

Comtec Intelligent Power Technology (Shanghai) Co., Ltd.

HIGH-EFFICIENCY ENERGY STORAGE SYSTEMS



China
Comtec Intelligent Power Technology (Shanghai) Co., Ltd.
No. 1112 Hanggui Road, 15th floor, room 1501
Jiading district, Shanghai
Tel: +86 18964305302
Email: sales@comtecpower.cn





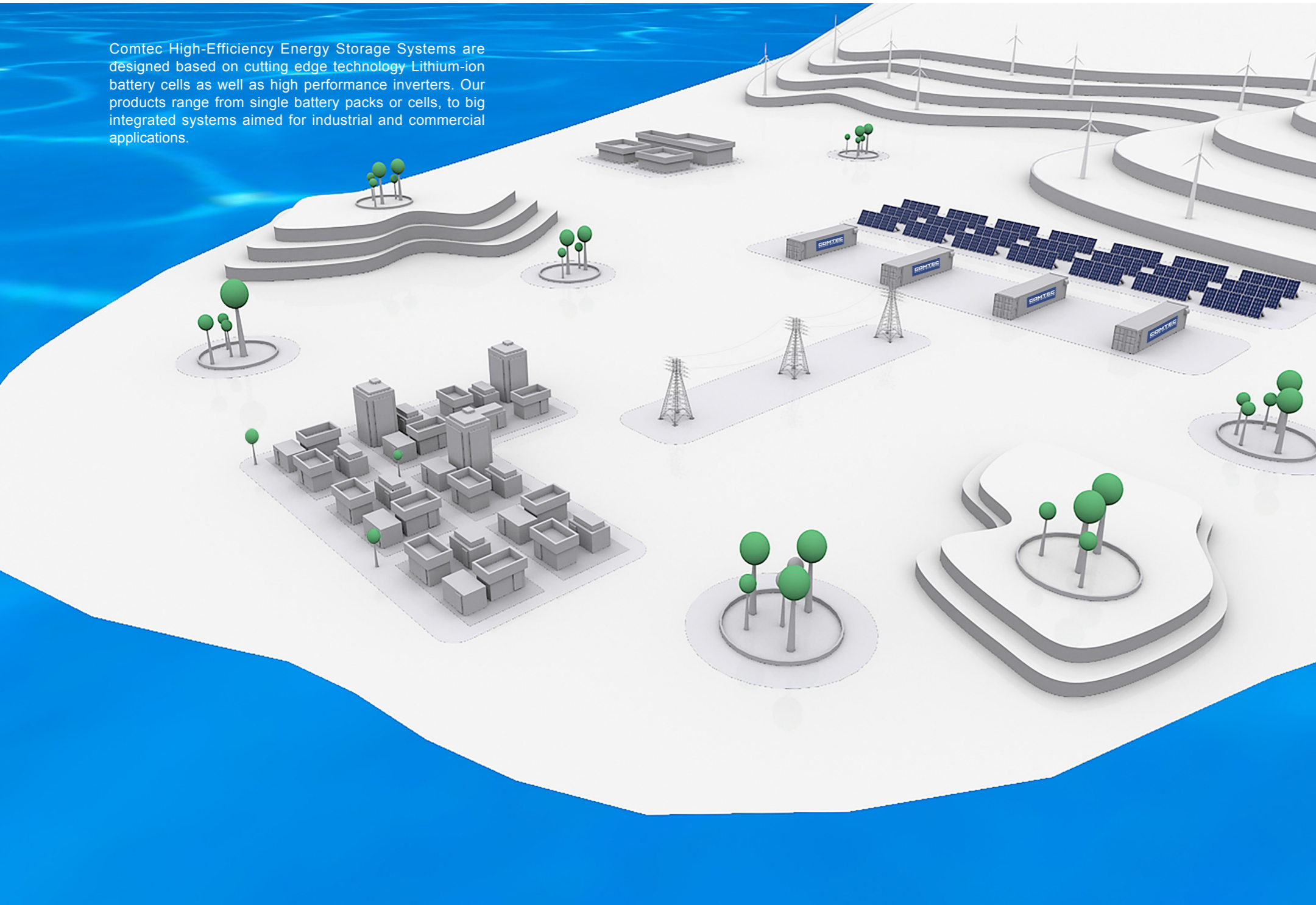
From Green Energy Generation
To Green Energy Storage

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Energy Storage Products

Comtec High-Efficiency Energy Storage Systems are designed based on cutting edge technology Lithium-ion battery cells as well as high performance inverters. Our products range from single battery packs or cells, to big integrated systems aimed for industrial and commercial applications.



System characteristics:

- 1 High performance, large capacity, long-lifespan Lithium iron phosphate batteries
- 2 Digital control, unattended automatic operation
- 3 Comprehensive, reliable monitoring system, strong data processing and transmission capabilities user-friendly interface
- 4 High performance bi-directional converters, with high speed, precision and stability characteristics
- 5 Equipped with a reliable fault protection unit with fault self-diagnosis abilities

Industrial and Utility Scale Integrated Systems

Industrial Scale Products

PRODUCT	CHEESS-I1	CHEESS-I2	CHEESS-I3	CHEESS-I4	CHEESS-I5
Power	18 kW	36 kW	50 kW	100 kW	250 kW
Energy	43 kWh	74 kWh	98 kWh	197 kWh	553 kWh
Battery packs	7	12	16	32	90
Container	20'	20'	20'	20'	40'
Charge/discharge rates	0.5 C	0.5 C	0.5 C	0.5 C	0.5 C
Typical Applications	Fuel saving, Microgrids, Unstable grids				

High-Energy Products

PRODUCT	CHEESS-E1	CHEESS-E2	CHEESS-E3	CHEESS-E4	CHEESS-E5
Power	50 kW	100 kW	250 kW	500 kW	1 MW
Energy	221 kWh	522 kWh	995 kWh	2.212MWh	5.069 MWh
Battery packs	36	85	162	360	825
Container	20'	40'	40'	2x 40'	5x 40'
Charge/discharge rates	<0.25 C	<0.25 C	<0.25 C	<0.25 C	<0.25 C
Applications	Renewables, Off-grid systems, Energy shift applications				

High-Power Products

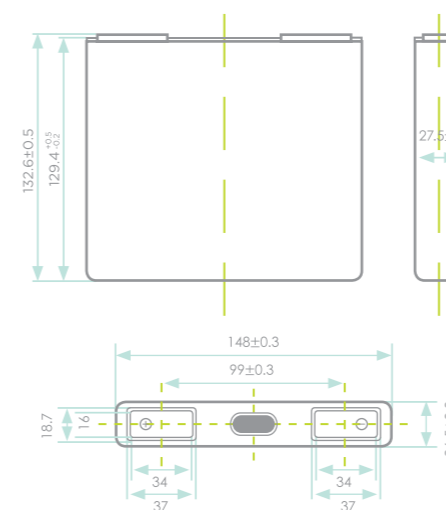
PRODUCT	CHEESS-P1	CHEESS-P2	CHEESS-P3	CHEESS-P4	CHEESS-P5
Power	100 kW	250 kW	500 kW	1 MW	2 MW
Energy	98 kWh	111 kWh	221 kWh	332 kWh	664 kWh
Battery packs	16	18	36	54	108
Container	20'	20'	20'	40'	40'
Charge/discharge rates	>1 C	>2 C	>2.5 C	3 C	3 C
Applications	Frequency regulation, Power demanding equipment, Peak trimming				

Battery Cells

Our systems utilize Lithium Iron Phosphate Cells, which are designed for optimal performance, longevity and safety, proving high discharge currents and cycle life of more than 6000 cycles.

Battery Cell Parameters

PARAMETER	VALUE
Model	EFP27148130 (3.2V 40Ah)
Nominal voltage	3.2 V
Nominal capacity	40 Ah
Rated energy	128 Wh
Rated energy	3C
Maximum continuous charge current	5C
Weight	1035g
Dimensions	148*27.5*132.6mm (L*W*H)
AC Resistance	≤0.8mΩ
Cycle life (High-Energy systems)	>6000 cycles



▲ Cell dimensions



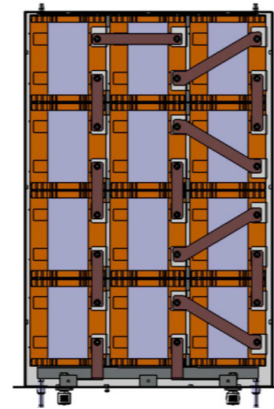
▲ A battery cell

Battery Packs

Our main battery pack product contains a total of 48 battery cells connected in a 4P1S configuration. Its operation is controlled by our specialized battery management system (BMS) to ensure its safety as well as maximize its performance.

▼ Battery Pack Parameters

PARAMETER	VALUE
Battery cell specification	EFP27148130 (3.2V 40Ah)
Battery group connection	4P12S
Distribution voltage tolerance	≤5 mV
Distribution capacity tolerance	0.4 Ah
Distribution resistance tolerance	0.1 mΩ
Nominal voltage	38.4 V
Nominal capacity	160 Ah
Rated energy	6144 Wh
Discharge cut-off voltage	33.6 V
Charging cut-off voltage	43.2 V
Dimensions	482×140×730 mm (W×H×D)
Weight	65 kg



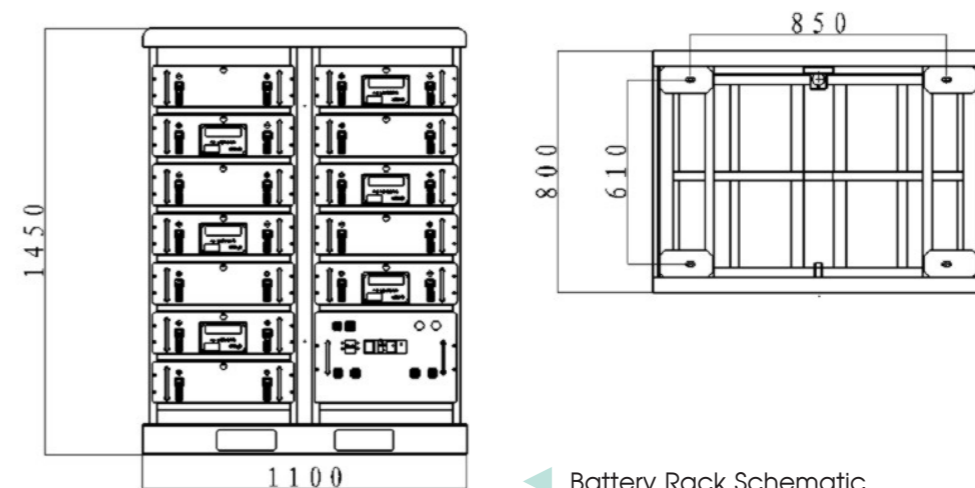
▲ Battery pack inner configuration

Battery Racks and Energy Cabinets

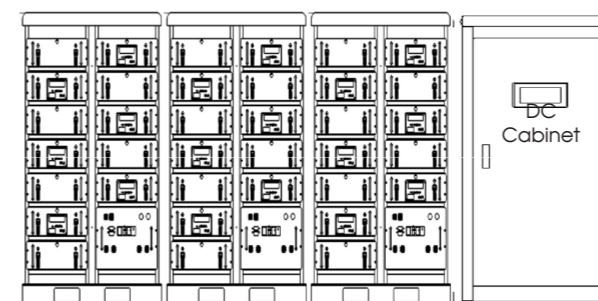
Battery racks and Cabinets are formed by connecting in series individual battery packs. Each Battery rack also contains the necessary supporting frame, connectors, switches, fuses as well as a master battery management unit (MBMU) that controls and directs the operation of the individual battery packs. The special designed cabinets also offer the option of an integrated display and control panel, which is optimal for stand-alone energy systems.

▼ Battery Rack Parameters

PARAMETER	VALUE
Composition	up to 27 battery packs in series
Nominal voltage	345.6 V to 1036.8 V
Nominal Capacity	160 Ah
Nominal Energy	55 to 166 kWh
Dimension (12 Pack-Rack)	1100*1450*800 mm (W*H*D)
Weight (12 Pack-Rack)	800kg



← Battery Rack Schematic



▲ Layout of a 200kWh System



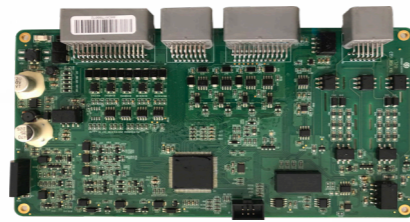
▲ A Battery Pack

Battery Management System (BMS)

Our BMS is designed to monitor, evaluate and protect the energy storage system as well as enhance its performance. The BMS operates at all different levels of the energy storage system from individual cells and battery packs, all the way to the complete system.

FEATURES

- Cell balancing and equalization
- Individual cell monitoring
- Fault detection and prevention
- Energy utilization optimization
- Real-time remote monitoring and control



▲ Battery Management System

▼ BMS Parameters

ITEM	SPECIFICATION
Power supply	18~32V
Single voltage collection range	0~5V
Unit voltage collection tolerance	≤±3mV
Current collection range	≤300A
Current collection tolerance	≤±1%
Temperature collection tolerance	≤±1°C
Voltage collection period	≤5ms
Current collection period	≤1ms
Temperature collection period	≤5ms
Equalizing current	1.2A
SOC estimated value	≤5%
Protection	over-charge, over-discharge, over-temperature, etc.
Communication with PCS	RS485
Communication with monitoring system	Ethernet
Event record storage	≥10000 items
Historical data storage	≥10 days

Power Conditioning System

Our systems utilize bi-directional converters ranging from 18kW to 1MW.
Communication with the battery management system ensures safety and optimal performance of the whole system.

Energy Storage System's AC Side Characteristics

PRODUCT	CHEESS-I1	CHEESS-I2	CHEESS-I3 CHEESS-E1	CHEESS-I4 CHEESS-E2 CHEESS-P1	CHEESS-I5 CHEESS-E3 CHEESS-P2	CHEESS-E4 CHEESS-P3	CHEESS-E4 CHEESS-P4
Nominal power	18kW	36kW	50 kW	100 kW	250 kW	500 kW	1000 kW
Max. AC power	20kVA	40kVA	55 kVA	110 kVA	275 kVA	550 kVA	1100 kVA
Max. AC current	26.1	52.2	79 A	159 A	397 A	1008 A	1176 A
Max. THD	< 3%	< 3%	< 3%	< 3%	< 3%	< 3%	< 3%
DC Component	<1%	<1%	< 0.5%	< 0.5%	< 0.5%	< 0.5%	< 0.5%
Nominal grid voltage	400V	400V	400 V	400 V	400 V	315 V	540 V
Grid voltage range	324-436	324-436	310 - 450 V	310 - 450 V	310 - 450 V	252 - 362 V	432 ~ 621 V
Nominal grid frequency	50 Hz	50 Hz	50 / 60 Hz	50 / 60 Hz	50 / 60 Hz	50 / 60 Hz	50 Hz / 60 Hz
Grid frequency range	47.55-51.45 Hz	47.55-51.45 Hz	45-55 Hz, 55-65 Hz	45-55 Hz, 55-65 Hz	45-55 Hz, 55-65 Hz	45 - 55 Hz, 55-65 Hz	47-55 Hz, 55-65 Hz
Power factor at nominal power	>0.99	>0.99	>0.99	>0.99	> 0.99	> 0.99	>0.99
Power factor range	0.95 (leading) 0.95 (lagging)	0.95 (leading) 0.95 (lagging)	0.9 (leading) 0.9 (lagging)	0.9 (leading) 0.9 (lagging)	0.9 (leading) 0.9 (lagging)	0.9 (leading) 0.9 (lagging)	0.9 (lagging) 0.9 (leading)
Maximum efficiency	>97%	>97%	96.00%	97.30%	97.30%	98.20%	98.40%

Experience

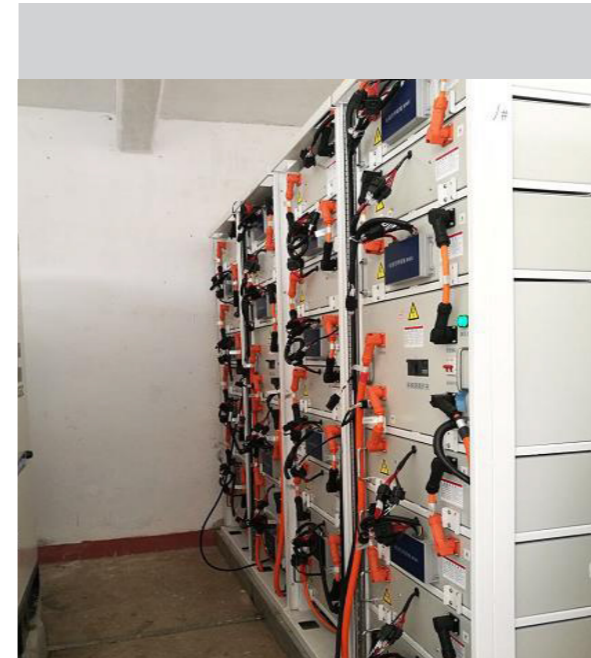
In 2017 Comtec has successfully completed several energy storage projects ranging from few hundred kWh to few MWh of energy storage.

Past Projects

Lunshi Technology Dingbian Energy Storage Power Station Phase I

Total capacity: 5MW/10MWh (Comtec won 1MW/2MWh)
Completion time: July 2017

The project includes photovoltaic power generation, energy storage units, energy management system as well as other microgrid elements. The system is used for car charging, generating photovoltaic power, energy shifting (taking advantage the hourly electricity price difference) and other microgrid applications.



Long Island County, Shandong Province, micro grid project

Total capacity: 500KW/1MWh
 (energy storage system part)
Completion time: August 2017

The three islands involved in this project are disconnected from the mainland grid, their power generation is covered by diesel generators, which are inefficient and expensive. The energy storage system together with the solar energy generation is used to reduce the fuel consumption as well as optimize the performance of the power generation system of the islands.

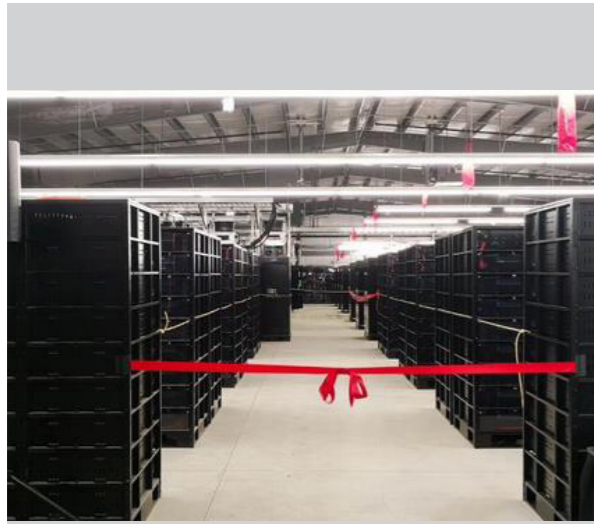


State Power Nanfang New Energy Microgrid Demonstration Project in Jiangning Park

Total capacity: 100KW/200KWh
Completion time: March 2017

The project includes photovoltaic power generation, energy storage units, energy management system as well as other microgrid elements. The system is used for car charging, generating photovoltaic power, energy shifting (taking advantage the hourly electricity price difference) and other microgrid applications.





Canadian Grid Service Energy Storage

Total capacity:54.5MWh
Completion time:July 2017

In December 2017 the largest (54.5 MWh) grid connected energy storage system in North America began its operation in Toronto, Canada. For this project our company has designed, built and commissioned a total of 8871battery packs and had a customer acceptance rate of 100%



Zhenjiang Public Transportation Corporation's Bus-Charging station

Total capacity: 5MW/10MWh
Completion time:March 2017

Due to electric buses being increasingly popular nowadays many large charging stations have been established. Bus-charging stations must rapidly recharge the bus batteries, which creates a very high power demand. Our energy storage system is balancing the loads of the charging station, "peak shaving" the high power demand and "load deferring" help to optimize the performance of the station as we as significantly reduce its electricity bill.



Japan Sendai Electric Power Research Institute Photovoltaic Demonstration Project

Total capacity: 100KW/300KWh
Completion time:April 2017

In February 2017 after successfully bidding in its tender for the project, our company has designed, built and commissioned it within two months. The energy storage system enables our customers to use more intelligent energy services, improve their power quality, and enjoy economic benefits.



Tianjin Highway Service Area Storage Project

Total capacity:250KW/500KWh
Completion time:May 2017

The project is located at the service area on the northern side of Xuguantun of Beijing-Tianjin-Tanggu expressway, it contains a photovoltaic installation of 292.1kWp and energy storage of 500KWh. The system provides green energy throughout the day to the service area.

This project has won a TOP10 price for Energy Storage Application Innovation in the 2017 International Energy Storage Innovation Competition, organized by the State Grid, Xinhua News Agency, China Central Television, Xinhua News, and Phoenix.com

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