

Identifying Different Iron Phosphate Battery Applications by Demonstrating Different Case Studies Worldwide



BYD Energy Storage



Build Your Dreams

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Home Based DESS

Micro Grid Application

Community ESS

Application Cases

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 device components
- Industrial, PC and security cameras
- Power management circuitry
- And more.

Transportation

Material
Science

Wireless
Communication

Electric Power

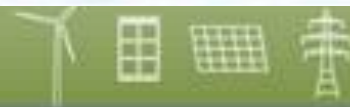
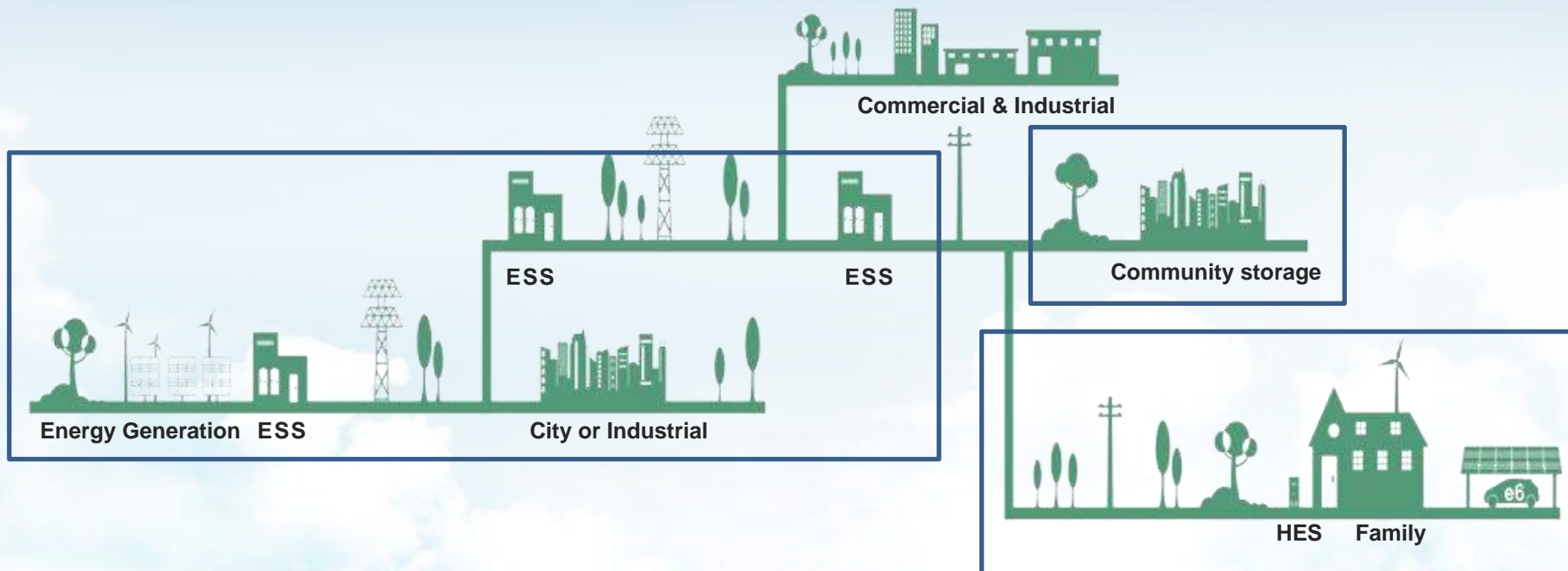


Energy Storage Solutions >



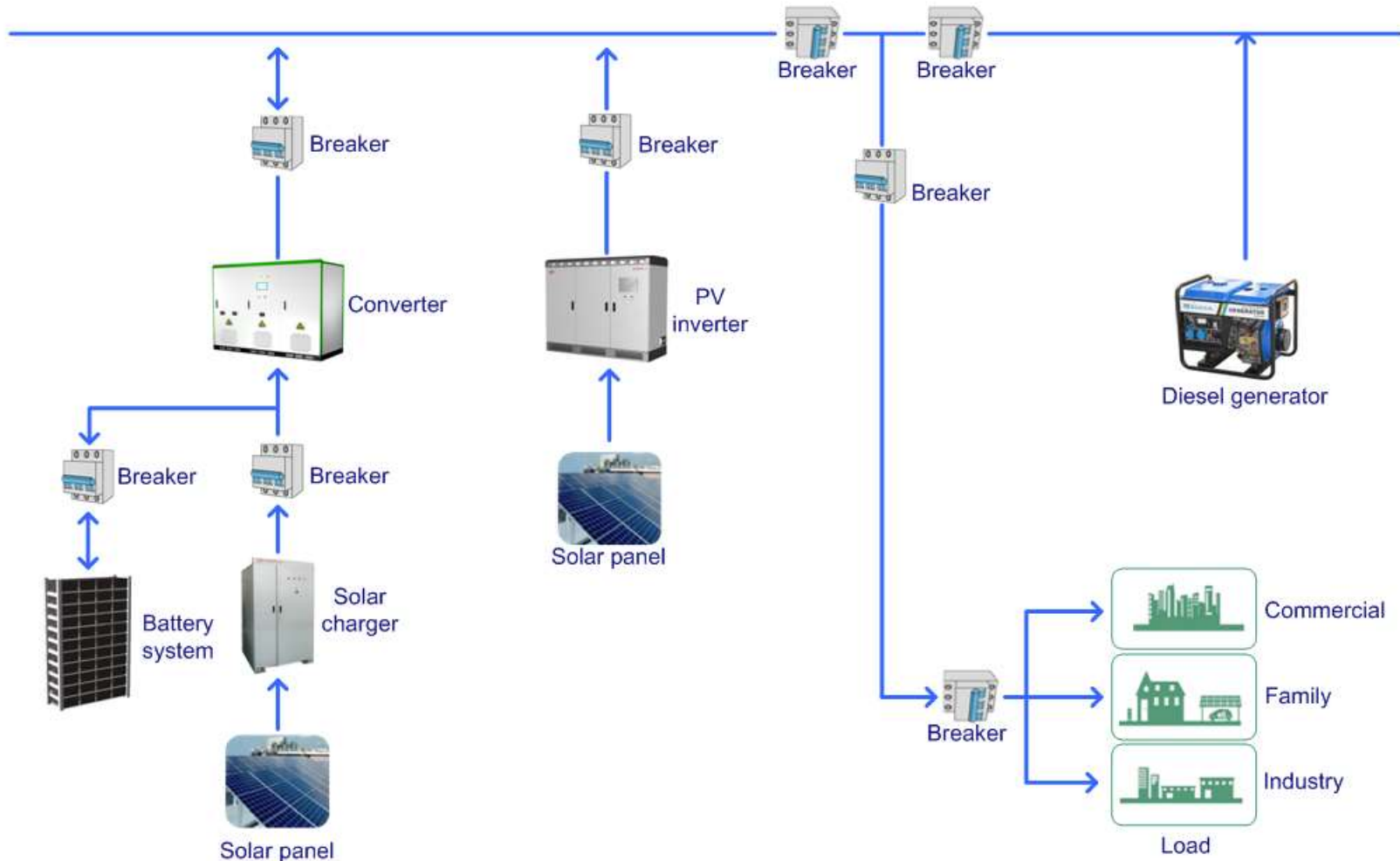
Transportable Energy Storage Station (TESS)

- 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

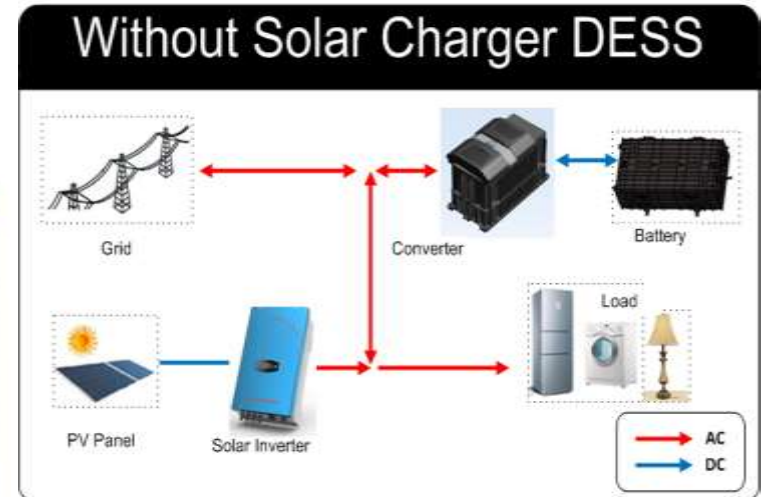
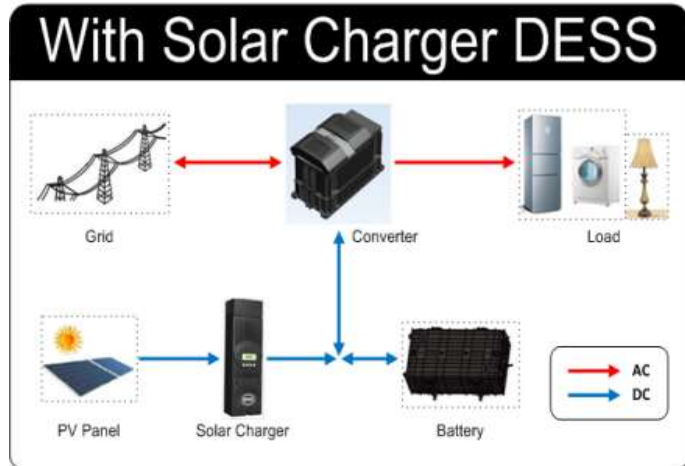


Micro-grid system

Micro-grid (MG) system takes use of the once energy and micro power supply, equipped with storage system to supply electricity, is small-scale versions of the centralized electricity system.



BYD Home based system>



DESS



EPS3000

EPS1500

IRR Calculation>

Without Incentives

With Incentive

BYD Community ESS>

BYD Large-scale ESS First Shipment to Switzerland

System Configuration:

- ◆ Capacity: 50kW/60kWh
- ◆ Voltage Level: 480V (AC60Hz)
- ◆ 50kW bi-directional BYD inverter
- ◆ 60kWh BYD Iron Phosphate battery pack
- ◆ Mode: Unattended/MODBUS
- ◆ Human Machine Interface (HMI) for operation and diagnosis
- ◆ Finished time: Nov. 2012



American EPRI 50kW/45kWh ESS is the first overseas project of BYD.



System Configuration:

- **Capacity: 50kW/45kWh**
- Voltage grade: 380V/50Hz
- Location: America
- Ambience: Indoor, 5~90%RH
- Mode: Unattended/MODBUS
- Finished time: Dec. 2010
- **Cooperator: American EPRI**

BYD Micro Grid System ESS

250kW/500kWh for United Nations Climate Change Conference in Doha
--GreenGulf and Chevron select Iron-Phosphate battery storage system

System Parameter

- ◆ System Capacity: 250kW/500kWh
- ◆ Nominal Output Voltage: 415VAC
- ◆ Nominal Frequency: 50Hz
- ◆ Round-trip-efficiency: 89% AC-DC-AC (with THD<3%).
- ◆ Running since December 9th, 2012
- ◆ Location: Doha, Qatar



This battery storage system is used in the micro grid which has been combined with PV, diesel generator, and grid. It could be used as energy storage and back up power.

Show Case >

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

Containerized ESS in Charlotte

Capacity: 200kW/500kWh

Location : Charlotte US

Finished time: Apri. 2012

China State Grid 6MW ESS



3 MW ESS



Chevron Micro-Grid ESS



BYD Utility Scale Energy Storage System>

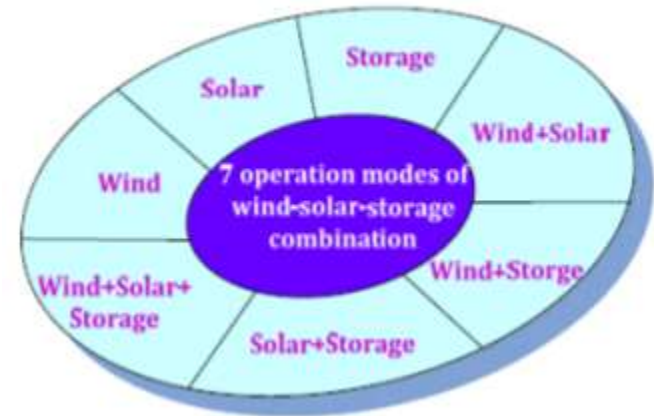
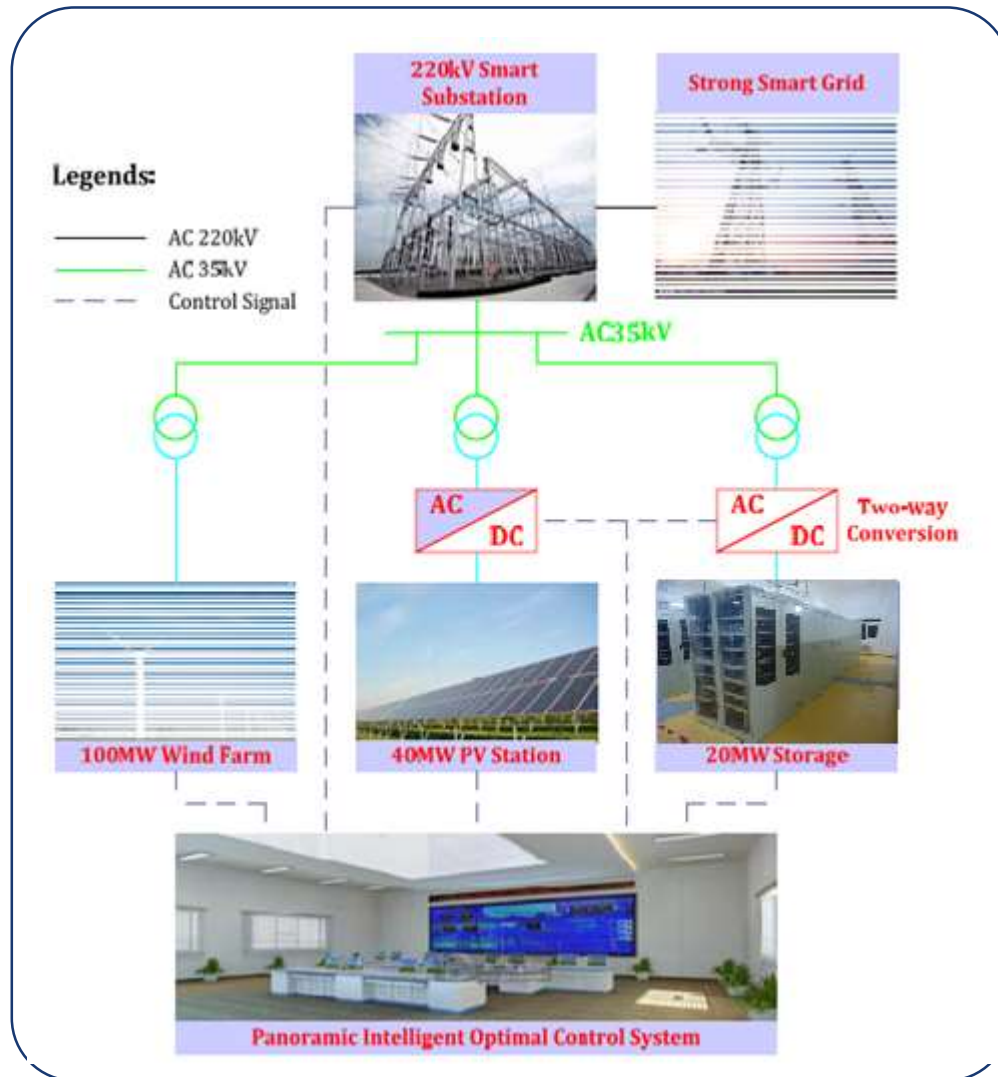


Current status: More generation but less consumption of the renewable energy in this region.

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

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);

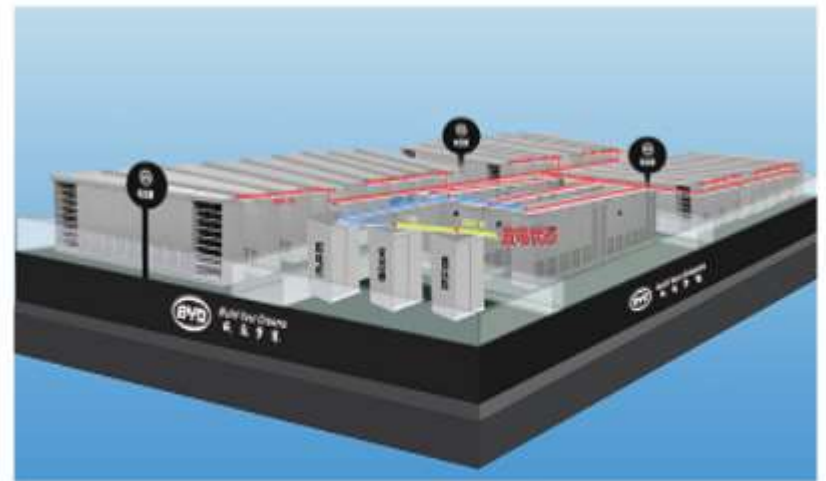
Capacity for single unit: 2MW / 12MWh;

Total Capacity: 6MW / 36MWh;

Finished time: 2011

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;



2MW energy storage unit



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

200kW/500kWh Containerized ESS in Charlotte, North Carolina, in operation since Nov 5, 2012



System Features:

- ◆ Peak shaving and load leveling
- ◆ Environmentally-friendly rechargeable battery chemistry
- ◆ Wider temperature range: 0C ~ 60C
- ◆ Superior service life: can be recycled over 6,000 times (100% DOD)
- ◆ Superior round-trip efficiencies: AC-DC-AC efficiency shown to be as high as 94%, **an industry benchmark high**; DC-DC efficiency as high as 96%

System Configuration:

- ◆ Capacity: 200kW/500kWh
- ◆ Voltage Level: 480V (AC60Hz)
- ◆ Standard 40' container
- ◆ 200kW bi-directional BYD inverter (UL compliant)
- ◆ 500kWh BYD Iron Phosphate battery pack
- ◆ Human Machine Interface (HMI) for operation and diagnosis
- ◆ Cooling system, ventilation, air-con, fire suppression



BYD Iron-phosphate Batteries in Service >

Over **200 MWh Batteries** service in EVs, Buses and ESS.

- >650 eTaxis have been running since May 2010

 - 33.5 Million miles travelled

- >200 electric buses have been running since '11

 - 9 Million miles travelled

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

TOTAL: **42.5 Million Fleet miles** in Service (as of Feb 2013)

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

ENERGY Capacity according to LUX Q1-2012 report

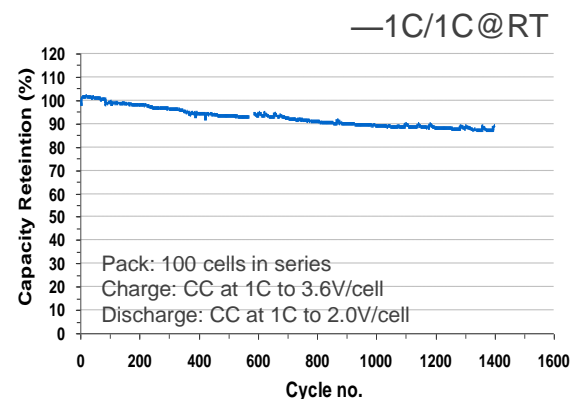
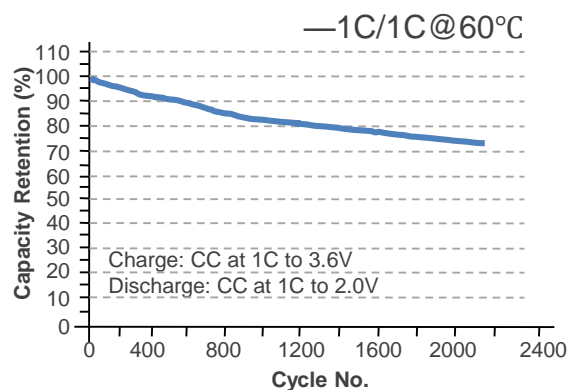
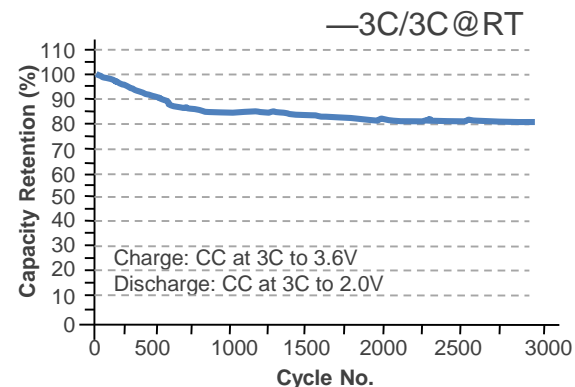
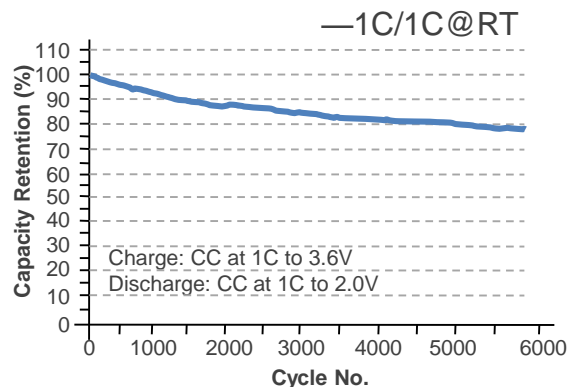
Fe Battery Advantages >

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



- More than 6,000 cycles life
- High energy output and high energy density
- Good performance in high temperature
- Excellent consistency

Life Cycle Tests



Thank you!