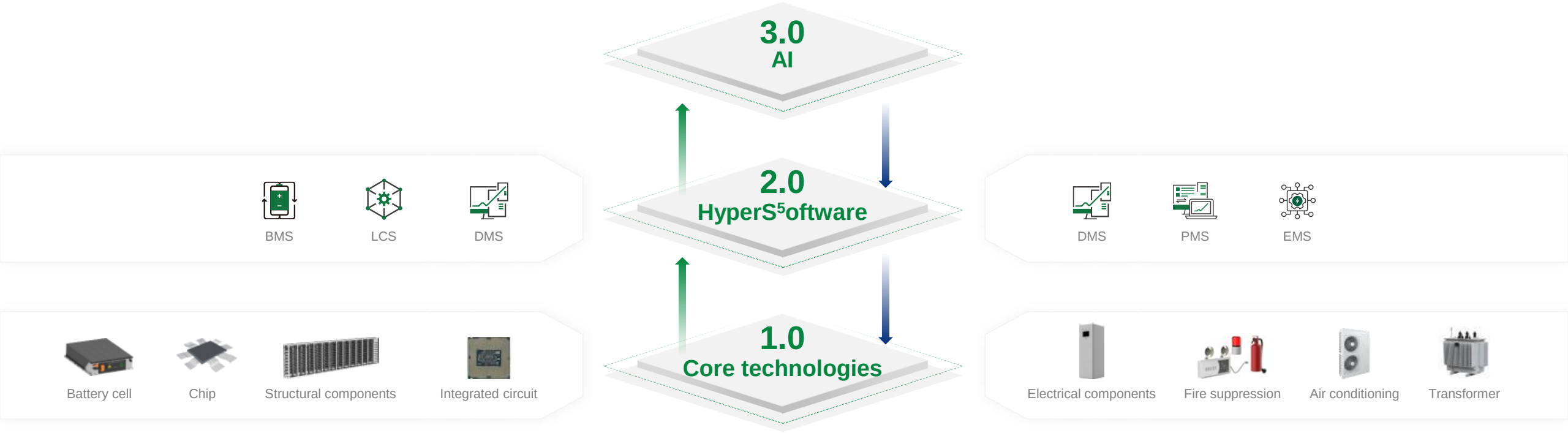
Standalone · **Renewables** · **Frequency Regulation** · **C&I**

Key differentiators in HyperStrong's value proposition: what we boast

1. Area saving by a back-to-back and side-by-side mechanical layout
2. Our "Open Architecture" lets us to adopt different battery cell and MV products manufacturers, depending on the actual customer needs
3. Thanks to our thermal management and system optimization, battery lifetime extends to more than 12000cls with SoH>60% (commonly accepted definition of EoL)
4. A centralized O&M office located in Frankfurt lets us manage the BESS plants wherever located in Europe
5. BESS 3.0 era: take full automatic control of the whole system **by AI**

Entering the BESS 3.0 era with embedded AI technologies, creating diverse long-term value for customers

Safe + Low LCOS + Efficient + Reliable + Longevity + Smart = HyperStrong



Integrated energy applications

Power safety and security

Grid ancillary services

Renewable energy generation

Main certifications so far (not exhaustive)

Level	Certification	Content
Cell	IEC 62619	Safety requirements for secondary lithium cells and batteries, for use in industrial applications
	UL 1973	Standard for Batteries for Use in Stationary, Vehicle Auxiliary Power, and Light Electric Rail (LER) Applications
	UL 9540A	Test Method for Evaluating Thermal Runaway Fire Propagation in Battery Energy Storage Systems
	UL 1642	Standard for Lithium Batteries
	UN 38.3	UN Manual of Tests and Criteria, Part III, Sub-section 38.3 - Lithium metal and lithium ion batteries
	MSDS	Material Safety Data Sheet
	RoHS	Restriction of Hazardous Substances Directive (2011/65/EU)
BMS	IEC60730	Automatic Electrical Controls
	IEC 61000	Electromagnetic Compatibility (EMC)
Battery Racks	IEC 62477	Safety Requirements for Power Electronic Converter Systems and Equipment
	IEC62619	Safety requirements for secondary lithium cells and batteries, for use in industrial applications
	UL 1973	Standard for Batteries for Use in Stationary, Vehicle Auxiliary Power, and Light Electric Rail (LER) Applications
	UL 9540A	Test Method for Evaluating Thermal Runaway Fire Propagation in Battery Energy Storage Systems
	UN 38.3	UN Manual of Tests and Criteria, Part III, Sub-section 38.3 - Lithium metal and lithium ion batteries
	IEC 63056	Safety requirements for secondary lithium cells and batteries for use in electrical energy storage systems
System&Container	IEC 61000	Electromagnetic Compatibility (EMC)
	IEC 62477-1	Safety requirements for secondary lithium cells and batteries, for use in industrial applications
	UL 9540	Container Level system Thermal Runaway Fire Propagation
	UL 9540A	Test Method for Evaluating Thermal Runaway Fire Propagation in Battery Energy Storage Systems
	UN 38.3	UN Manual of Tests and Criteria, Part III, Sub-section 38.3 - Lithium metal and lithium ion batteries
	IEC62933-5-2	Electrical Energy Storage (EES) Systems - Part 5-2: Safety Requirements for Grid-Integrated EES Systems
	NFPA 69	Standard on Explosion Prevention Systems
	NFPA 68	Standard on Explosion Protection by Deflagration Venting
	NFPA 855	Standard for the Installation of Stationary Energy Storage System
	Arc Flash-NFPA70E	Standard for Electrical Safety in the Workplace
	Anti-seismic performance	Zone 3

HYPER STRONG

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Welcome to visit us at the smart E Europe at B1.519 on May 7-9

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Unlocking BESS potential in the EU: Driving grid resilience and innovation

Q&A

28 April 2025
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9:00 am – 10:00 am | BST, London

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10:00 am - 11:00 am EDT, New York City

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4:00 pm – 5:00 pm CEST, Berlin
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