BYD Battery Energy Storage Solution

Build Your Dreams

CONTENT

BYD Business Areas

Robust Research Institutes

Transportation

- Pure electric, hybrid and combustion automobiles
- Pure electric transit buses
- Pure electric fork lift

New Energy

- Solar power generation
- Utility scale battery storage system
- Rechargeable batteries
- LED lighting

Consumer Electronics

- LCD touch panels
- Laptop and mobile devise components
- Industrial, PC and security cameras
- Power management circuitry
- And more.

Transportation

Material Science

Wireless Communication

Electric Power

BYD Zero Emission Eco-system

SOLAR POWER

ENERGY STORAGE

ELECTRIFIED TRANSPORTATION

BYD Zero Emission Total Solution

Fe Battery

Energy Storage

Household Energy Control System

Providing the Whole Set Energy Consumption Solution

LED Lighting

PV System

Energy Generation

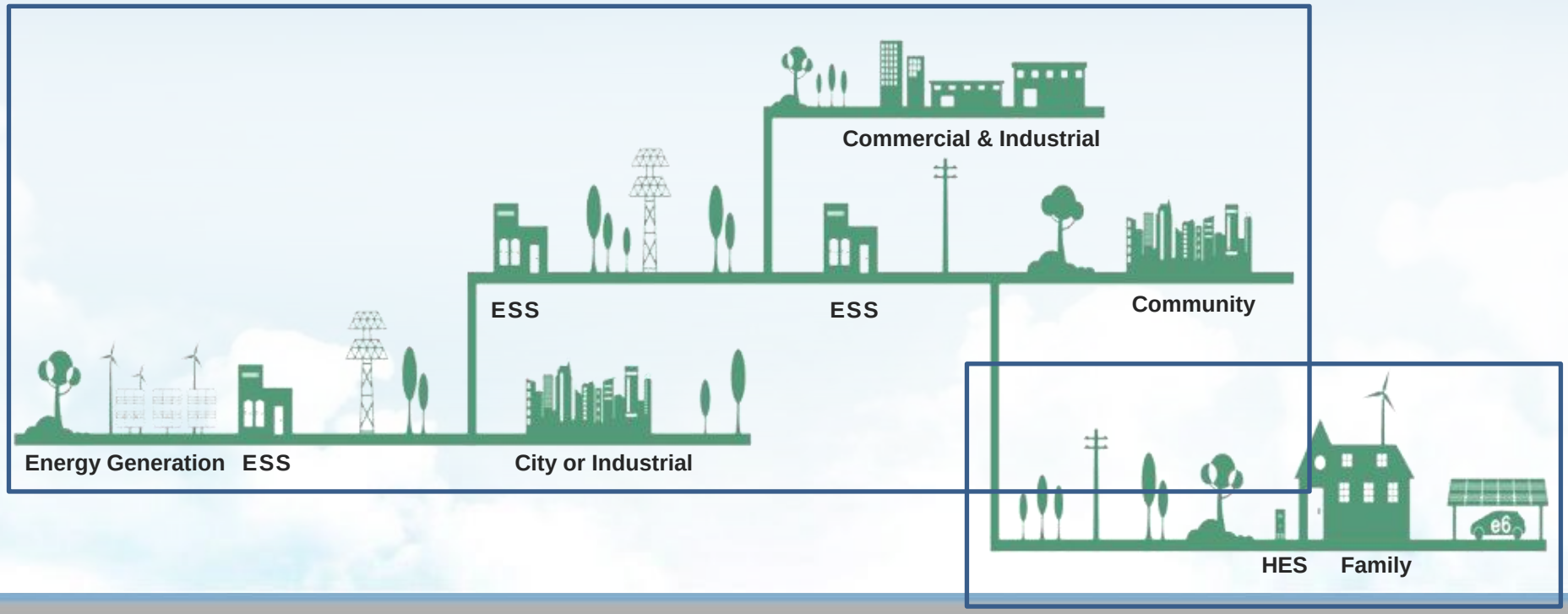
Electric Vehicle Charging Pole

Energy Application

BYD Energy Storage Solution

Transportable Energy Storage Station (TESS)

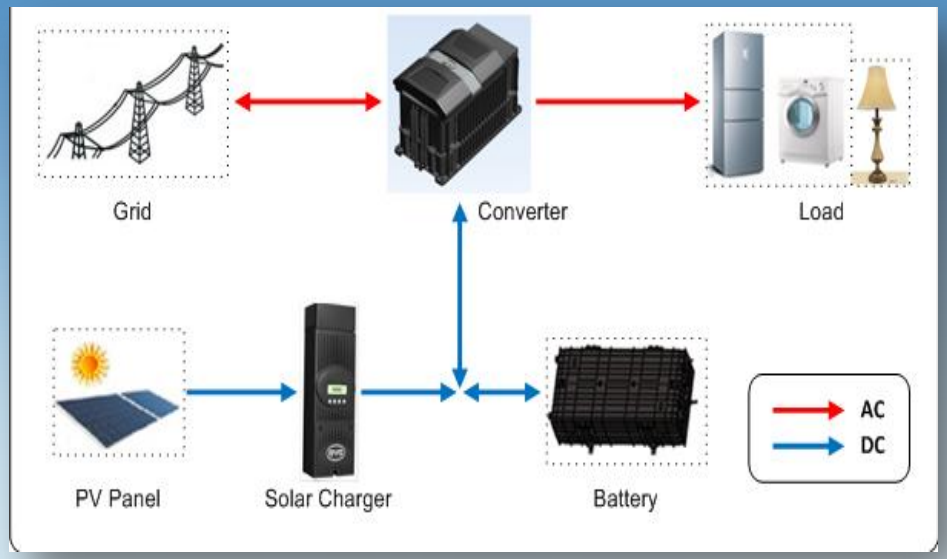
- Safe and Eco-Friendly Battery Technology
- Long Service Life (20 years =6,000 cycles)
- Light-Weight (Energy Density: 120Wh/kg)
- High Power Density: 623 W/kg



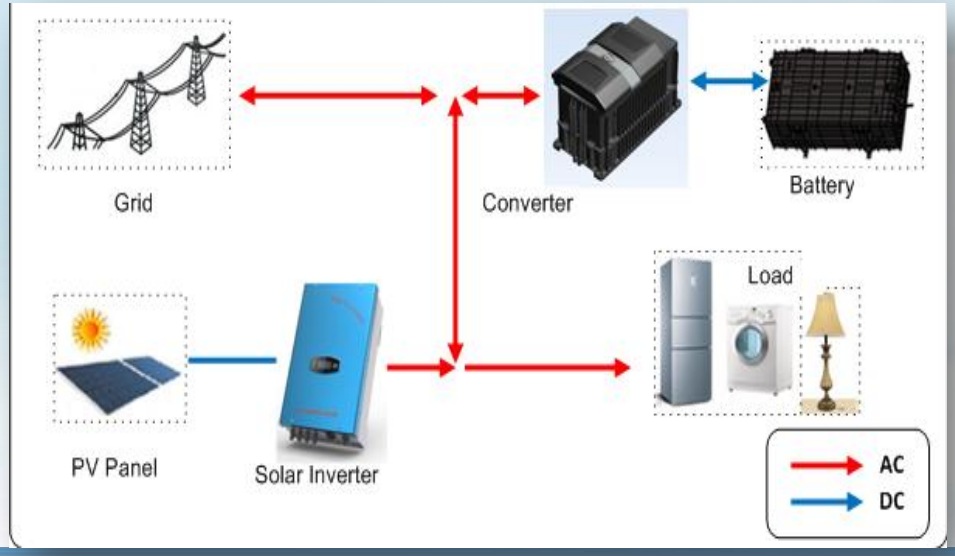
Home Based ESS Product and Topology

3KW/8KWh

9KW/8KWh



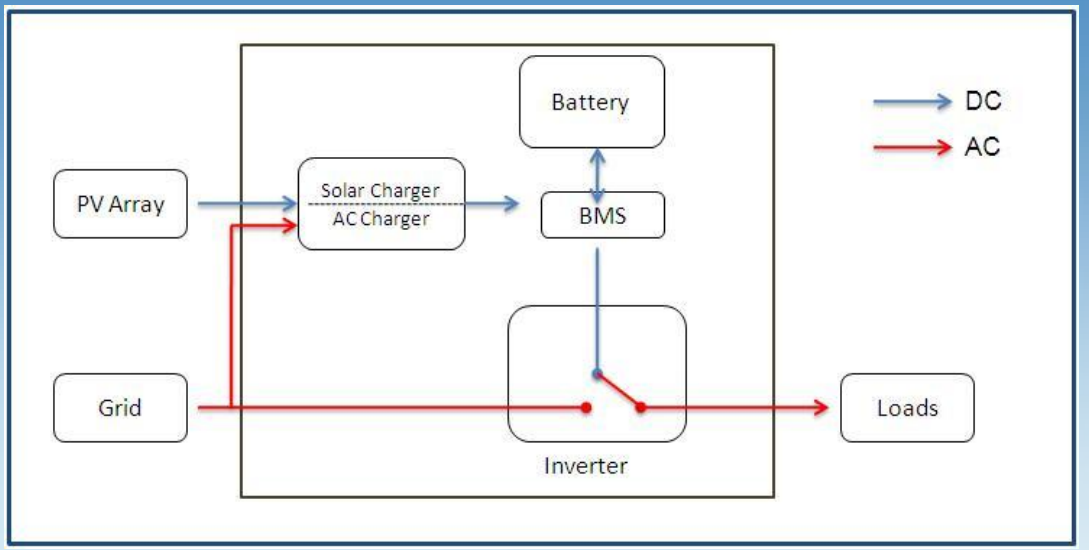
With Solar Charger DESS



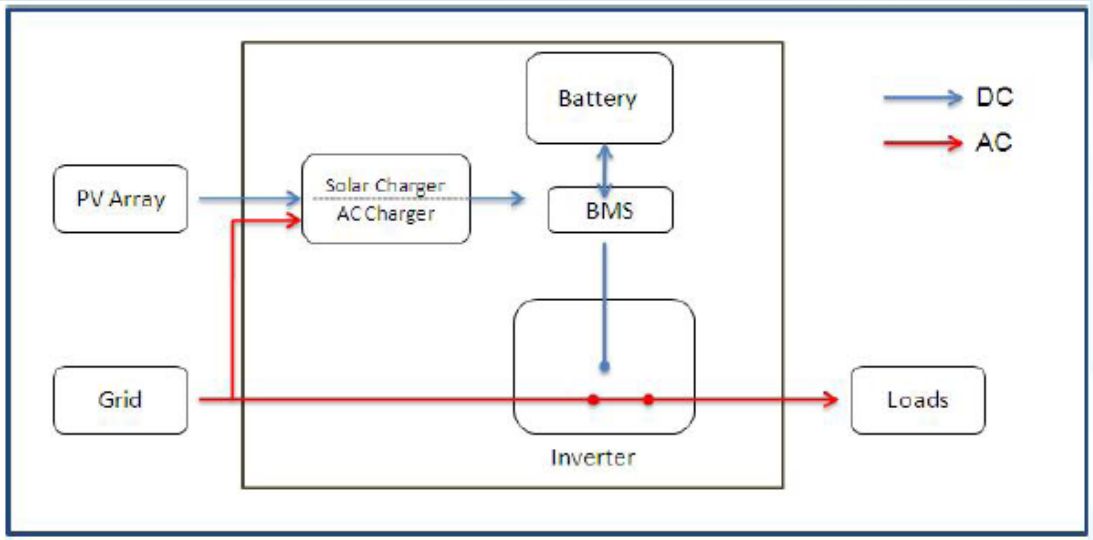
Without Solar Charger DESS

Home Based ESS Product and Topology

MEPS1000



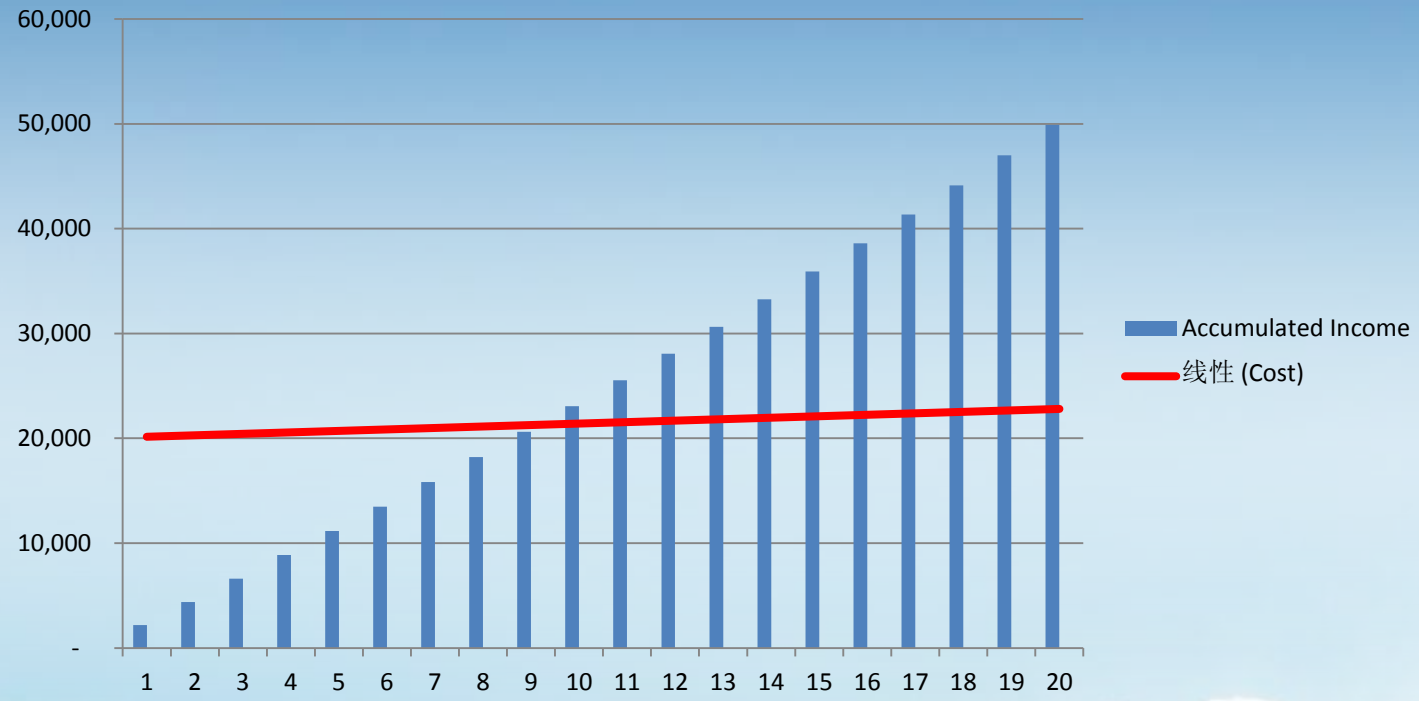
Solar Priority Mode



Back-up UPS Mode

(Recommended if system without PV)

IRR Calculation For Germany



Assumption:
8kw PV + 9kw inverter+8kwh battery
Cost of energy annual increase : 5%
Power loss of PV module 0.3% per year, 1% for storage
PV FIT:0.18EUR per kwh
Electricity Cost :0.24EUR per kwh
IRR can reach 10%

Industry Adoption of BYD Energy Storage Systems >

China State Grid ESS
Capacity : 6 MW/36 MWh
Location : Hebei, China
Operation time : Dec., 2011

Chevron Micro-Grid ESS
Capacity : 2MW/4MWh
Location : CA, US
Finished time: Oct. 2011

China Southern Grid ESS
Capacity : 3 MW/12 MWh
Location : Shenzhen, China
Operation time : Sep., 2011

China State Grid 6MW/36MWH Project >

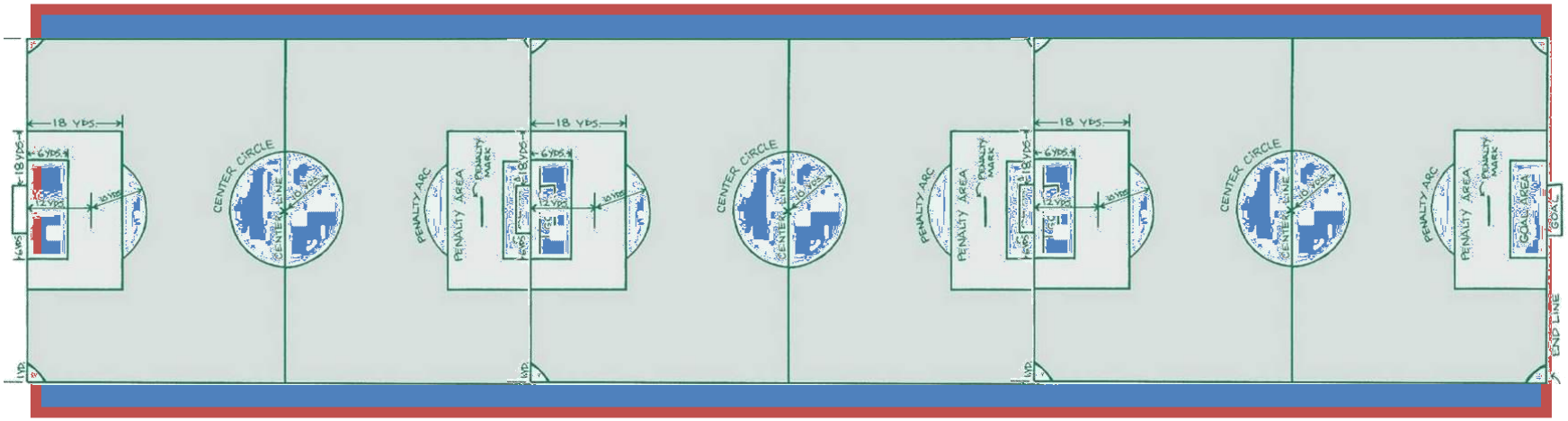
Current status: More generation but less consumption of the renewable energy in this region.
Lots of wind farms in North of China, but the output is not stable, lots of wind power was waste. Energy Storage is deemed to be a good option to resolve this problem,

- ZhangBei State Grid Renewable Generation Site was designed by SGCC and is part of the National “Golden Sun” program
- BYD commissioned 36MWh here in 12/30/11

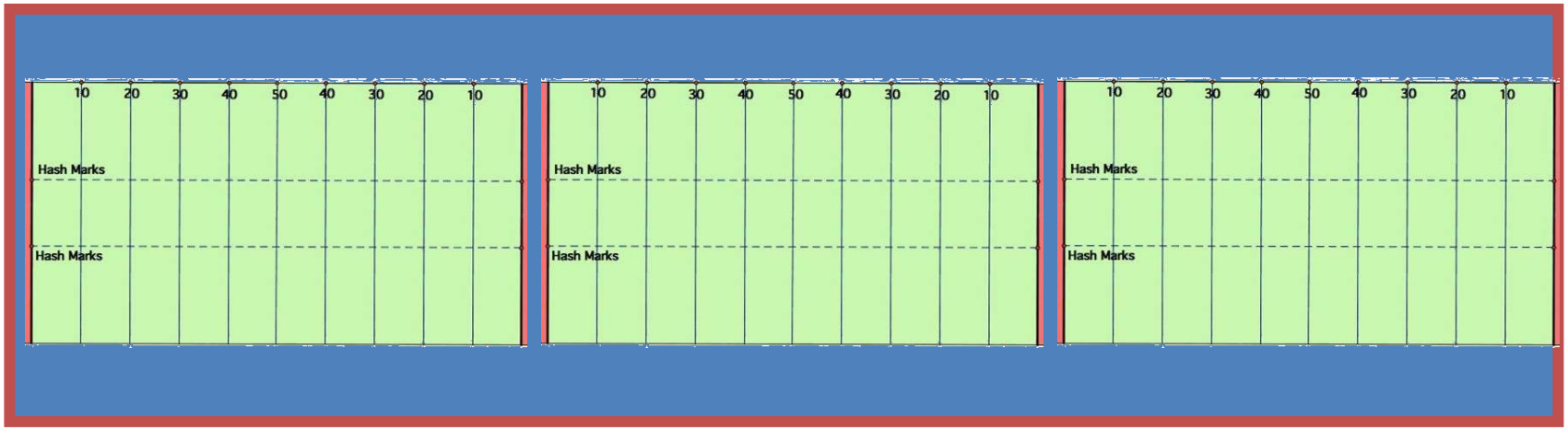
State Grid Battery Energy Storage Buildings in Blue are 275 meters long >

~3 Soccer Fields in Length

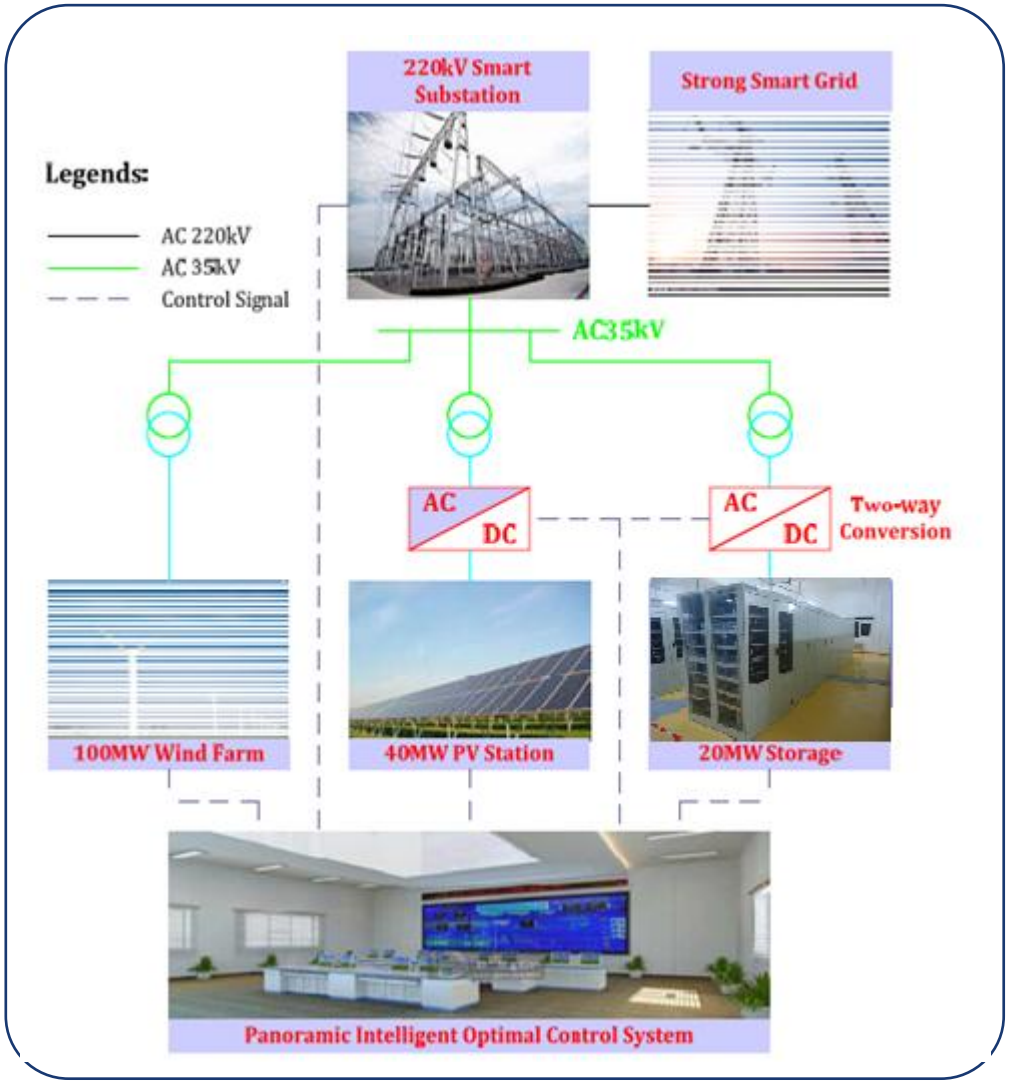
~ 45-50m

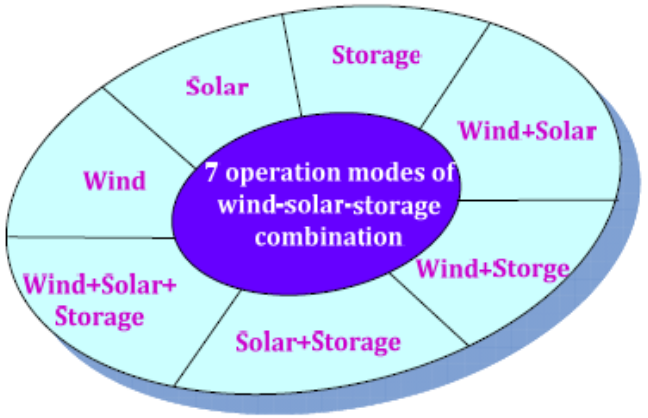


~275m Long
>3 Football Fields in Length



Topology of the National Wind Power, Solar Power, Energy Storage and Transmission Demonstration Project, Phase (source: SGCC) >





Panoramic Intelligent Optimal Control System can realize the panoramic monitoring and intelligent optimization of the wind farm, PV station and storage system according to the dispatch schedule, wind power forecast and solar power forecast. It can also automatically configure and seamlessly switch from one operation mode to another.

The main parameter and function of 36MWh storage project >

Main parameter

System Spec：6MW / 36MWh；

Battery Spec：BYD Fe 200AH battery module；

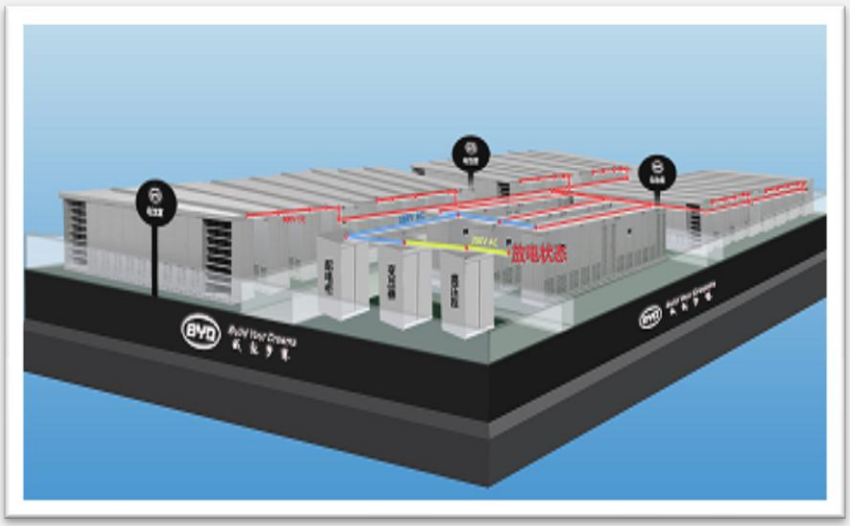
Power Conversion System: 18 BYD 500kW PCS

Electric interface：380V (three phase)；

Capacity for single unit：2MW / 12MWh；

Total Capacity：6MW /36MWH；

Finished time：2011

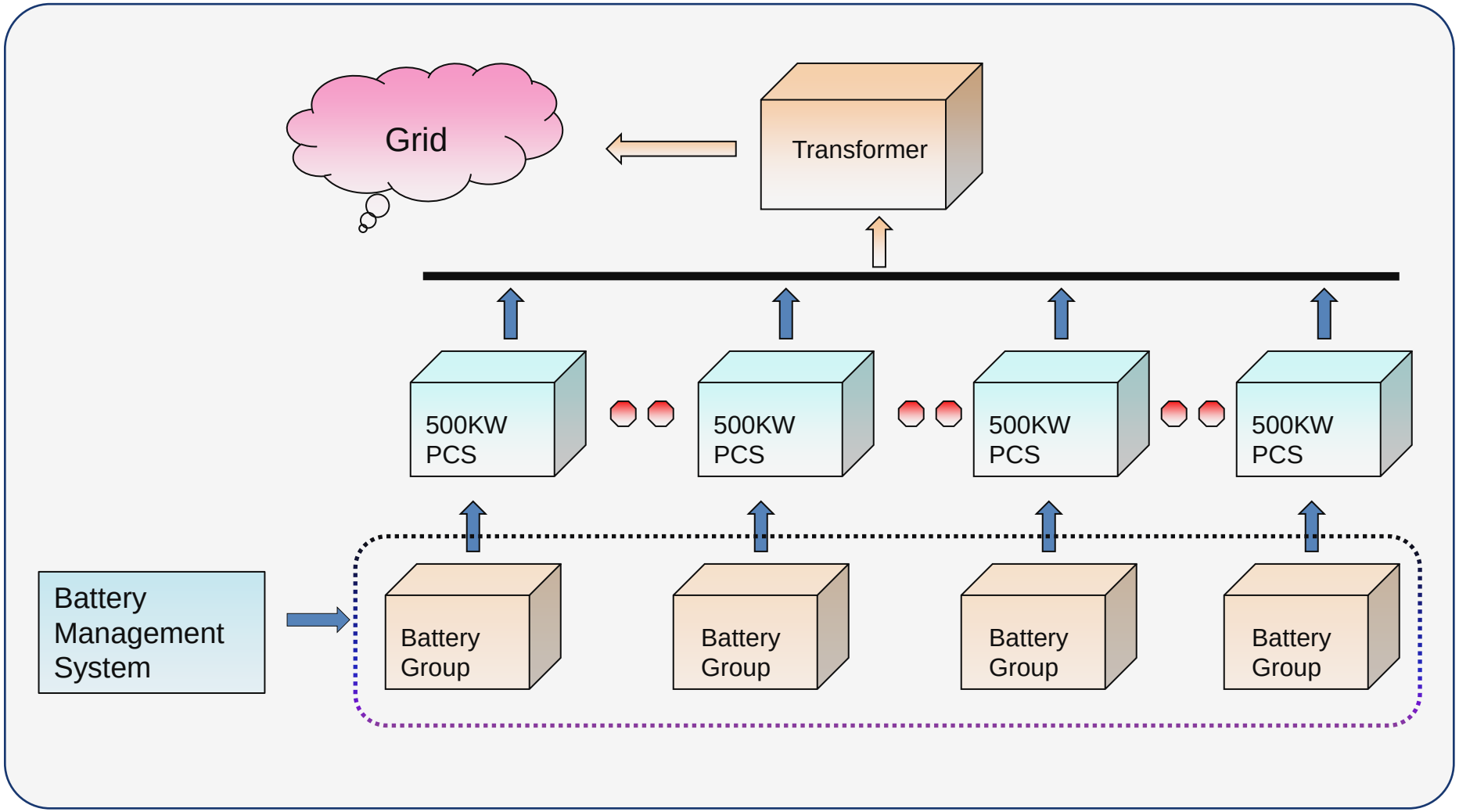


2MW energy storage unit

System main function:

1. Smooth the output of wind&solar output;
2. Peak shaving and fill the valley;
3. Participate in frequency regulation;
4. Urgency transient active power response;
5. Urgency transient voltage supporting;

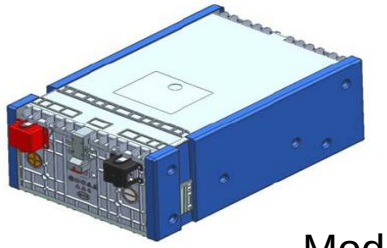
Composition of ESS >



Fe Battery Advantages >

BYD Lithium-ion Iron-Phosphate (Fe) Battery Module

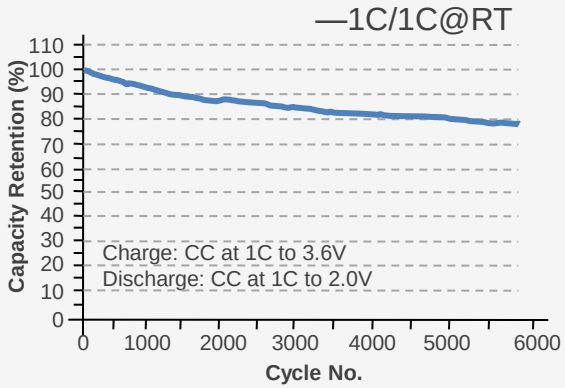
Cell

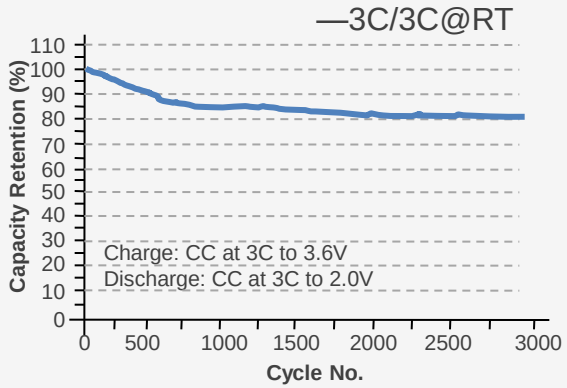


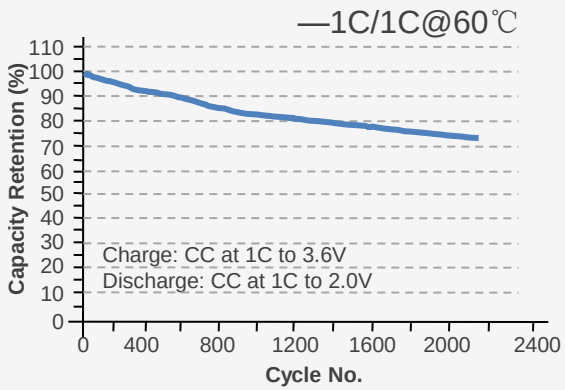
Module

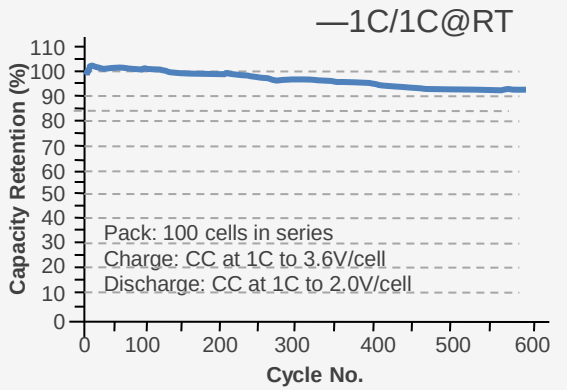
- *More Than 6,000 Cycles Life*
- *High energy output and high energy density*
- *Good performance in high temperature*
- *Excellent consistency*

Life Cycle Tests









Battery Management System >

Guarantee for high performance of Fe battery—— BMS

Overall protections from the bottom to the top

- Protection for Cell

—— Critically protect the temperature and voltage for each cell

- Protection for Battery Module

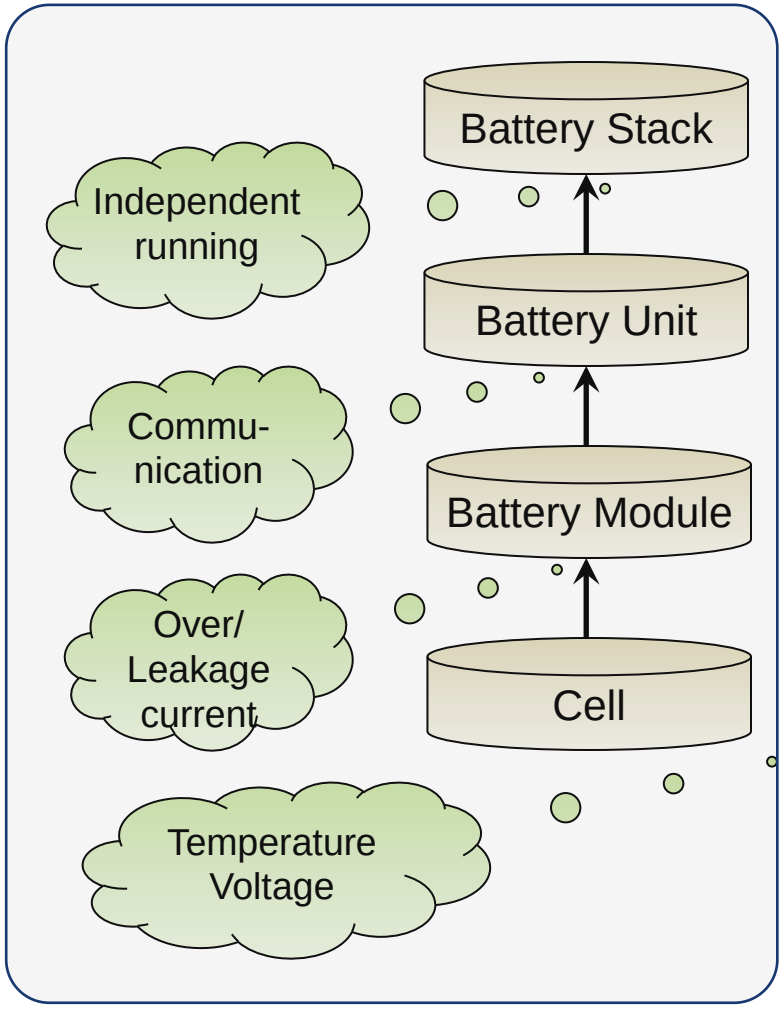
—— Prevent the battery module from over current and leakage current

- Protection for Battery Unit

—— Cut off the unit individually when communication failing

- Protection for Battery Stack

—— Run independently and switch on/off automatically



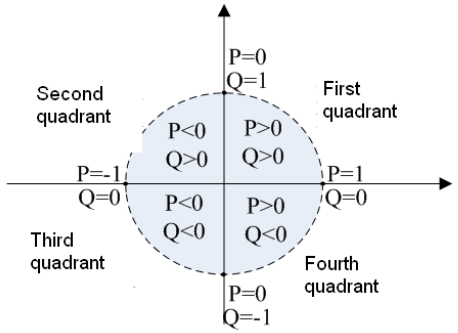
Power Conversion System >

500kW PCS(Power Conversion System)

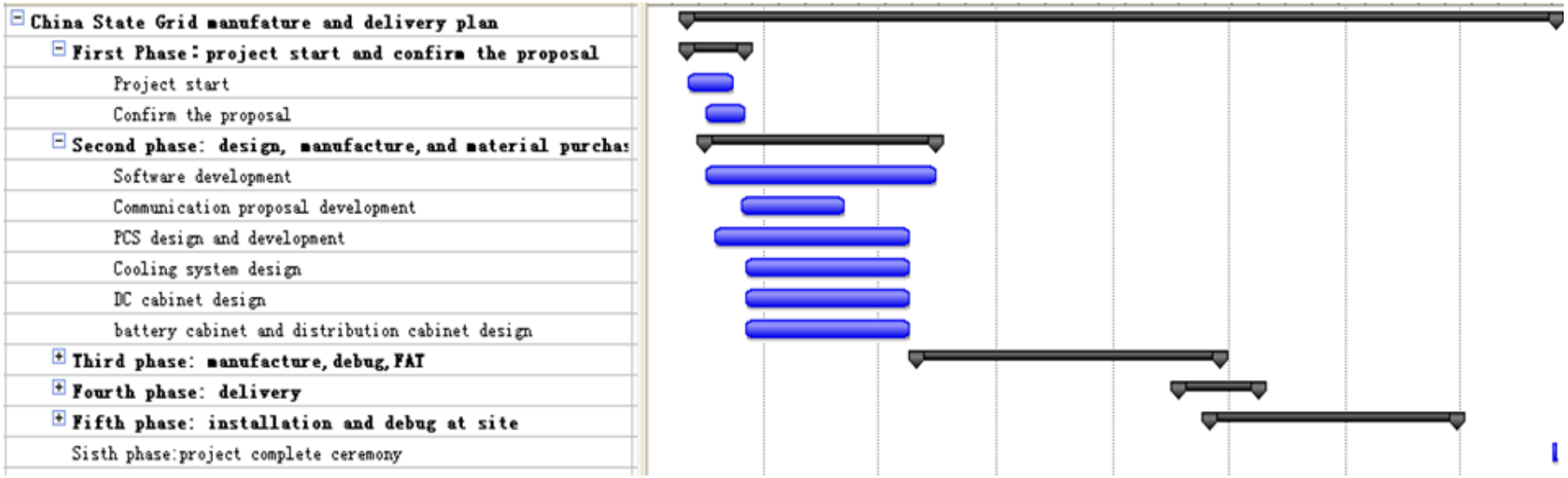
Data of DC side	
Max. permissible DC voltage	1000Vdc
DC voltage range	700-900Vdc
Nominal power(charge)	500kW
Nominal power(discharge)	520kW
Max. permissible DC current	820A
Data of AC side	
Nominal AC power(discharge)	500kW
Nominal AC power(charge)	520kW
Nominal grid voltage	380Vac
Permissible grid voltage	323~418Vac
Nominal grid frequency	50Hz
Permissible grid frequency	49.5~50.2Hz
Power factor	≥0.99（Nominal power)
THD of AC current	<5%（Nominal power）

Advantage：

1. Most suitable for BYD battery
2. High voltage ride through, at least 3ms
3. Average response time: 5ms
4. Power Factor: continuous regulation in 4 quadrant, from -1 to +1



Project Schedule >



June 1st :PO released

June 15th: technology proposal fixed

July 5th : business contract signed in

August 30th : ready for delivery

September 18th: delivery

September 26th: Installation and debug at site

November 27th: transfer to China State Grid

Chevron 4MWH Project in San Francisco>

System Parameter

- System Capacity: 2MW/4MWh
- Voltage Level: 480V (AC60Hz)
- Round-trip-efficiency: around 91%
- Running since 2012 Spring

Micro-grid Application (2 hours storage)

Southern Grid 3MW ESS >

System Significance

- Help to regulate the Grid frequency, and shift the load peak
- Combine commercial and scientific research, explore the max potential application of BESS in National Grid

System Parameter

- **Capacity: 3MW / 12MWh**
- Battery cell: BYD FV200 (3.2V/200Ah)
- Voltage Grade: 380V/50Hz (3 phase 3 line)
- Communication: Ethernet (modbus)
- Ambience: Indoor
- Location: Baolong, Shenzhen
- Finished Time: The first 1MW Jan.2011
  The second 1MW May.2011
  The third 1MW Aug.2011

Southern Grid 3MW ESS >

Current State:

- System charge time: from 2:00am to 6:00am
- System discharge time: from 9:00am to 11:00am
  from 14:00pm to16:00pm

BYD Iron-phosphate Batteries in Service >

Over ***165 MWh Batteries*** service in EVs, Buses and ESS.

>300 eTaxis have been running since May 2010

6 Million miles travelled

>270 electric buses have been running since ‘11

1.8 Million miles travelled

70 MWh in ~10 Energy Storage Stations (ESS) world-wide

TOTAL***:*** ***7.8 Million Fleet miles*** in Service (as of Dec 2011)

BYD is now #2 in the world for installed-Grid-Tied

ENERGY Capacity according to LUX Q1-2012 report

New Bidding Project

---2.5MW/3.5MWh For CGNPC

China Guangdong Nuclear Power Corp
Nuclear Power Plant

BYD Company
BYD Energy Storage

On August 30th, 2012, BYD once again won the bidding of a nuclear power station's high power capacity battery energy storage project from CGNPC (China Guangdong Nuclear Power Corp).

Total capacity is *2.5MW/3.5MWh.*

The energy storage station will work as emergency electric power source to protect the human and the station from being damaged, when the nuclear power station is out of electric power supply caused by extreme accidents.

Thank you!