



*Build Your Dreams*

# **BYD-Your Reliable Battery Partner**





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**BYD Introduction**

2

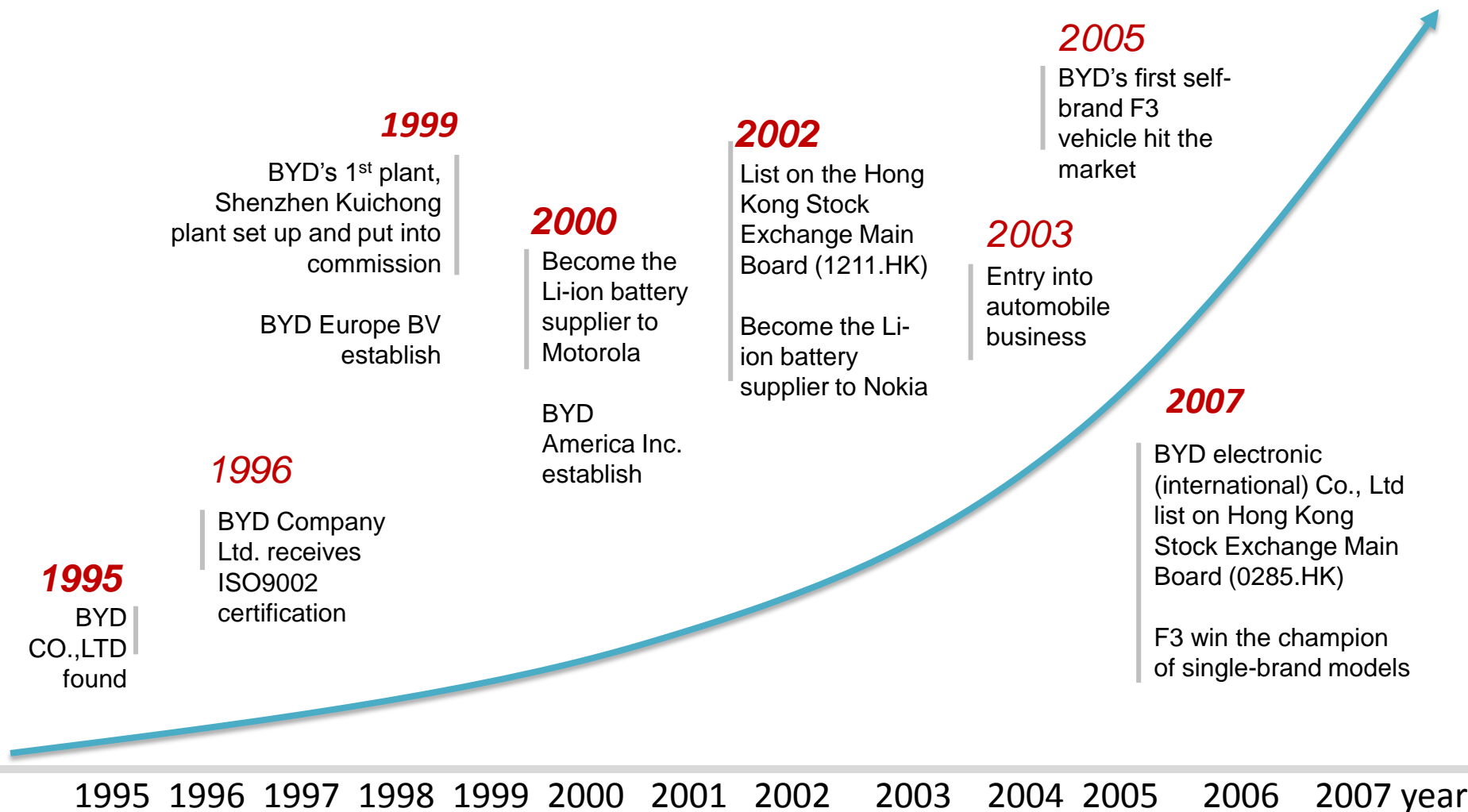
**BYD Battery Profile**

3

**BYD Proposal for Storage Market**



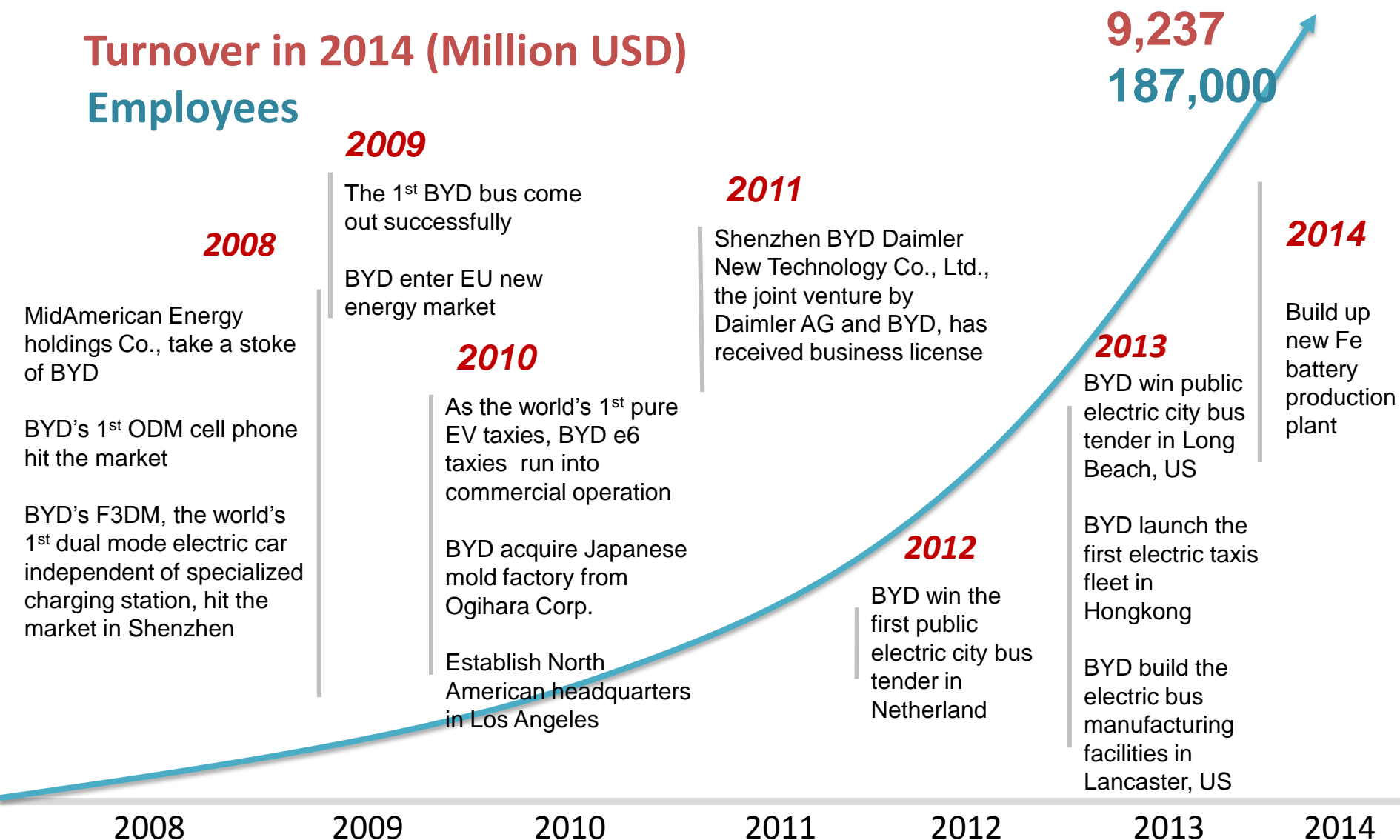
# BYD Milestones





# BYD Milestones

## Turnover in 2014 (Million USD) Employees





# 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

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

Transportation

Material  
Science

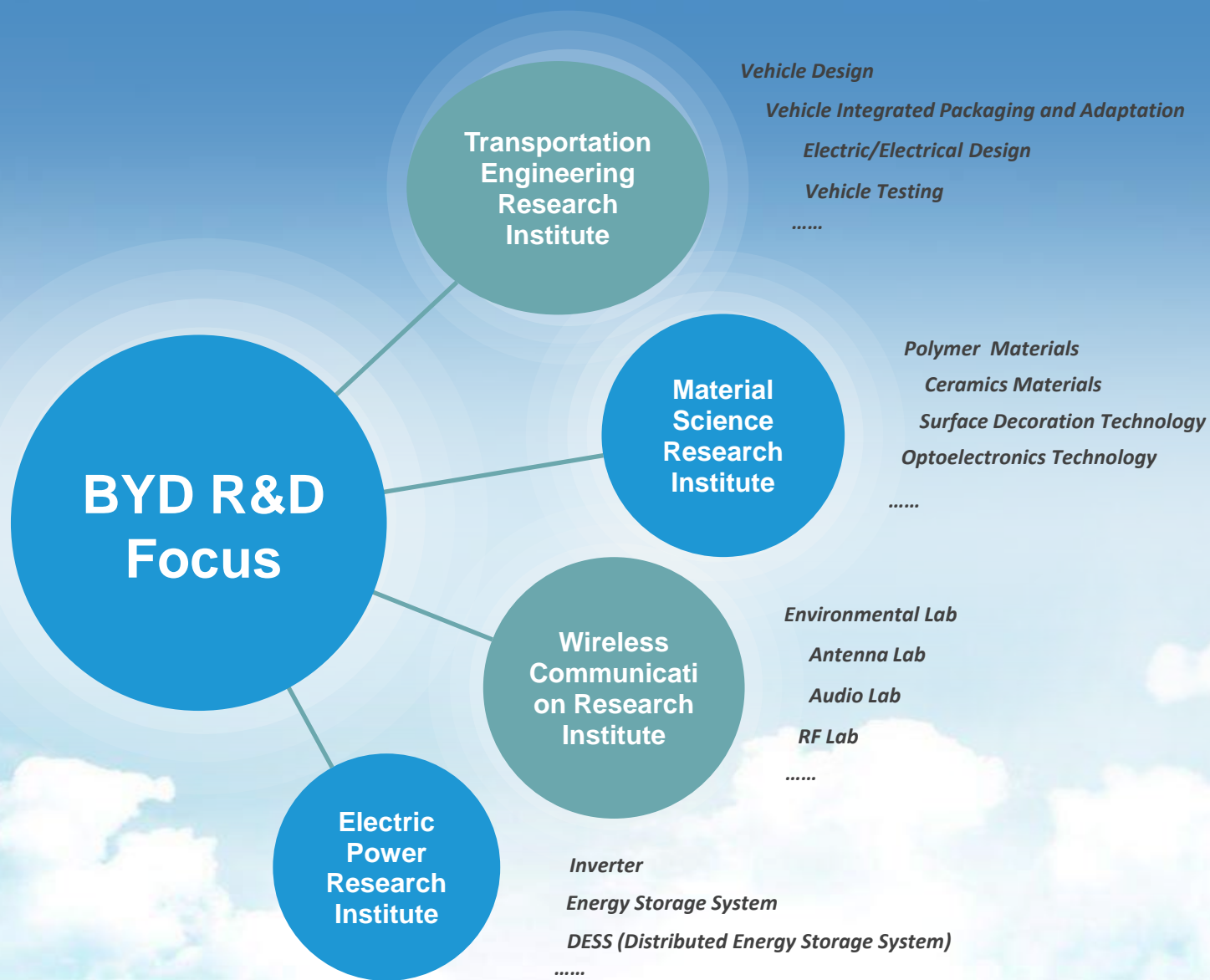
Wireless  
Communication

Electric Power





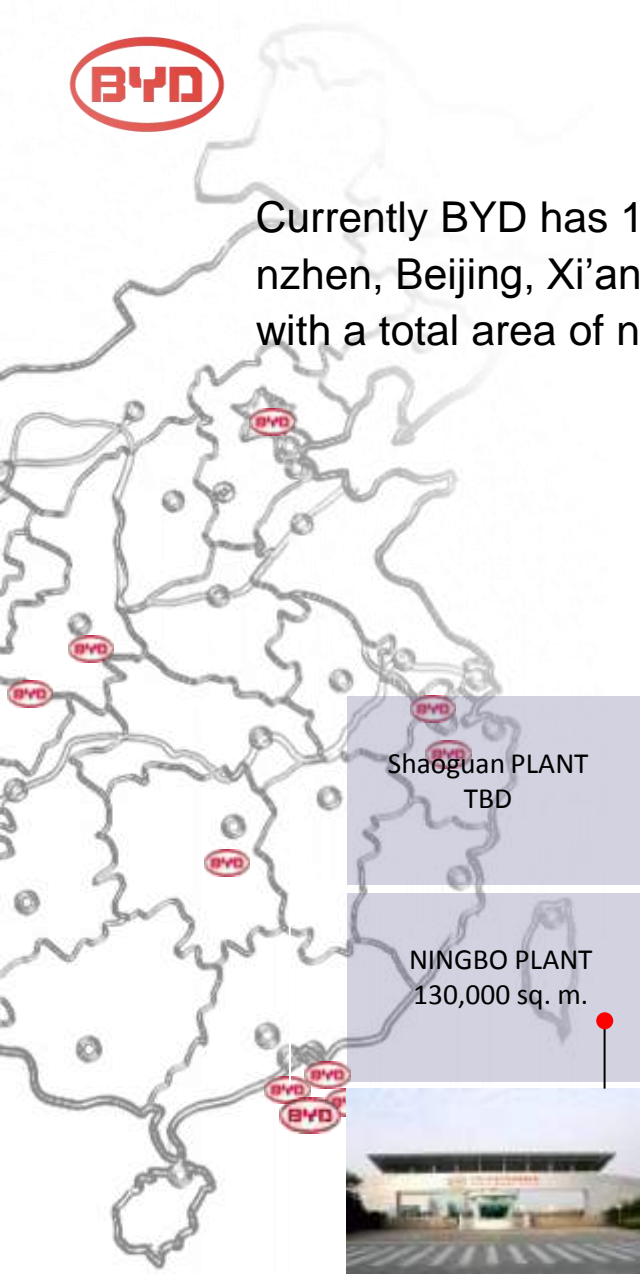
# BYD R&D Capability





# BYD Domestic Industrial Plants

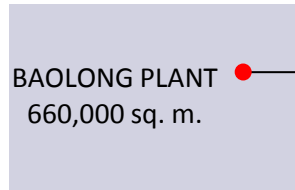
Currently BYD has 11 industrial plants in China: Shenzhen, Beijing, Xi'an, Shanghai, and Shangluo, etc. with a total area of nearly 17 million sqm.



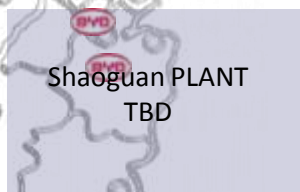
● **PINGSHAN PLANT**  
(Headquarters)  
1,700,000 sq. m.



● **KUICHONG PLANT**  
400,000 sq. m.



● **BAOLONG PLANT**  
660,000 sq. m.



● **Shaoguan PLANT**  
TBD



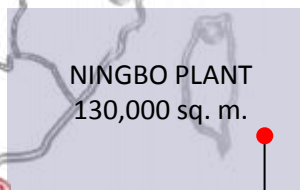
● **SHANGHAI PLANT**  
570,000 sq. m.



● **HUIZHOU PLANT**  
1,320,000 sq. m.



● **XI'AN PLANT**  
1,430,000 sq. m.



● **NINGBO PLANT**  
130,000 sq. m.



● **BEIJING PLANT**  
190,000 sq. m.



● **SHANGLUO PLANT**  
270,000 sq. m.

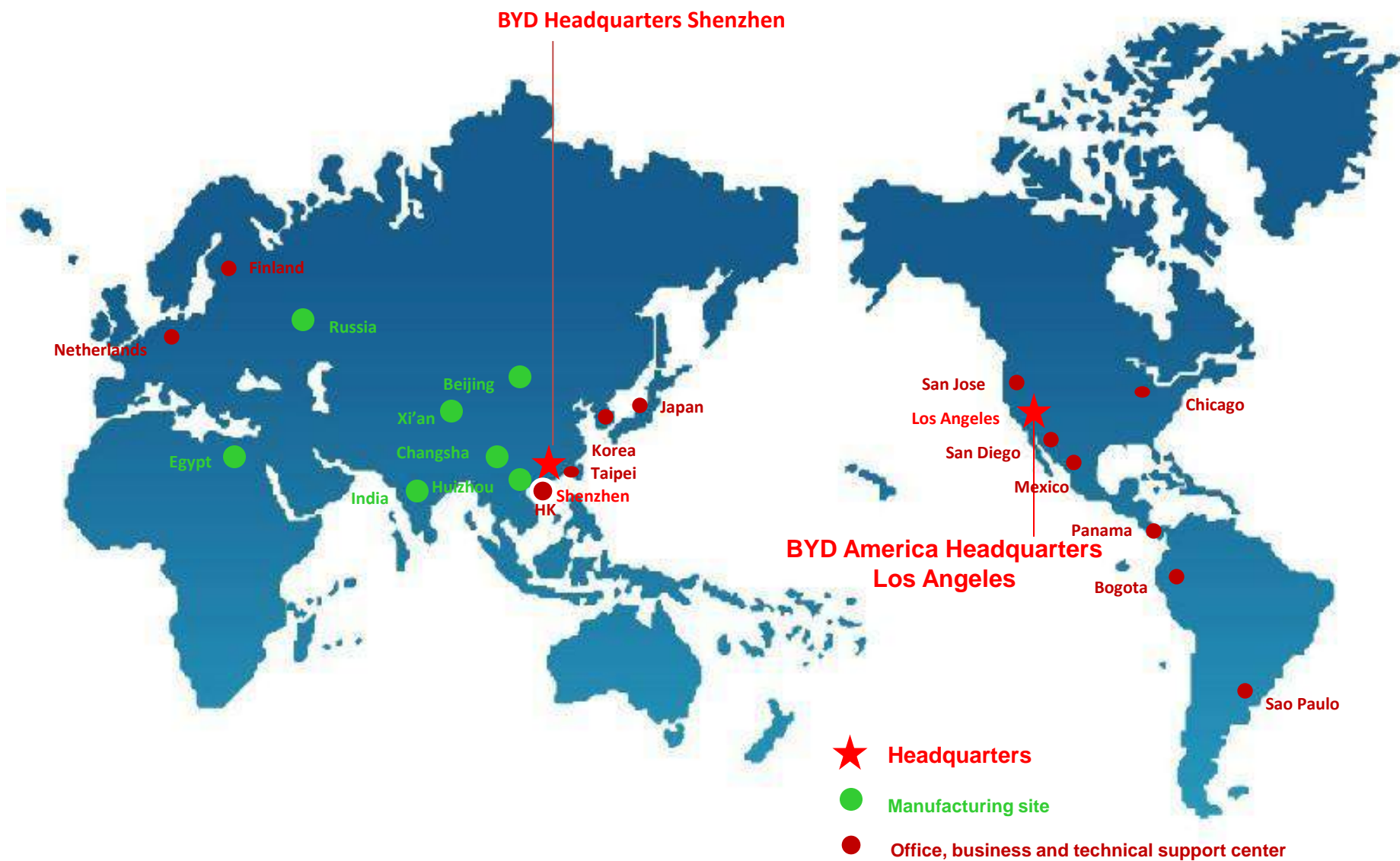


● **CHANGSHA PLANT**  
4,200,000 sq. m.





# BYD Global Footprint





# ***BYD Battery Profile***

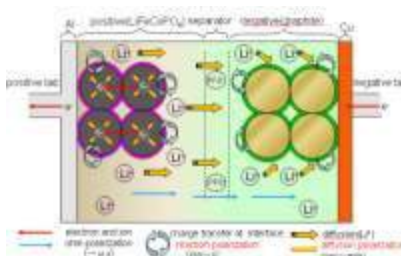
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## Material Component



## Cell design



## Pack design



**Material**



**Cell**



**Pack**



**Application**



**Manufacture**



**Quality Control**



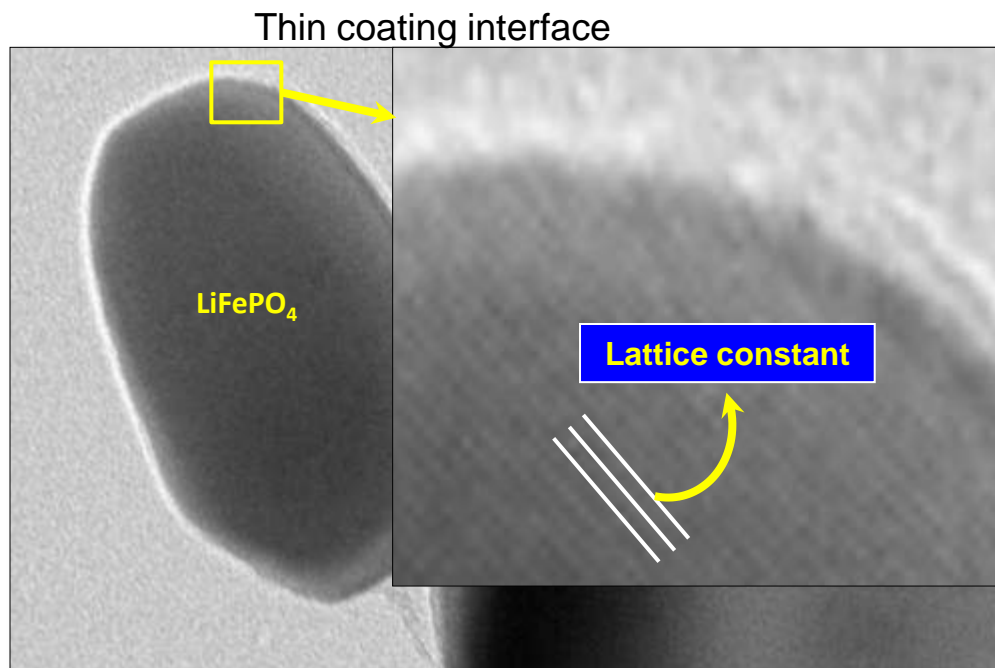
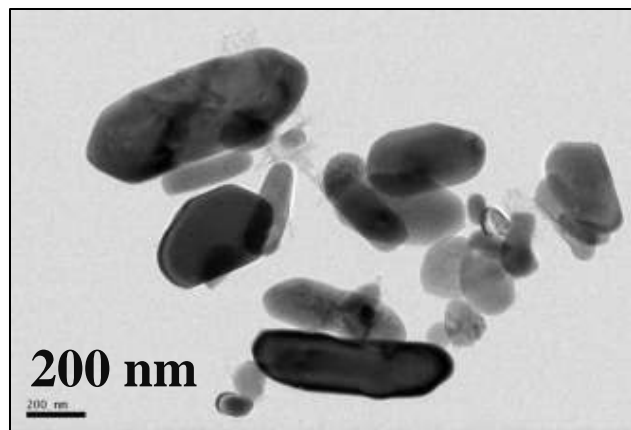
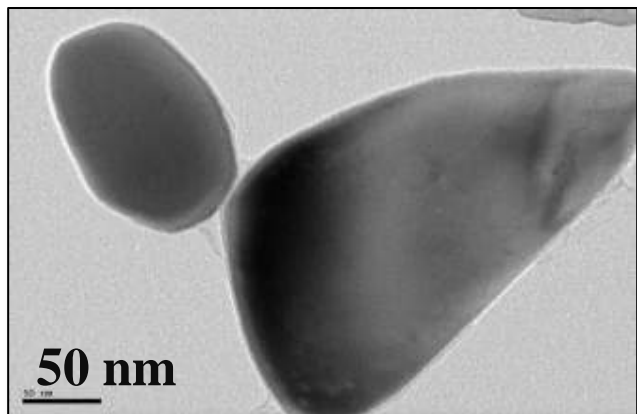
**Full-scale Test**



**Application Technology**

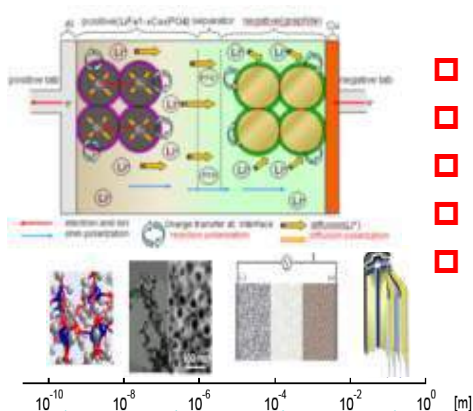


# Raw Material R&D/Mass Production Ability

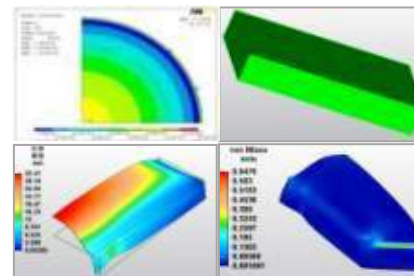


- ❑ Excellent temperature endurance
- ❑ Low impurity content
- ❑ Good stability between block
- ❑ High diffusion coefficient

*BYD has R&D/ mass production capability for main materials (cathode, anode, separator, electrolyte).*



- ❑ Material thermal characteristic
- ❑ Electrode structure design
- ❑ Impedance balancing design
- ❑ Abuse prevention design
- ❑ Electrochemistry failure model



- ❑ Temperature characteristic design
- ❑ SOC strategy
- ❑ C-rate strategy
- ❑ Power strategy

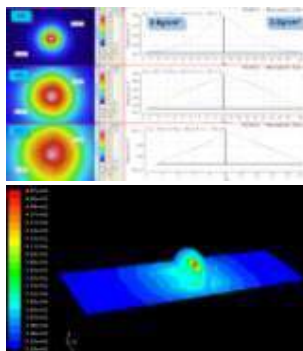
## Electro-chemistry Design

## Chemical safety Design

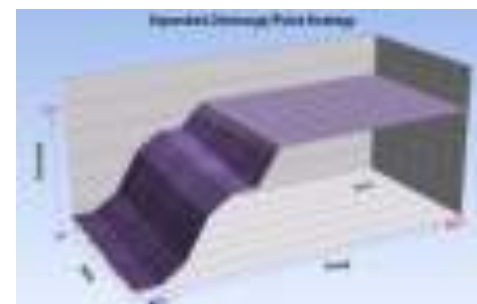
## Structural safety Design

## Application Strategy

- ❑ Mechanism research
- ❑ Component proportion
- ❑ Electrode design
- ❑ Impedance design
- ❑ Interface design
- ❑ Thermal model
- ❑ Polarization model



- ❑ Structure design
- ❑ Seal design
- ❑ Vent design
- ❑ Safe-reliability design



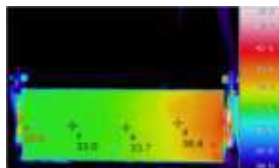


# Pack Design Ability



Intensity / reliability / Low resistance

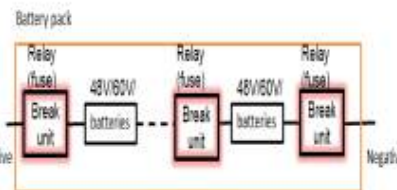
## Connection Design



IP class (water & dust)

Anti-aging

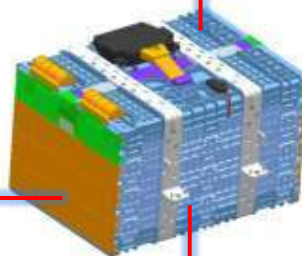
## Seal Technics



Active safety when:

- ✓ Abnormal Voltage /Current /temp.
- ✓ Impact signal
- ✓ Leakage of electricity

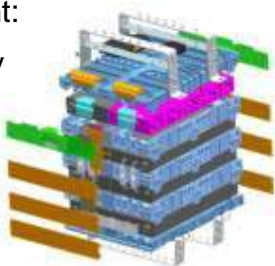
## High-Voltage Safety



## Modularization

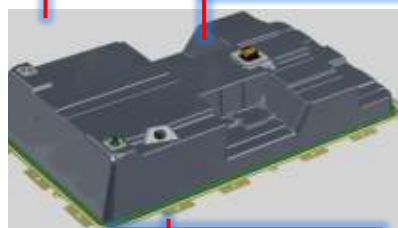
Combined free for different requirement:

- ✓ Quantity
- ✓ Space



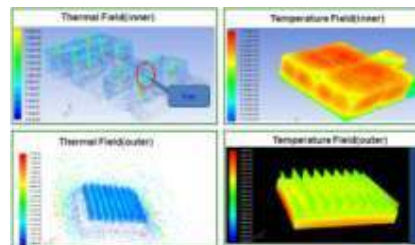
## Signal Line & Sensor

- ✓ Safe
- ✓ Temperature sensor
- ✓ High reliability



## Thermal management

Cooling and thermal balancing



## BMS



Control/ Communion/  
Protection/ Diagnosis



# Manufacturing Ability



Full  
Automatic

High  
Speed

High  
Precision

Strict  
Environment  
Control

Weighing:  $< \pm 0.5\%$

Electrode thickness:  $\pm 0.001\text{mm}$

Winding excursion:  $\leq 0.3\text{mm}$

Voltage precision:  $0.01\text{mV}$

70m/min coating/ rolling/  
slitting speed

Only **20sec** for a 200Ah-cell

Temperature:  $\pm 2^\circ\text{C}$

Dew point:  $-40 \sim -60^\circ\text{C}$

Purification:  $10^5 \sim 10^4$  degree

***BYD has unique technics  
and ability to manufacture  
the best LFP battery!***



# Manufacturing Ability



Auto mixing system



Auto coating system



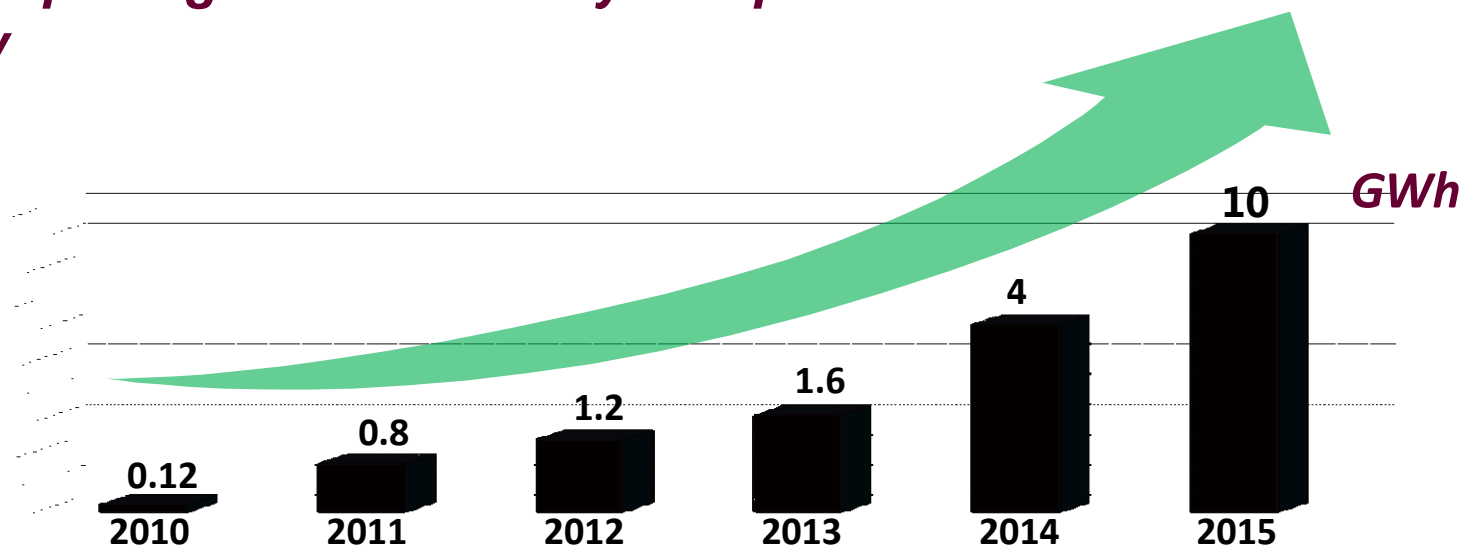
Auto winding system



Auto assembling system



## Ground Opening of BYD Battery Campus with 8GWh capacity





# Quality Control Ability

## Certification of product and test ability



UL 2580

UL Certification



UL 1642



CQC Certification



QC/T Certification

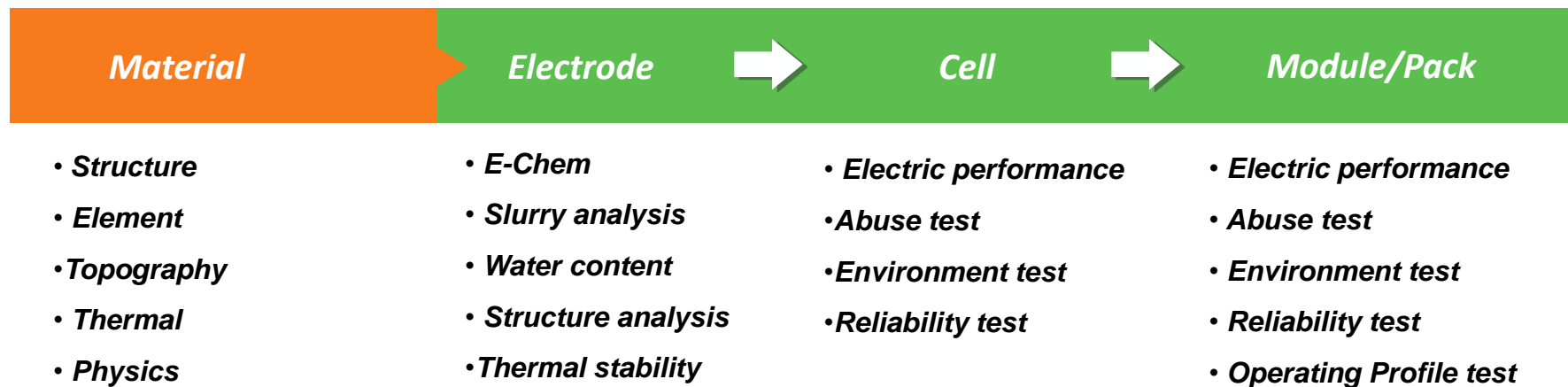


UL WTDP



# Full-scale Test Ability

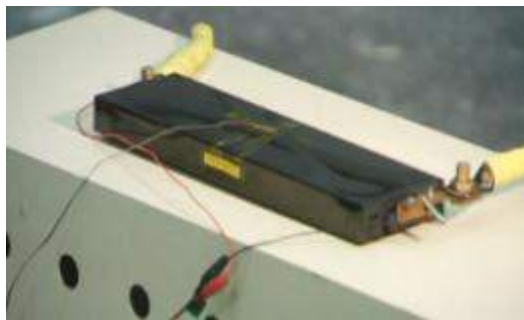
## Test ability from raw material to battery pack



*All the cells for xEVs and ESS has been certificated by UL1642 and QC/T743, to make sure the stability of the safety, BYD carries out partial abuse tests periodically to examine the stability.*



**Flame**



**Short circuit**



**Nail Penetration**



**Impact**



**Oven**



**Crush**



## Vibration

IEC 62660-2-2010, 10~2000HZ



## Shock

$\frac{1}{2}$  sign wave, 25 g<sub>n</sub> peak,  
15 msec, 3 shocks in 3 axes



## Soaking

3.5%NaCl, 2h



## Thermal shock

-40~+85°C/6h/5~10times



## Crush



15%~50% compression



## Salt Spray

5% NaCl, PH: 6.5 -7.2, 8 test  
cycles, 56 days

*Simulate what will happen to the battery pack when be impacted*

	<p><b>SOC : 100%</b>  <b>Inbreak Angle : rear-end collision</b>  <b>Speed : 20Kmph</b></p>	<p><b>SOC : 100%</b>  <b>Inbreak Angle : rear-end collision</b>  <b>Speed : 64 Kmph</b></p>
Photo		
Result	<p><i>Lightly destroyed</i>  <i>No fire, No exploding</i></p>	<p><i>Smoking</i>  <i>No fire, No exploding</i></p>

*Simulate the scene that may occur in the real operation*

**Short Circuit**



**Fire Simulating**



**Soaking Simulating**



**Gas Flaming**

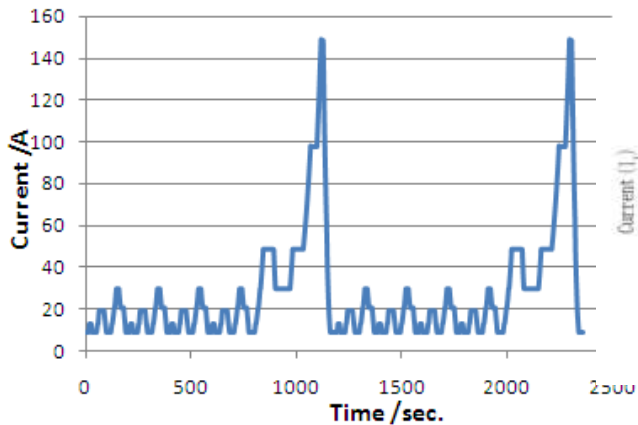




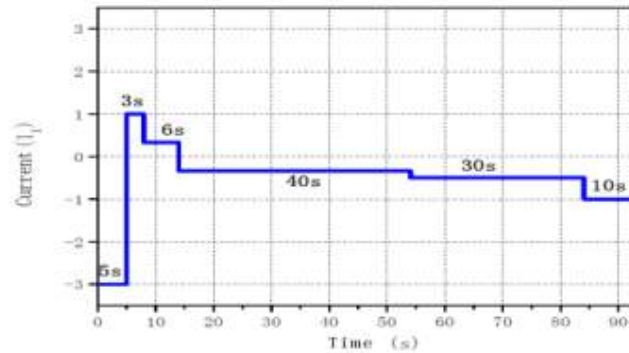
# Application Technology Research Ability

*Research and test on different operating profile for different customer*

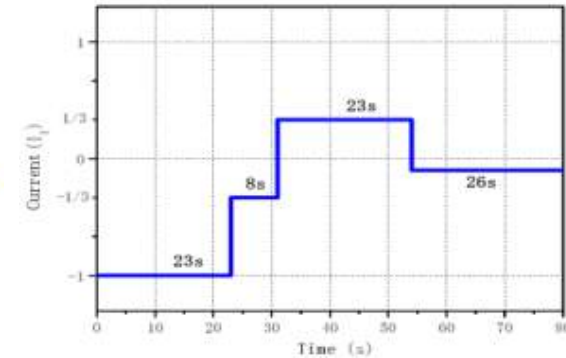
**NEDC Cycle**



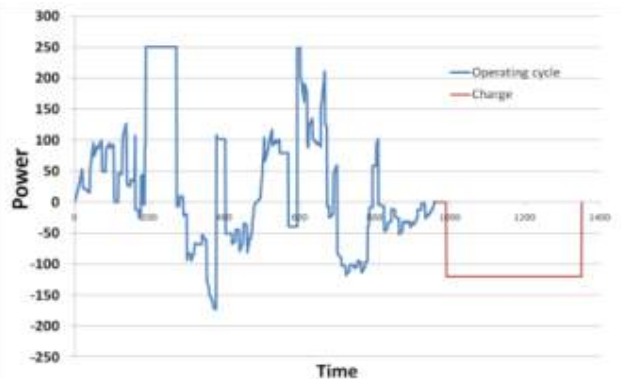
**Profile of e-Car**



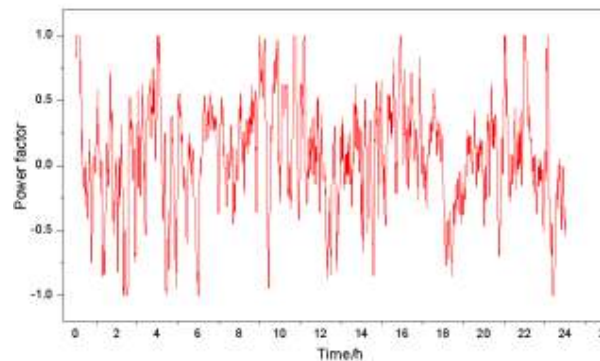
**Profile of e-Bus**



**Profile for special vehicle**

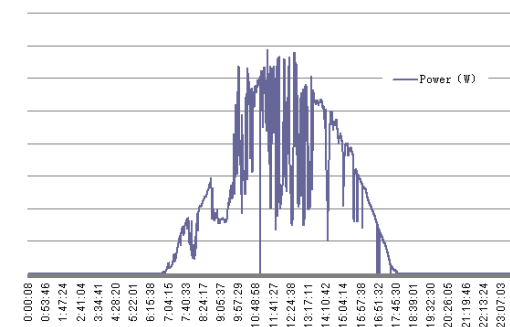


**Frequency Regulation**



**PV ESS**

Power from PV (W)





# Application Experience

*BYD cumulated a mass of application data in wide mass application in different area, which make it possible to designing or improving aimed at every typical application.*





# Operation Experience

## Basic Parameters

e6	Energy	60	kWh	General Profile
	Range	300	km	
	Max. Speed	140	km/h	
K9 (Bus)	Energy	320	kWh	
	Range	≥400	km	
		≥250	km	
	Max. Speed	≥70	km/h	



\*Ecology Label  
Busbuilder of the Year Worldwide 2014

Award from Busworld exposition, Kortrijk, Belgium, 10.2013

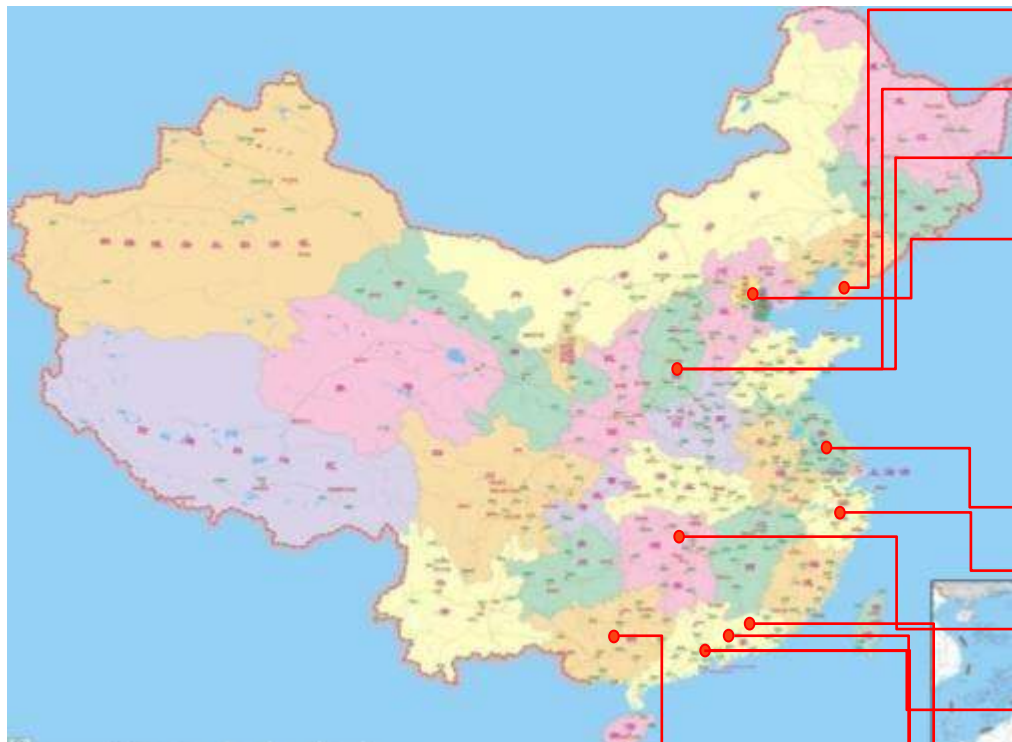
The maximal odometer of **single e6** is over **475,000** kilometers\*;  
The total odometer is over **165 million** kilometers (in Shenzhen).

The maximal odometer of **single K9** is over **180,000** kilometers;  
The total odometer in Shenzhen is over **25 million** kilometers (in Shenzhen).

\* Timeline: Apr. 2014



# Application—Inland



1200 K9 in Dalian, Liaoning, 2014~2015 \*

20 e6 taxi in Baoji, Shanxi, from 2012

50 K9 in Xi'an, Shanxi

14 e6 for the State of Council, China



650 K9 and 400 e6 in Nanjing, Jiangsu, Q2, 2014

2000 K9 & 1000 e6 in Hangzhou, Zhejiang, 14-15\*

100 K9 in Chang Sha, Hunan

800 e6 Taxi in Shenzhen

780 K9 for public transit in Shenzhen

500 e6 squad car for Shenzhen

100 e6 Taxi in Huizhou, Q4, 2013

200 e6 Taxi in Wuzhou, Guangxi, Q4, 2013

400 e6 Taxi in Shaoguan, Guangdong, Q4, 2013



\* Number of intention with the local government



# Application Experience—Overseas Market



49 e6 ,Bogota, Colombia



## The Most Energy-efficient Bus

Clinton Environment and Climate Initiative (CCI) and the Inter-American Development Bank , December 2012,



Palmas, Brazil



Sao Paulo , Brazil



Gilberto - Kassab , Sao Paulo Mayor ,was driving K9



## STO and STM, Canada

Examination operation from July, 2013



## New California Plant

To produce electric buses, put into operation In 2013. 50-100 electric buses in 2014, the annual volume will be more than 500



## MTA, California

25 K9, will be put into exam and operation in Q1, 2014.

## New York MTA Manhattan





## **China State Grid ESS for New Energy:**

- ◆ Capacity: 6MW / 36MWh
- ◆ Function : ESS for PV & Wind new energy generation
- ◆ Location: Zhangbei, China
- ◆ Cooperator : State Grid
- ◆ Status: Operating since Oct, 2011

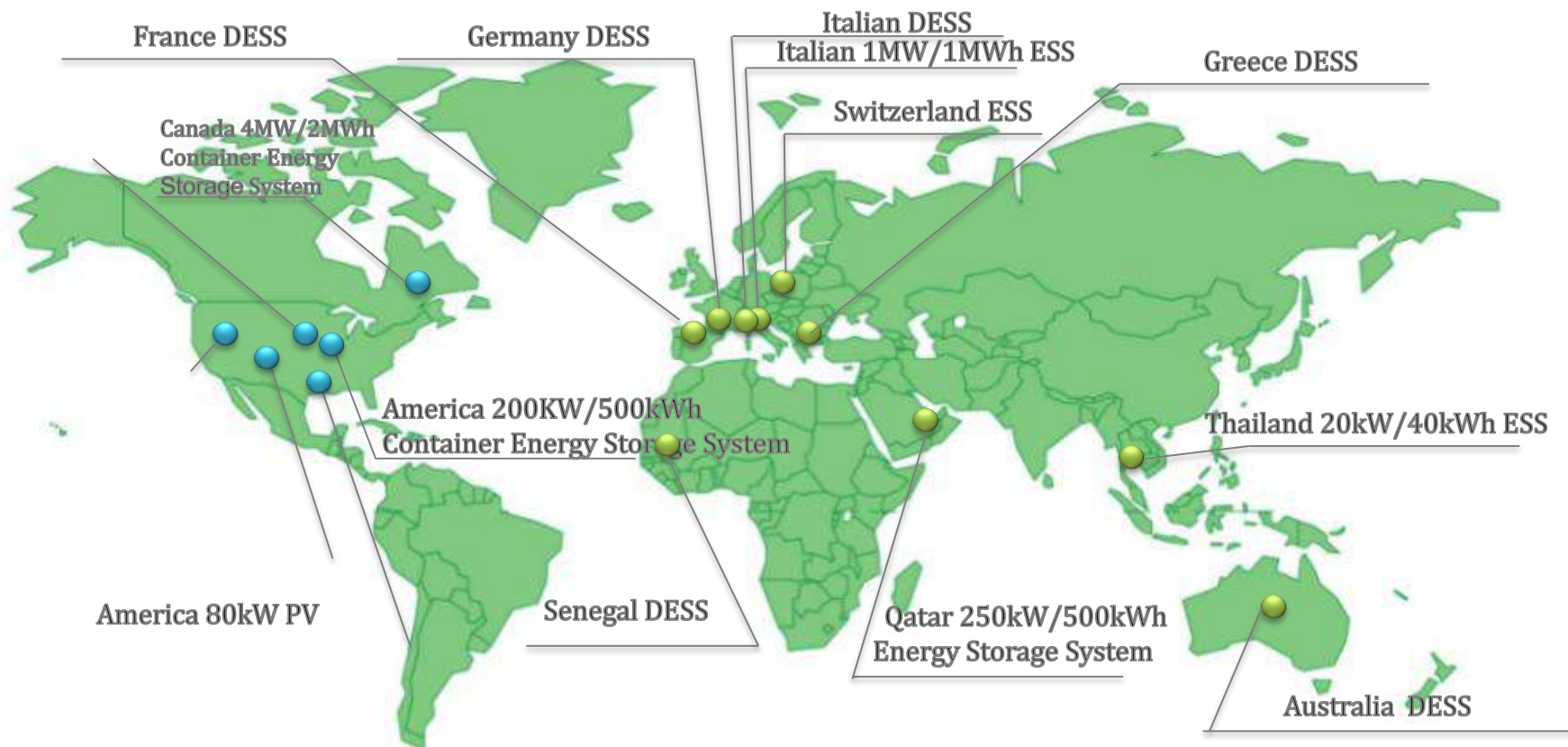


## **China Southern Grid ESS:**

- ◆ Capacity: 3MW / 12MWh
- ◆ Function: Peak-Shaving
- ◆ Location: Shenzhen, China
- ◆ Cooperator: China Southern Grid
- ◆ Finish Time: Jan. 2011

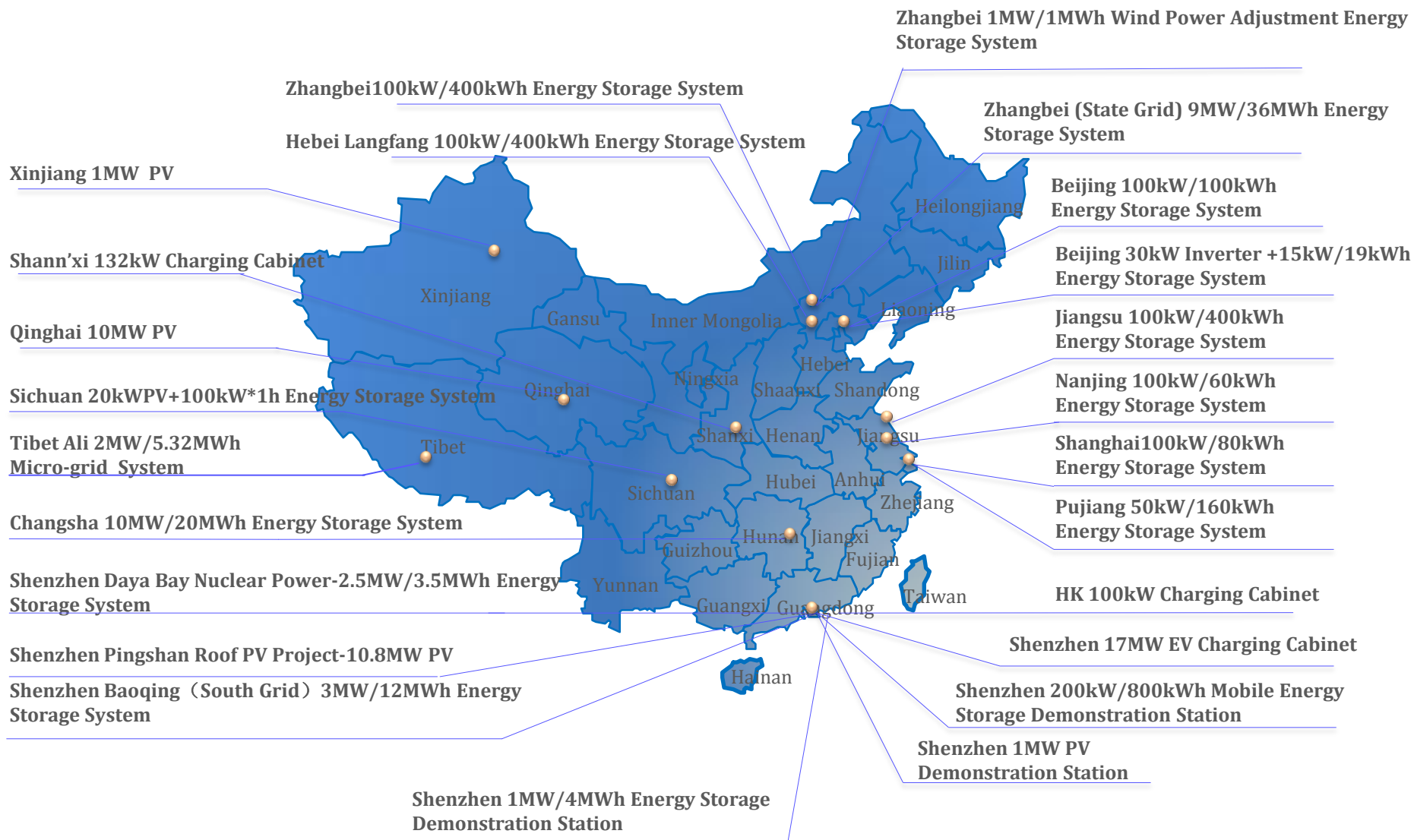


# Application Experience - Storage





# Application Experience - Storage





# Application Experience - Telecom

## Datacenter Application:

- ◆ Cooperator: **China Mobile**
- ◆ System Capacity: 300kW/300kWh
- ◆ Function: Backup Power for Datacenter
- ◆ Location: Neimenggu ,China
- ◆ Finish Time: 2012

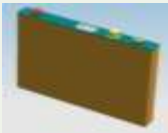





## Base Station Application:

- Cooperator: **China Unicom, China Telecom, China Mobile**
- System Capacity: 48V, 10-1200Ah
- Location: China
- Time: since 2008



# Product Series

Model	C20	C19	C12	C15
Appearance				
Dimension /mm	19*173*120	39*109*420	58*146*416	58*146*416
Nominal Capacity /Ah	25	110	235	250
Nominal Voltage /V	3.2	3.2	3.2	3.2
Energy Density (Wh·Kg <sup>-1</sup> )	105	110	120	130
Energy Density (Wh·L <sup>-1</sup> )	205	200	215	230
Power Density (W·Kg <sup>-1</sup> )	1800	1500	2500	2000
Weight /Kg	0.77	3.30	6.10	6.40
Can Material	Aluminum	Aluminum	Aluminum	Aluminum
Production Status	Mass Production	Mass Production	Mass Production	Mass Production



# Very Long Cycle Life

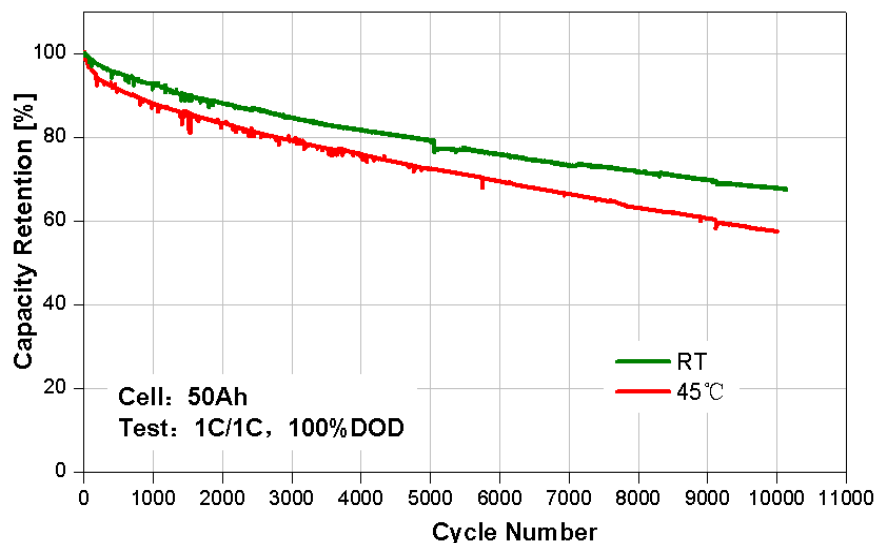
BYD's LFP battery has very long cycle life.

– The difference between single cell and battery pack is little.

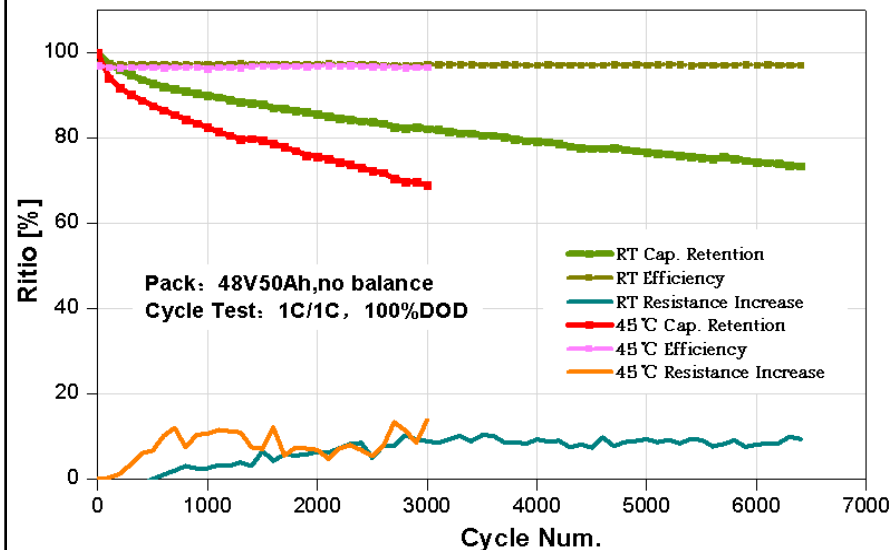
– The inner resistance increases no more than 10% after thousands of cycles, whether at RT or HT.

So, the power will fade little during operating.

## Cell (RT and 45°C)



## Pack (RT and 45°C)

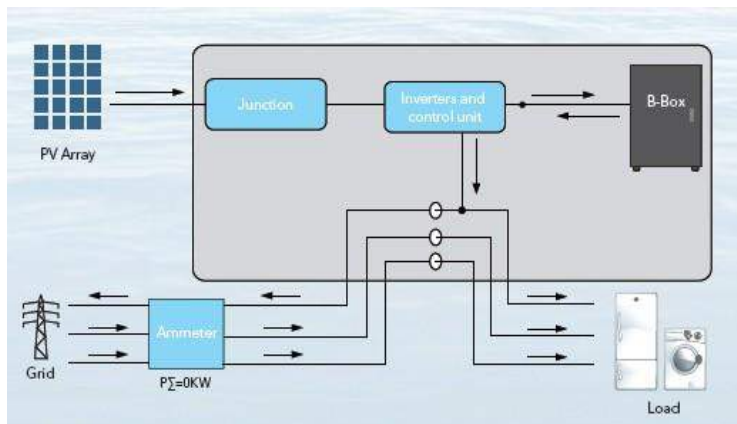




# BYD Battery Solutions/ B-Box

Battery Box takes along BYD reliable Fe battery which can be used as energy storage unit in energy storage system. The modular design gives flexibility of 2 to 4pcs of battery modules in one battery rack.

Both **B-Box 5.0** and **B-Box 12.8**, with different energy, is able to meet the requirement of different storage by increasing the capacity through parallel connection of battery rack.



## B-Box 5.0

- ◆ Installed via B-Plus 2.5 ( 3U battery 2.56kwh)
- ◆ RS485/ Can Communication
- ◆ 600\*600\*1108
- ◆ 6000 cycles @100% DOD
- ◆ UL, CE, TUV, UN38.3
- ◆ Compatible with SMA Sunny Island & Goodwe ES series hybrid inverter

## B-Box 12.8

- ◆ Installed via B-Plus 12.8 ( 12.8Kwh Battery Pack)
- ◆ RS485/ Can Communication
- ◆ 600\*600\*1108
- ◆ 6000 cycles @100% DOD
- ◆ UL, CE, TUV, UN38.3
- ◆ Compatible with SMA Sunny Island & Goodwe ES series hybrid inverter



B-Box 5.0



B-Plus 2.5



B-Box 12.8



B-Plus 12.8



*Build Your Dreams*

***Thanks for your attention***

