

# Tellhow Energy Solution Technology

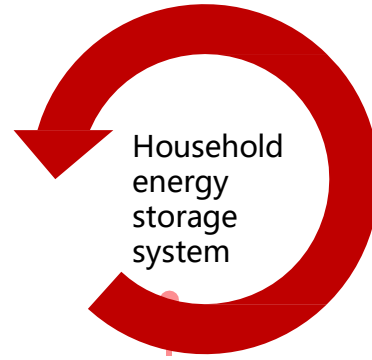
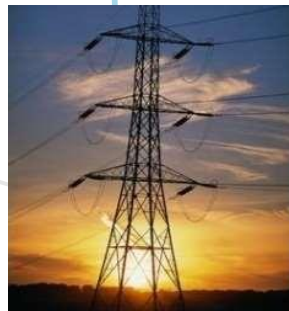
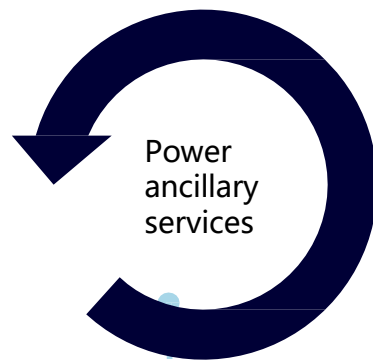
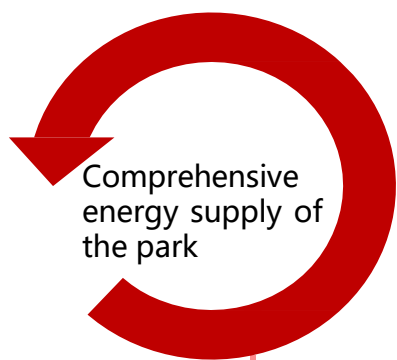
-- Energy storage and frequency modulation aided AGC solution

Tellhow Energy Solution Technology Co., Ltd. (hereinafter referred to as Tellhow EST) is a high-tech enterprise that can rely on its advantages in energy infrastructure and finance to provide users with a full range of smart energy solutions.

Tellhow EST's products and services cover natural gas, solar energy, energy storage and smart grids. At the same time, Tellhow EST relies on the Internet of Things and artificial intelligence technology to independently develop the "Integrated Energy Smart Operation Service Platform" to provide customers with the operation and maintenance of energy assets, maintenance and various value-added services.

The mission of Tellhow EST is to "make energy safer, more efficient and cleaner." Relying on the integrated energy intelligent operation service platform, we will strive to combine the concepts of energy saving, smart grid, Internet, and new energy to lead the transformation of the energy industry and create an advanced "integrated energy intelligent operation service platform".





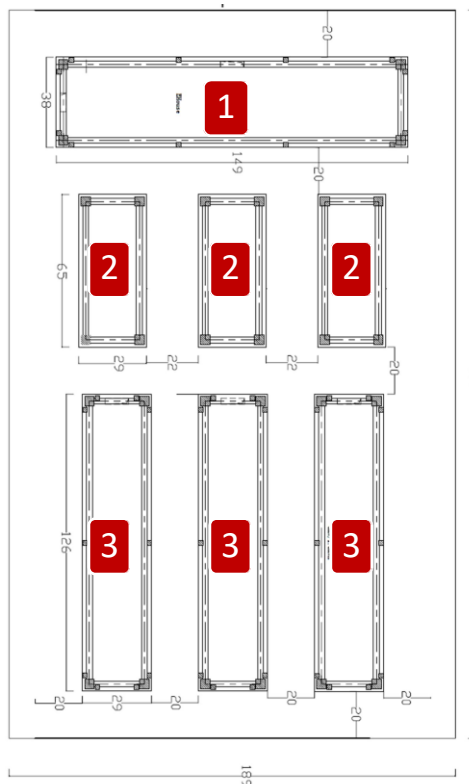


With the development of energy storage technology and technology economy, the application of energy storage system is more and more extensive. Large scale energy storage system has become an important means to ensure the reliable power supply of power system. Especially on the power generation side, through the configuration of energy storage system in the power generation enterprise, it can provide the power grid company with frequency modulation resources that can quickly respond to the power dispatching instructions, ensure the more stable operation of thermal power units in the region, improve the efficiency of primary energy use, reduce the fatigue wear and failure rate of units, and the operation of the energy storage system will not generate additional CO<sub>2</sub> emissions To help power generation enterprises achieve sustainable development.





- ◆ Simple access mode and integrated construction.
- ◆ Highly customized and modular.
- ◆ Reduce the floor area by 40% ~ 50%.
- ◆ The energy storage converter is designed to separate from the battery to ensure the optimal overall performance of the system and the longest battery life.
- ◆ The size between containers is determined according to the site, which can further reduce the maintenance space.



## 1 Ring network switchyard

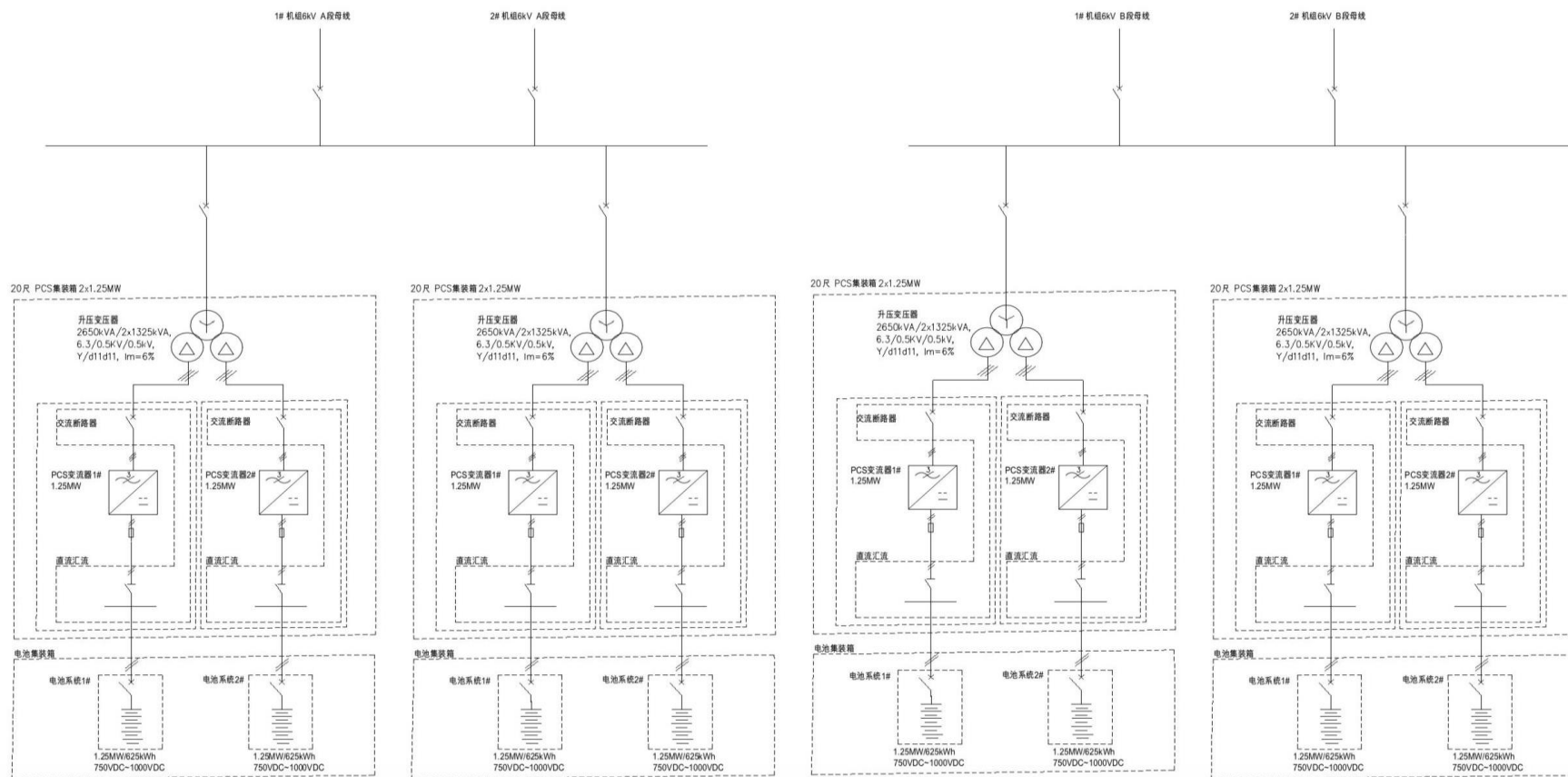
- prefabrication
- Medium and low voltage switch
- Centralized control center

## 2 High voltage energy storage converter

- High voltage switch
- Transformer
- AC / DC protection
- Energy storage converter
- Control system

## 3 Battery system

- Battery Module
- Battery rack
- Air conditioning, fire protection, power distribution and lighting

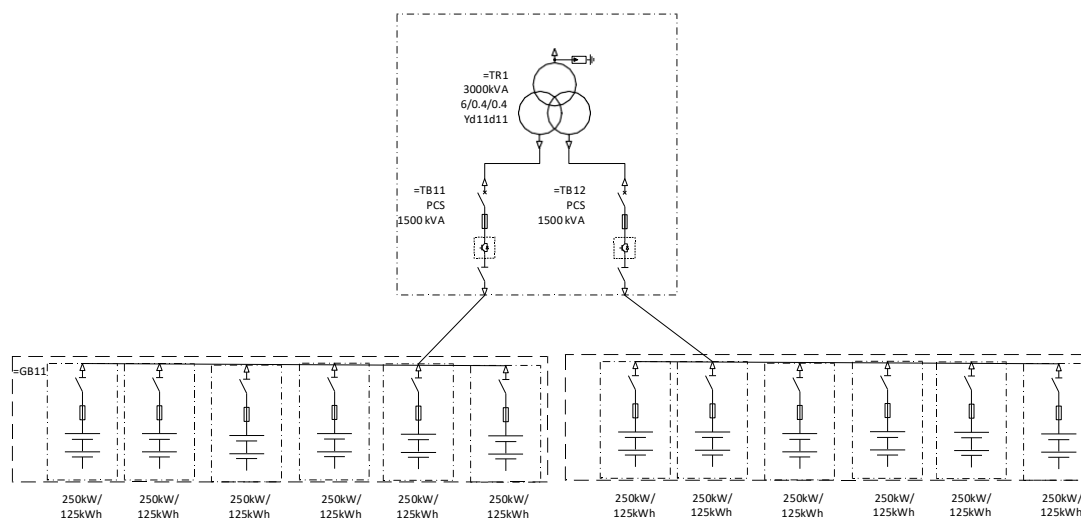


The primary circuit diagram of the energy storage system can only be determined according to the needs and conditions of users

## 9MW/4.5MWh

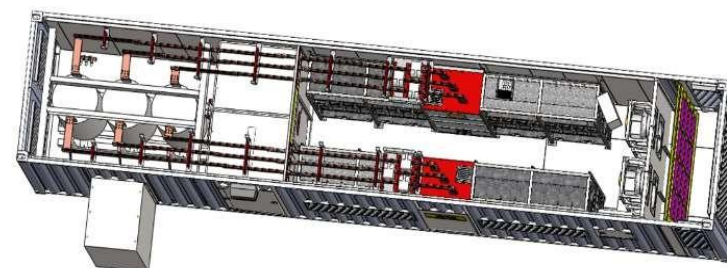
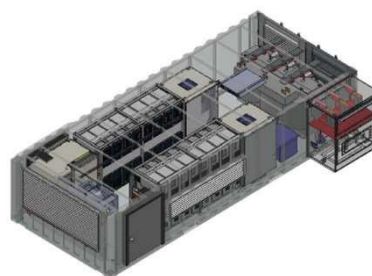
- Energy storage system composition: 9MW / 4.5MWH energy storage system is composed of three 3MW / 1.5MWH energy storage subsystems;
- High safety lithium iron phosphate battery;
- Energy storage subsystem composition: single 3MW / 1.5mwh energy storage subsystem consists of two off 1500kW / 750kwh energy storage unit;
- Battery management system collects and manages batteries

## 3MW/1.5MWH energy storage subsystem





## Outdoor solution : All-in-one SOLUTION

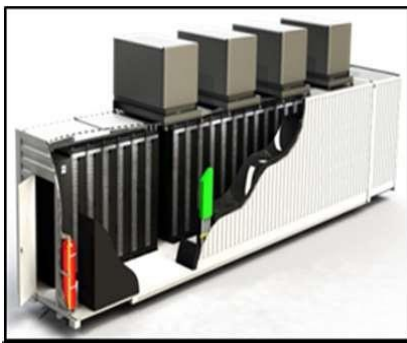






## System

The electrical fault protection is compatible with the downstream protection. Electrical fault protection current / voltage limited inverter full power protection disconnect.



## Container

It controls monitoring and ensures that the operating system is in a safe range and can be powered off if necessary. Each battery cabinet is equipped with an automatic fire extinguishing system.



## Battery cabinet

The automatic switch (contactor) disconnects the rack from the system. The whole frame is equipped with high-voltage fuse.



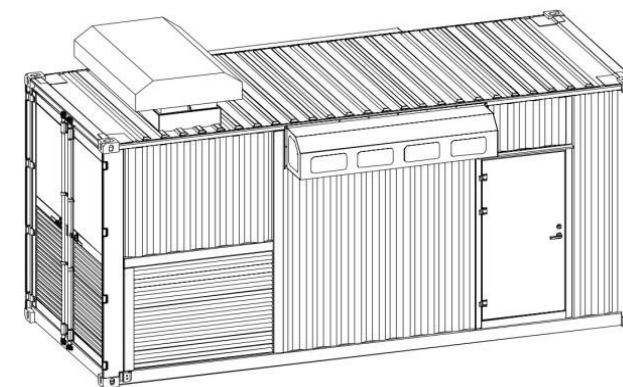
## Module group

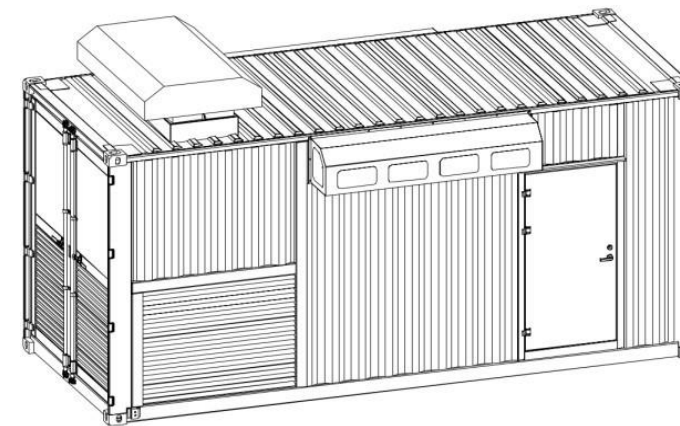
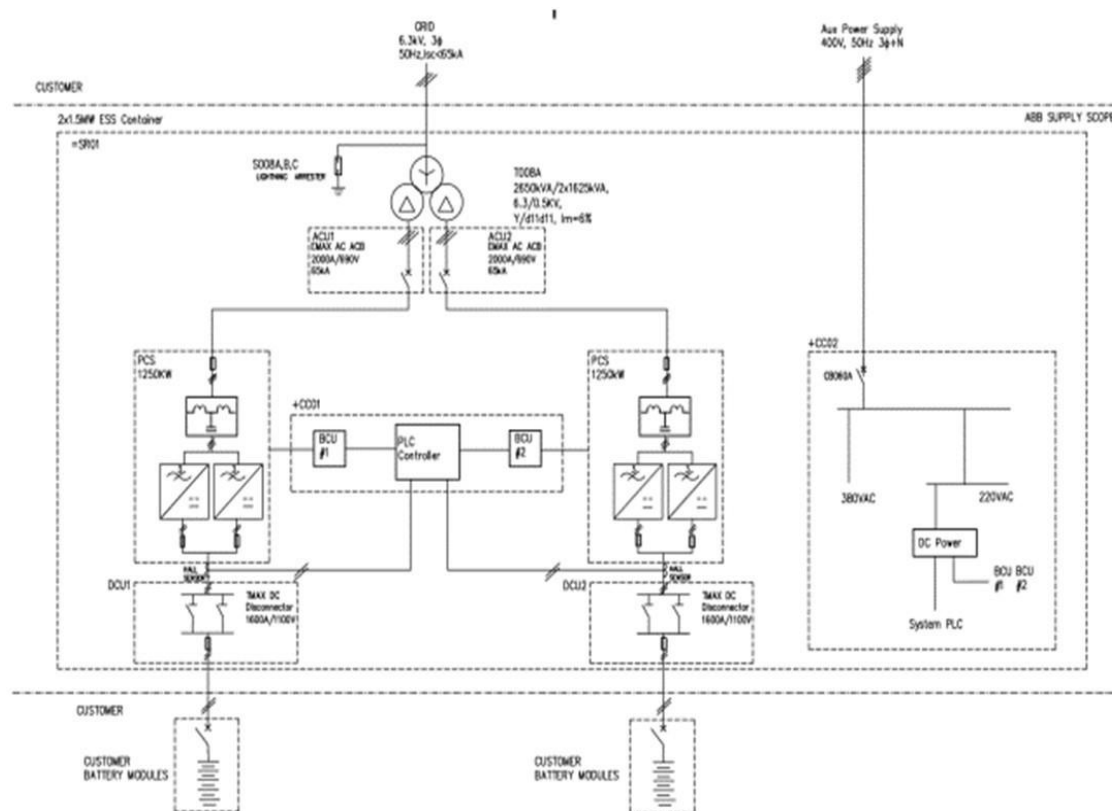
The module monitors the voltage of each cell and the temperature of the module. Integral module level fuse.

# Solution: 3MW energy storage converter

Rated power:	2x1500 kW (charging / discharging power)
DC voltage range:	600-800v DC or 750v-1000vdc, other voltages can be customized
Output voltage of converter:	400V AC or 500V (+ 10% / - 10%, other definitions can be made as required)
Frequency:	50Hz
Harmonic distortion:	< 5% at rated power, meeting the requirements of IEEE 519
Efficiency:	97% at rated power, excluding transformer
Overload capacity:	110% overload, 10 minutes
Enclosure protection:	Container, outdoor operation
Ambient temperature:	0 ~ 40 °C
Altitude:	< 1000m, (1.2% for every 100m above 1000m)
Cooling:	Forced ventilation with filter
Humidity:	0-95%
Seismic rating:	UBC seismic zone 4
Noise:	80dB @ 2m
EMC:	FCC class A, industrial and commercial emission standard requirements
Power accuracy:	3% accuracy within the battery voltage range
Response time:	The acceleration and deceleration time of frequency converter shall not exceed 20ms. The lag time of converter control system shall not exceed 50ms. The delay time of the whole system shall not exceed 70ms.
DC voltage / current noise:	Peak DC bus common mode noise < 100V, DC bus common mode noise < 5% DC current average value.

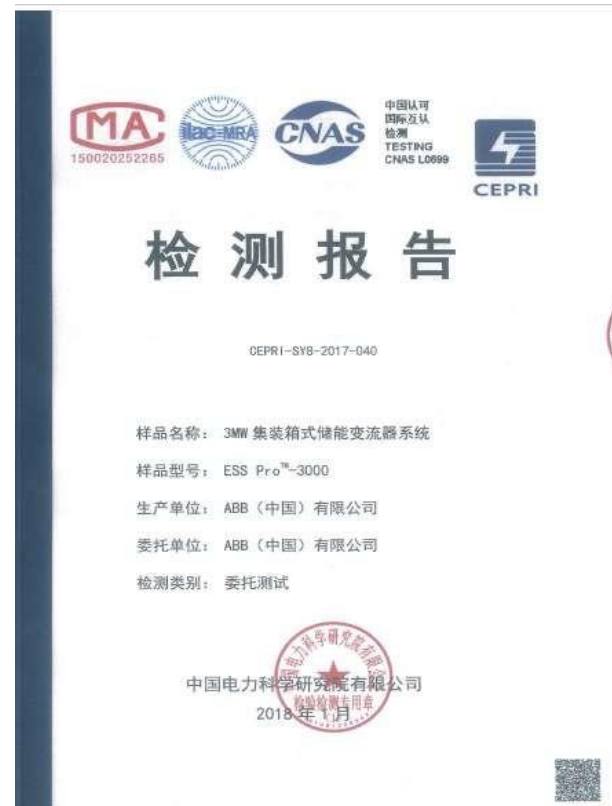
Note: Power and overload capacity can be adjusted according to actual demand





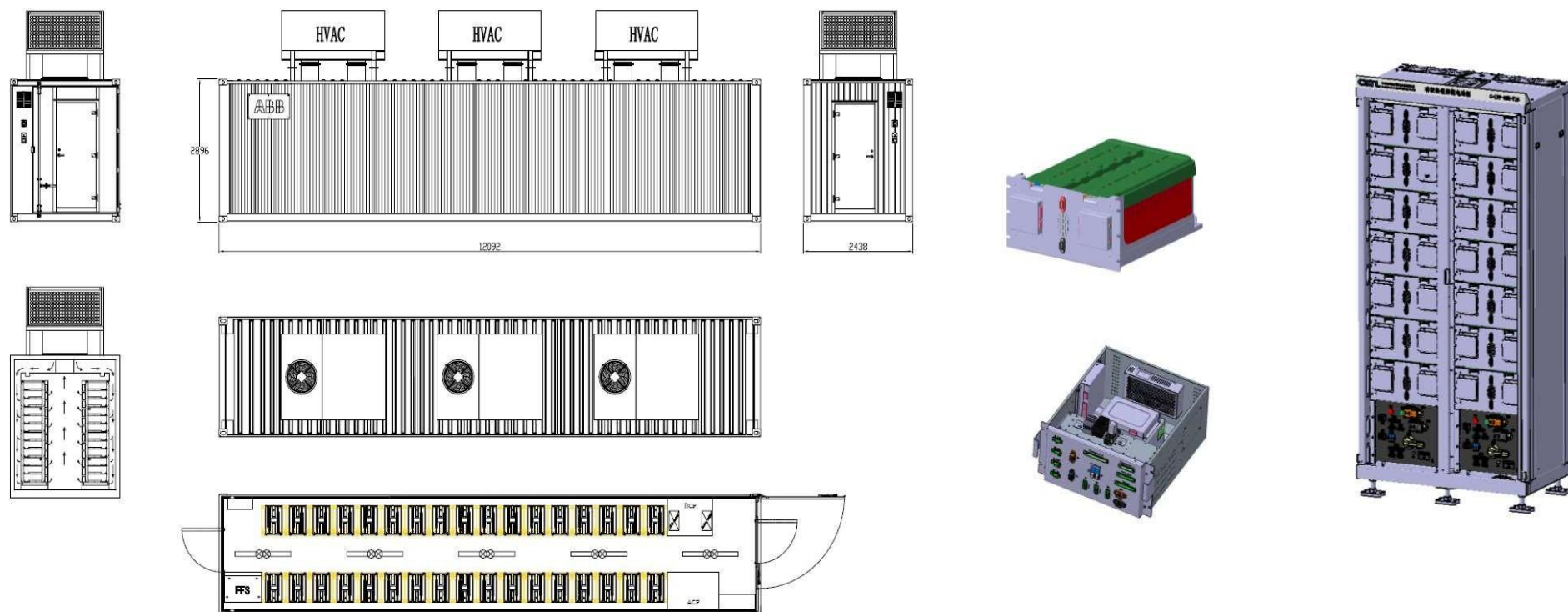
Each converter corresponds to one transformer LV winding. In this way, the circulation and harmonics can be suppressed to the maximum, especially the influence of common mode voltage on the BMS of the battery can be eliminated.

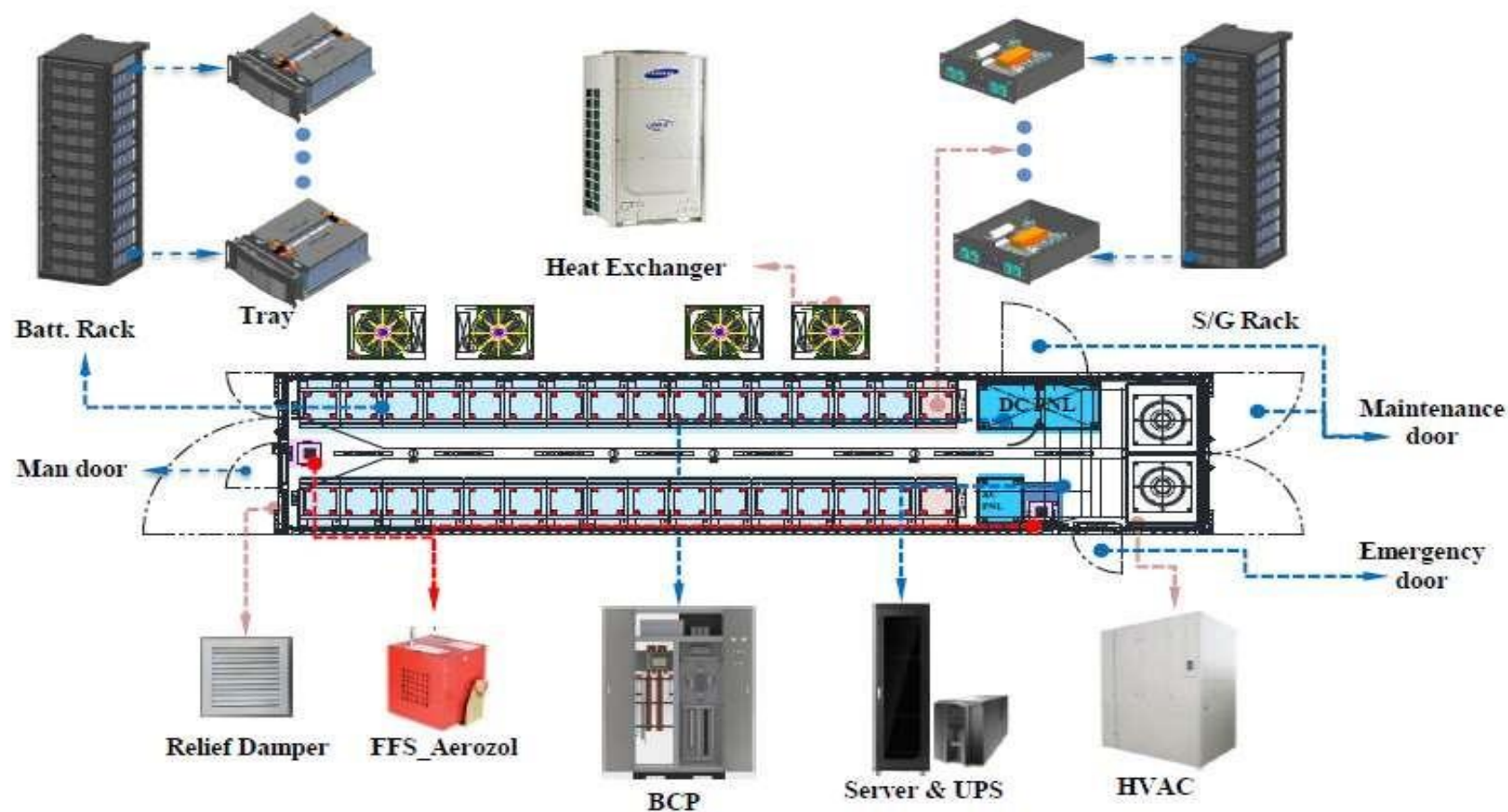
- IEEE 519 - Requirements for harmonic control
- IEEE 1547 - grid connection standard
- CE
- Low Voltage Directive 2006/95/EC
- Machinery Directive 2006/42/EC
- EMC Directive 2004/108/EC
- Quality assurance system ISO 9001 and Environmental system ISO 14001
- RoHS
- UL, cUL, UL508C and CSA, C22.2 NO.14-10, EAC/GOST R 5),
- C-Tick
- Functional safety: STO, TÜV Nord certificate
- ATEX-certified Safe Disconnection Function, Ex II (2) GD
- Test report of CETC (PCs and container system)





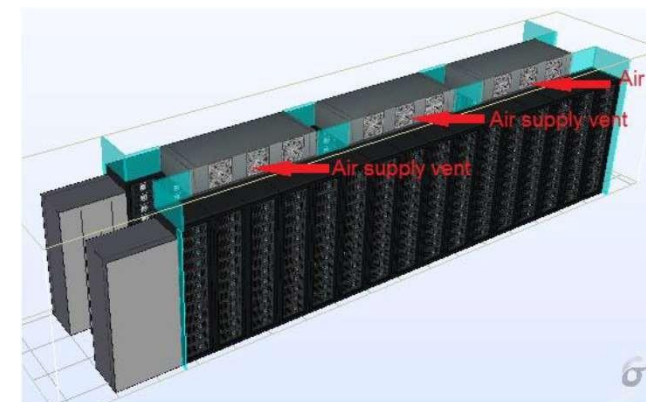
## 4x1.5mwh 40" battery container





## Air conditioning design code

- Code for design of electronic information system room (GB50174-2008)
- Code for design of installation of communication power supply equipment (YD5040-97)
- Technical requirements and test methods for monitoring and control of switching power supply system for communication (YD/T 1104-2001)
- Code for design of electronic information system room (GB 50174-2008)
- Roof air conditioning units (GB / T 20738-2006)
- Air filter (GB / T 14295-2008)
- Totally enclosed scroll refrigerant compressor (GB / T 18429-2001)
- Fin heat exchanger for freon refrigeration plant (JB / T 7659.5-1995)
- Coil pressure test and sealing inspection (JB / T 9064-1999)
- Air cooler and air heater (GB / T14296-2008)
- Safety requirements for air handling units (GB10891-89)
- Safety requirements for ventilators for air conditioning (GB10080-2001)
- Standard for energy conservation design of public buildings (GB 50189-2005)



## Why do battery containers need strict temperature design?

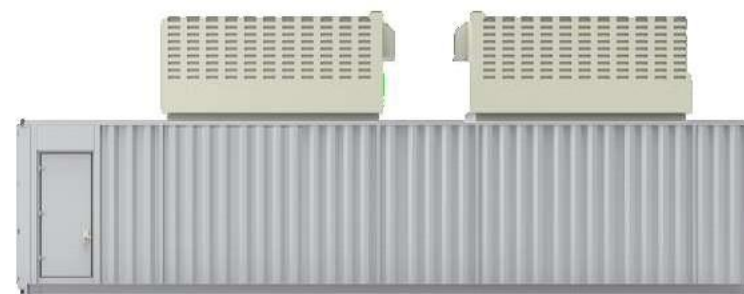
Efficiency and calorific value of a certain type of battery with different discharge rate

倍率 Magnification	效率 Efficiency	能量损失 Energy loss	散热功率 Heat dissipation power
0.1C-rate	99.4%	40Wh	2W
0.3C-rate	97.2%	185Wh	27.75W
0.5C-rate	96.4%	238Wh	59.5W

- The higher the discharge rate, the higher the cooling demand index.
- Temperature control has great influence on battery life and absolute influence on safety



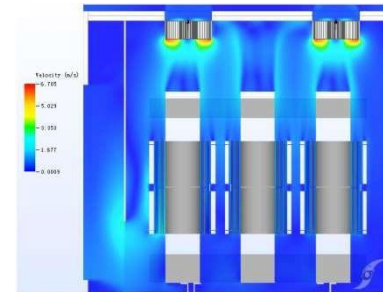
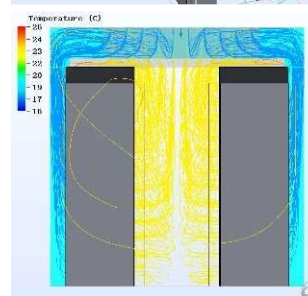
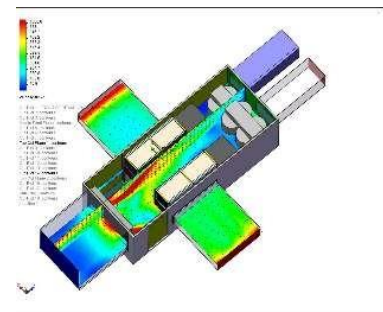
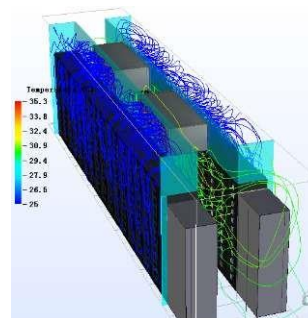
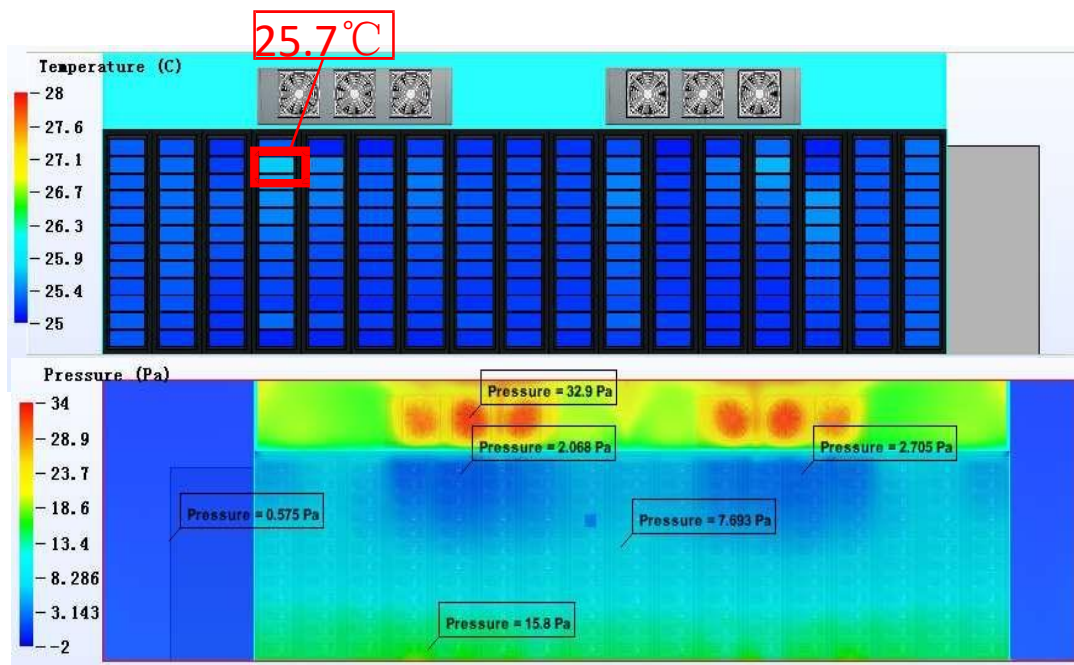
Design of high rate energy storage container

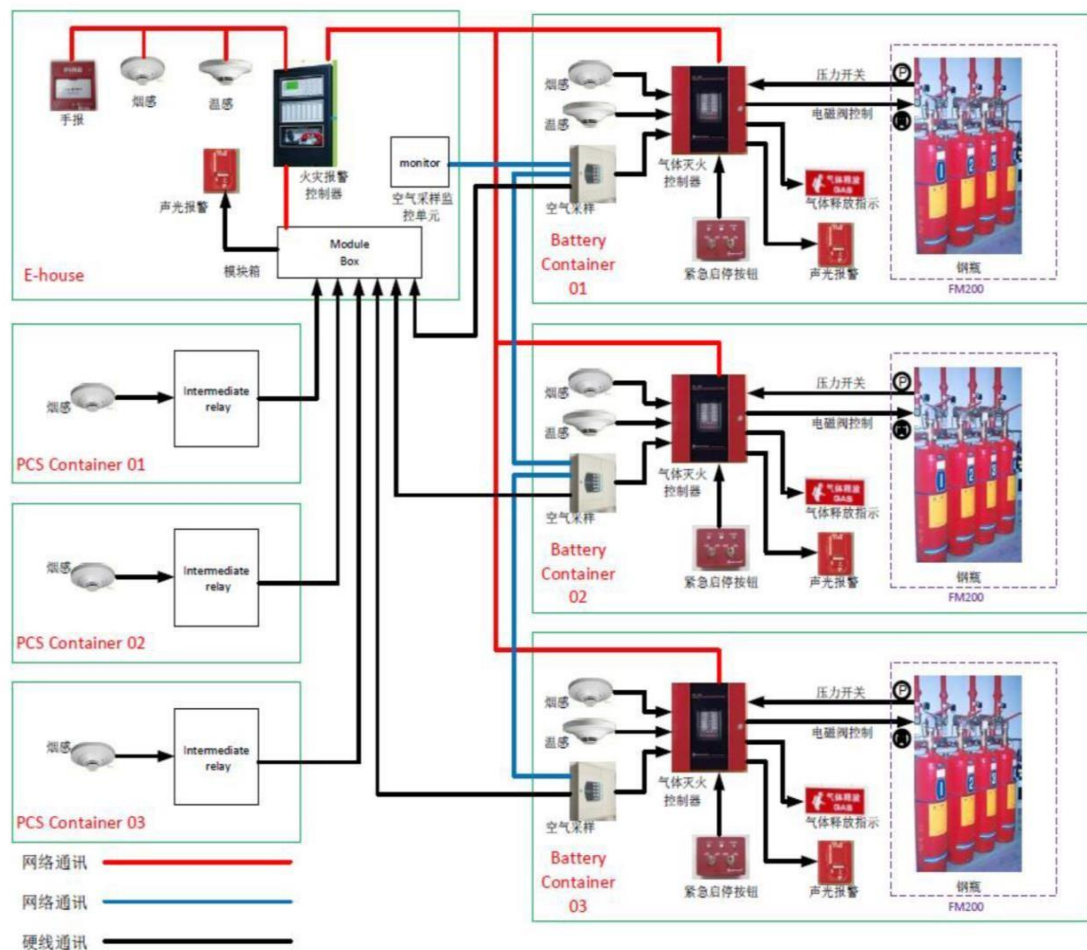




## Temperature control system of battery container

Maximum temperature **25.7 °C** minimum temperature **25 °C**, maximum temperature difference **0.7 °C**





- Adopt Honeywell fire control system
  - Tyco Fire pipeline and cylinder system
  - Heptafluoropropane gas
  - Battery container, PCS container and central fire monitoring system of medium and low voltage ring network cabinet can be connected to the fire control system of the plant area
- **Design specification:**
  - Code for design of automatic fire alarm system (GB 50116-2013)
  - Fire fighting linkage control system (GB16806-2006)
  - Code for design of gas fire extinguishing system (GB50370-2005)
  - Code for construction and acceptance of gas fire extinguishing system (GB 50263-2007)
  - Code for construction and acceptance of automatic fire alarm system (GB50166-2007)
  - Inspection rules for fire alarm equipment (GB12978-91)
  - Code for design, construction and acceptance of inspiratory smoke fire detection and alarm system (DB11 / 1026-2013)
  - Technical specification for air sampling smoke detection and alarm system. (DBJ/CT516-2005)