Lishen Advanced Battery Development for EV and ESS

Qin Xingcai

President

Tianjin Lishen Battery Joint-Stock Co., Ltd.

Content

- Brief Introduction of Lishen Company
- Lishen's Advanced Li-ion battery Technology and Application in EV & ESS
- Lishen's Development Outlook
- Summary

Lishen Company Overviews

- ***Established:*** *Dec. 25, 1997*
- ***Location:***
  - *No.38 Haitai South Road Huayuan Technological Park Binhai Hi-tech Industrial Development Area, Tianjin, China*
- ***Gross Area:*** *282,500 m^2*
- ***Investments:***
  - *Registered Capital: $ 192 Million USD*
  - *Total Asset: $ 923 Million USD*
- ***Main Shareholders:***
  - *China National Offshore Oil Corporation*
  - *SDIC Hi-Tech Investment Co., Ltd*
  - *Tianjin Lantian Power Sources Co., Ltd*
- ***Employee Composition:***
  - *Total employee: 6000*
  - *Engineer : 1000*

Business Overviews – Production Introduction

Small type cells & modules of Li-ion

Large format LIB cells & modules

Transportation

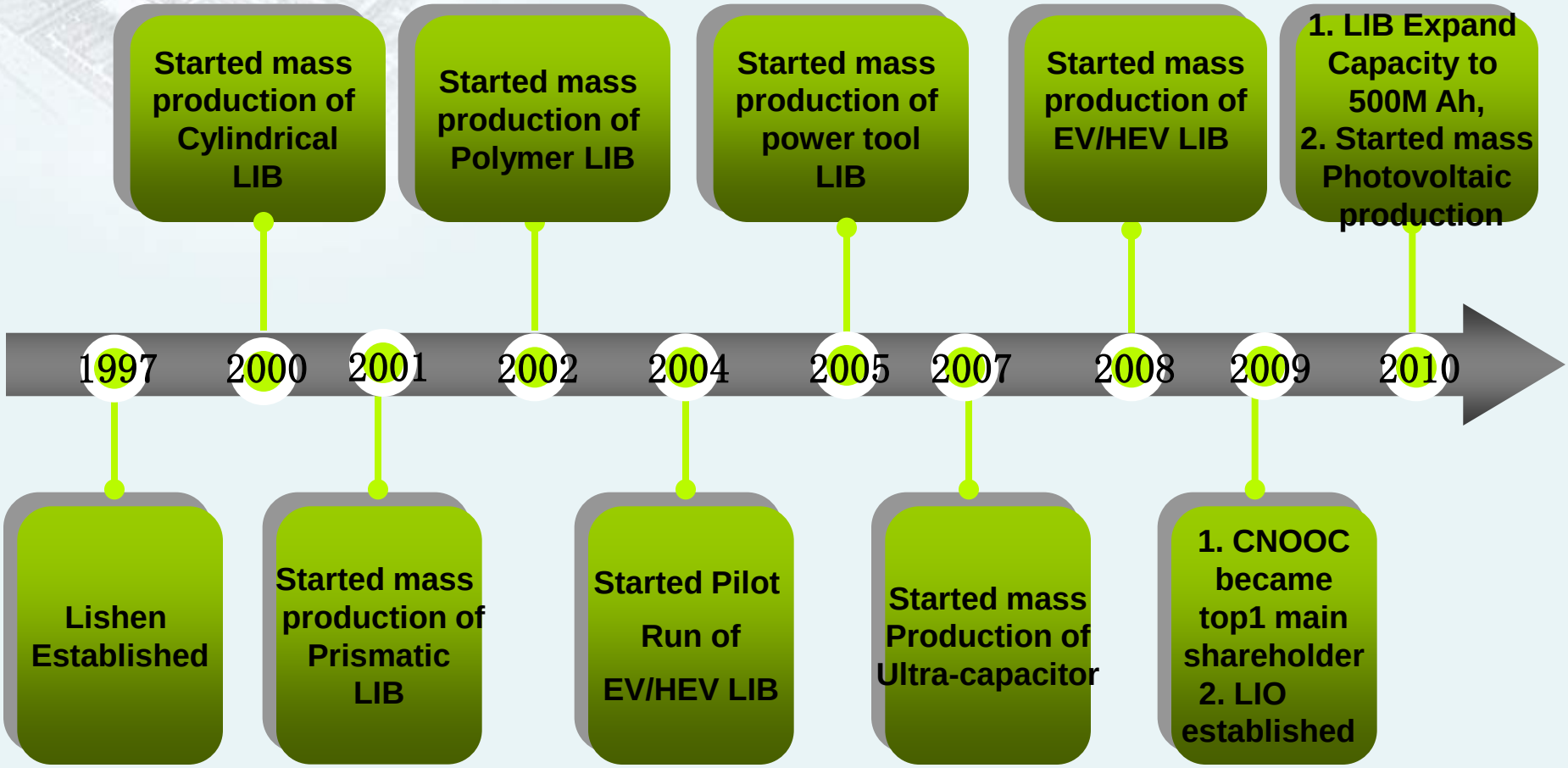
Energy Storage

Solar Light

UPS

Modules+ Power Grid

Business Overviews - History and Milestone



In the future 5 years, Lishen will focus on developing advanced power battery, photovoltaic, ultra-capacitor and relative power systems for new energy vehicles, renewable energy and ESS application, as well as keep continuous increasing of small type Li-ion battery production.

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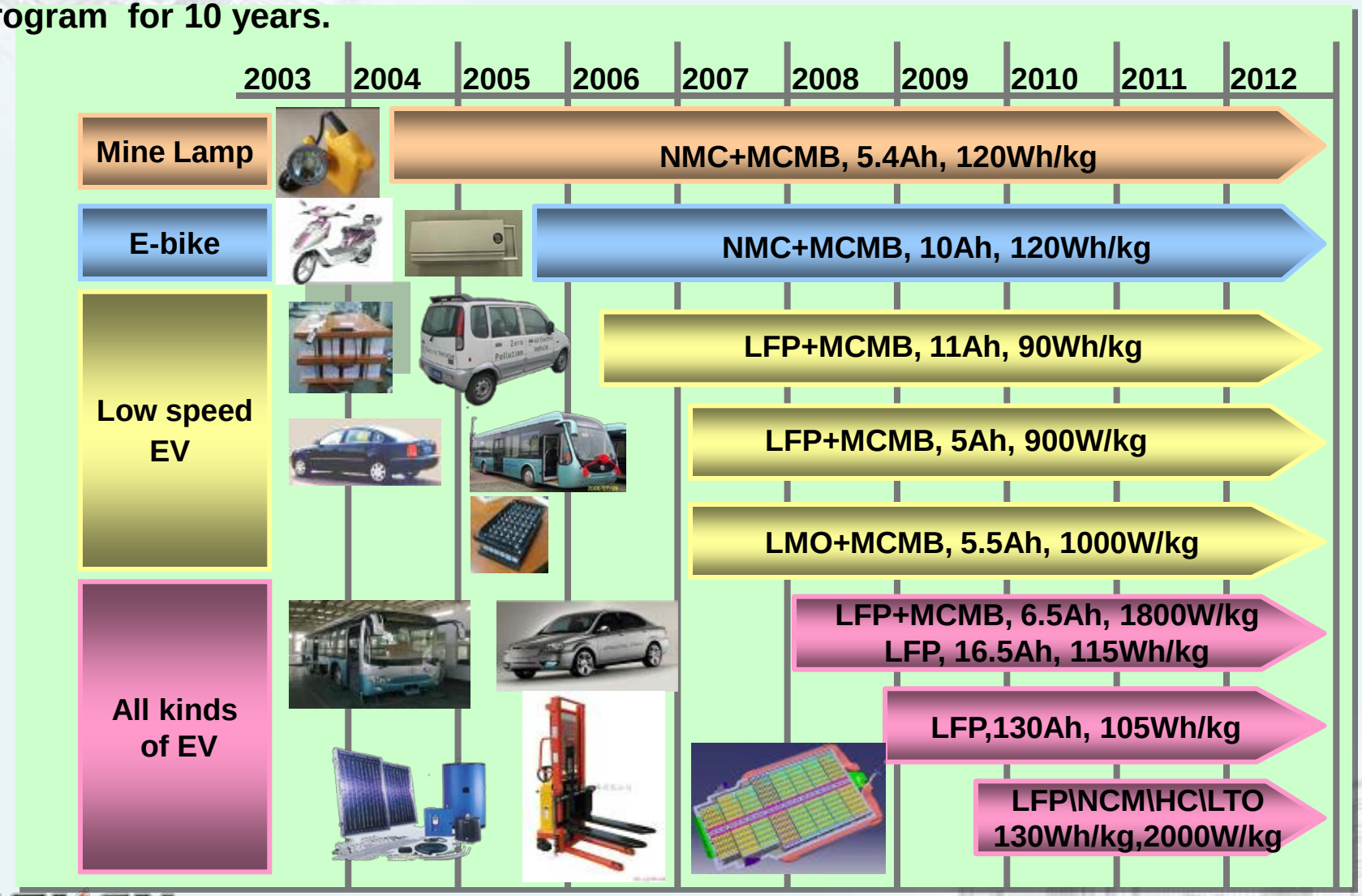
Lishen Current Li-ion Power Battery Technology

Lishen is one of main participants in Chinese MOST 863 EV & HEV Advanced Battery Program for 10 years.

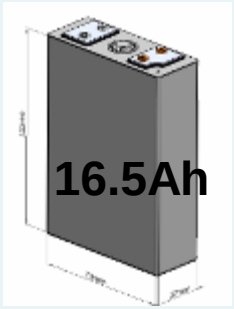


Lishen Current Li-ion Power Battery Technology

Lishen Mass Production Prismatic Power Cell (LFP, Al-Can)

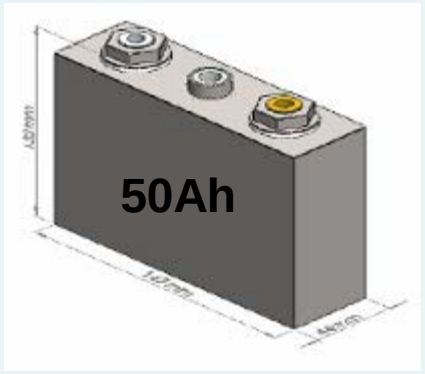
LP2712AB

LP2702AB/AC

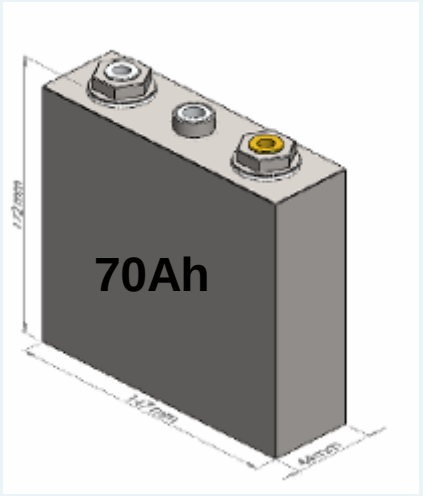


LP2720AB/AC

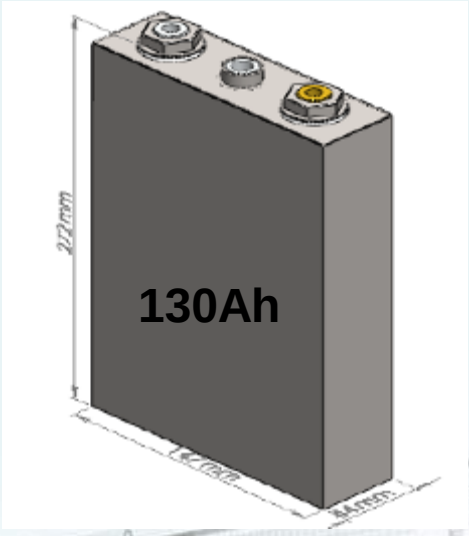
LP2717AC



LP44132AB



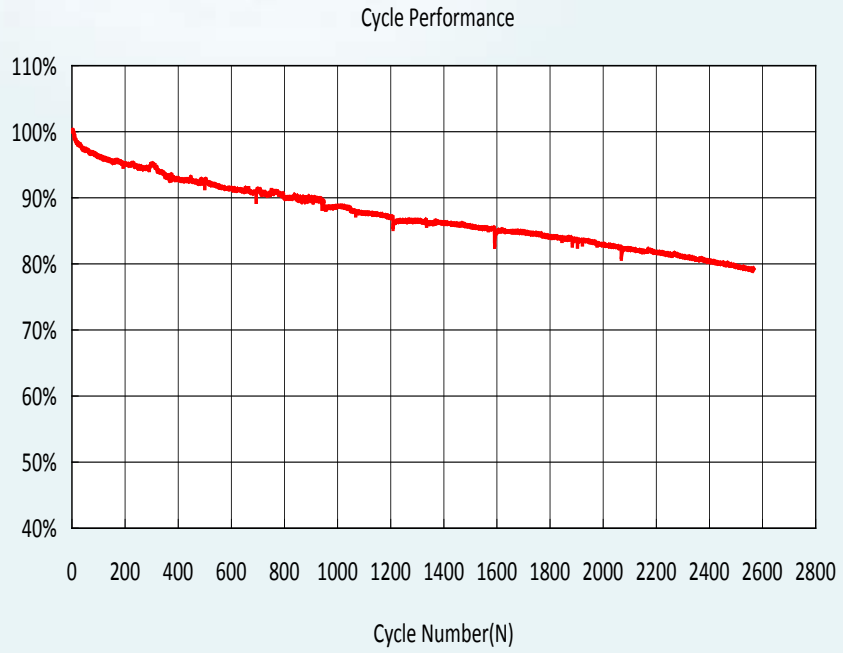
LP44172AB



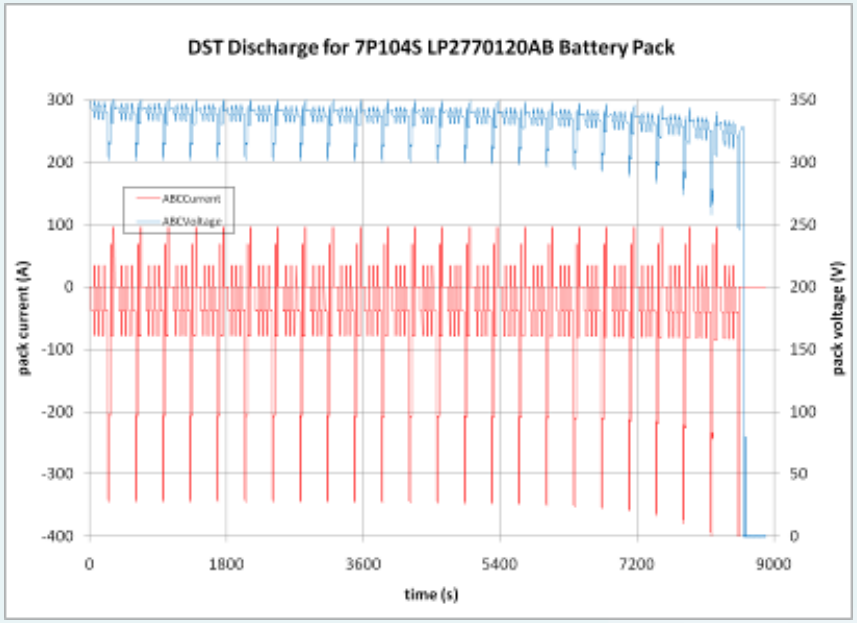
LP44272AB

Lishen Current Li-ion Power Battery Technology

System Cycle Life



System DST Testing



Efficiency; 97%

Note: Dynamic Stress Test

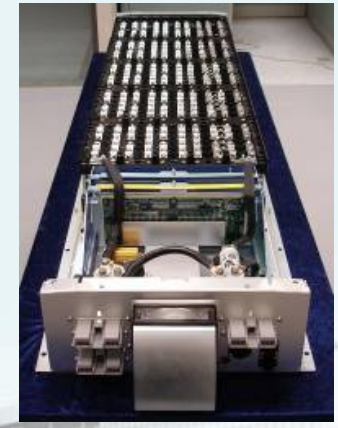
Li- ion Battery Technology From Cell to Pack System

Cell

Cell Block

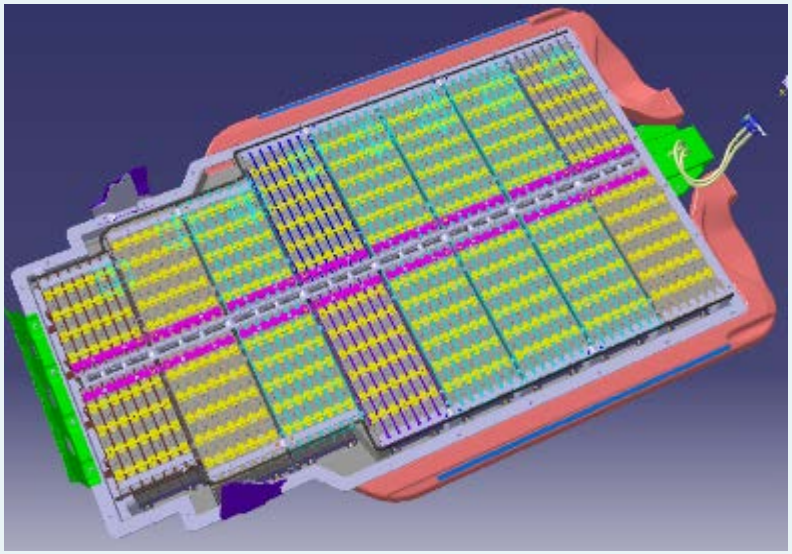
Module

System



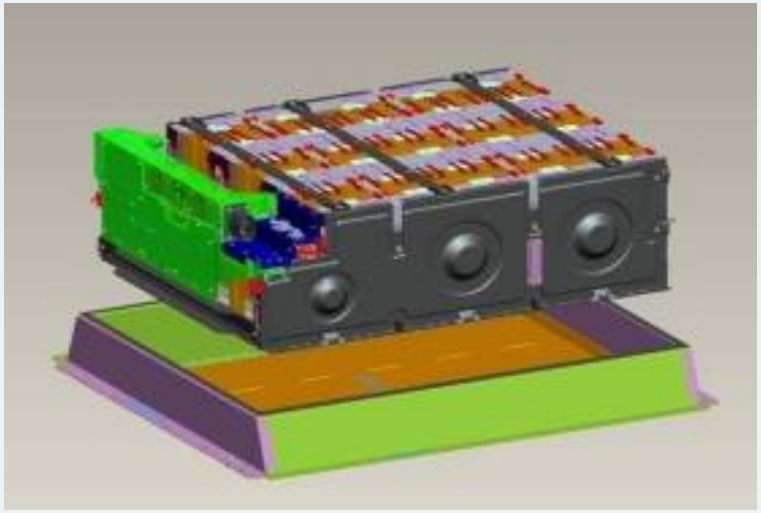
Application of Lishen Power battery for EV

Coda EV



Performance
Battery Pack : 35kWh
Vehicle range: 90-120 miles (US 06 & UDDS)
Top Speed: 80 mph (Electronically Limited)
Acceleration: 0-60 mph - under 11 seconds
Charge Time: 6 hours from 220V (30AMP)
Occupancy: 4 passengers
Vehicle Warranty: 3 years / 36,000 miles
Battery Warranty: 8 years / 100,000 miles

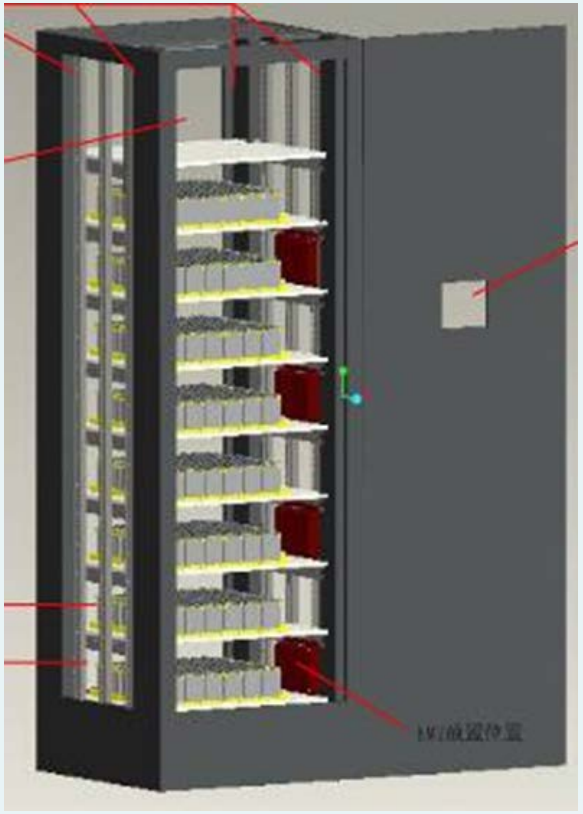
Application of Lishen Power battery for EV



Mini EV

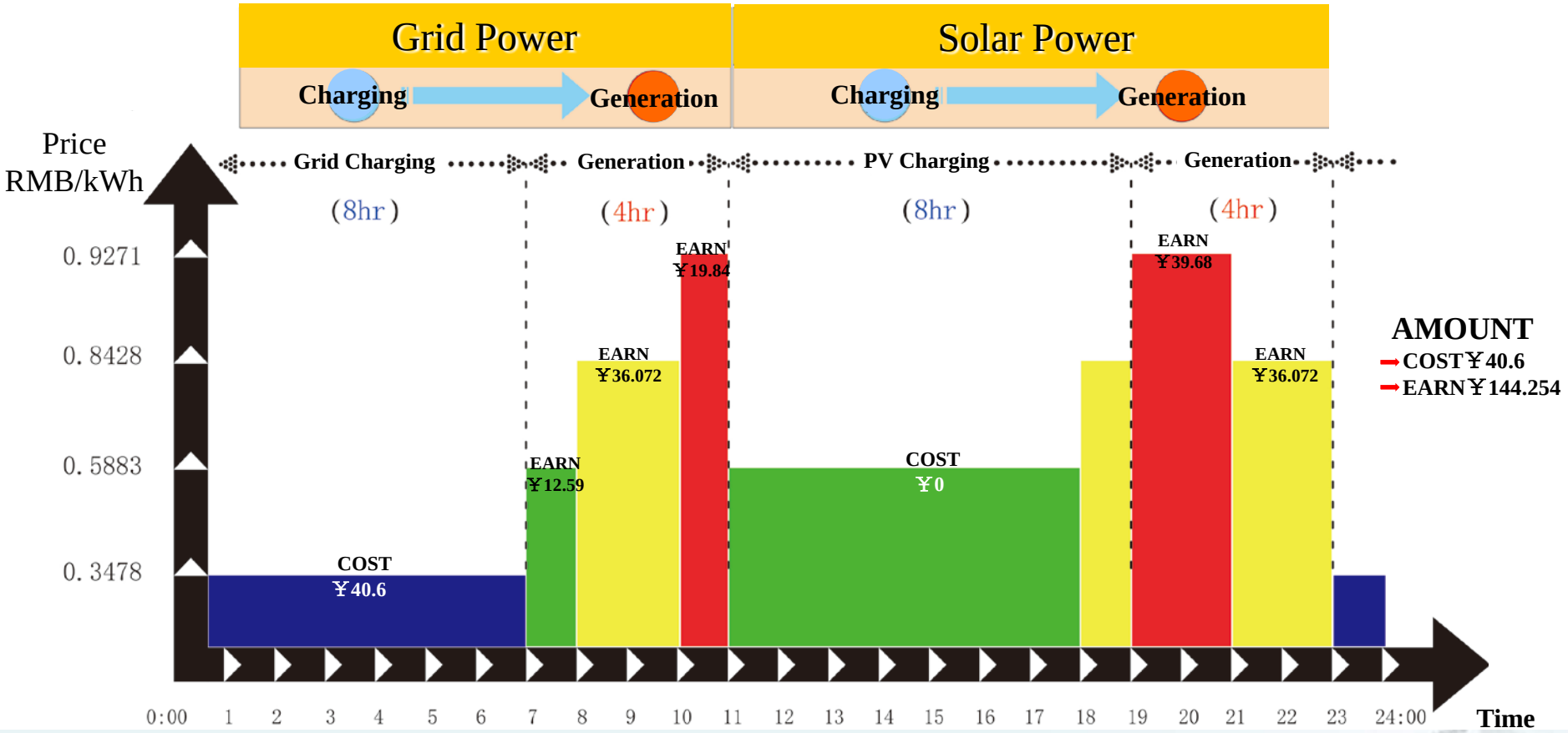
Battery Pack: 19kWh

Application of Lishen Power battery for ESS



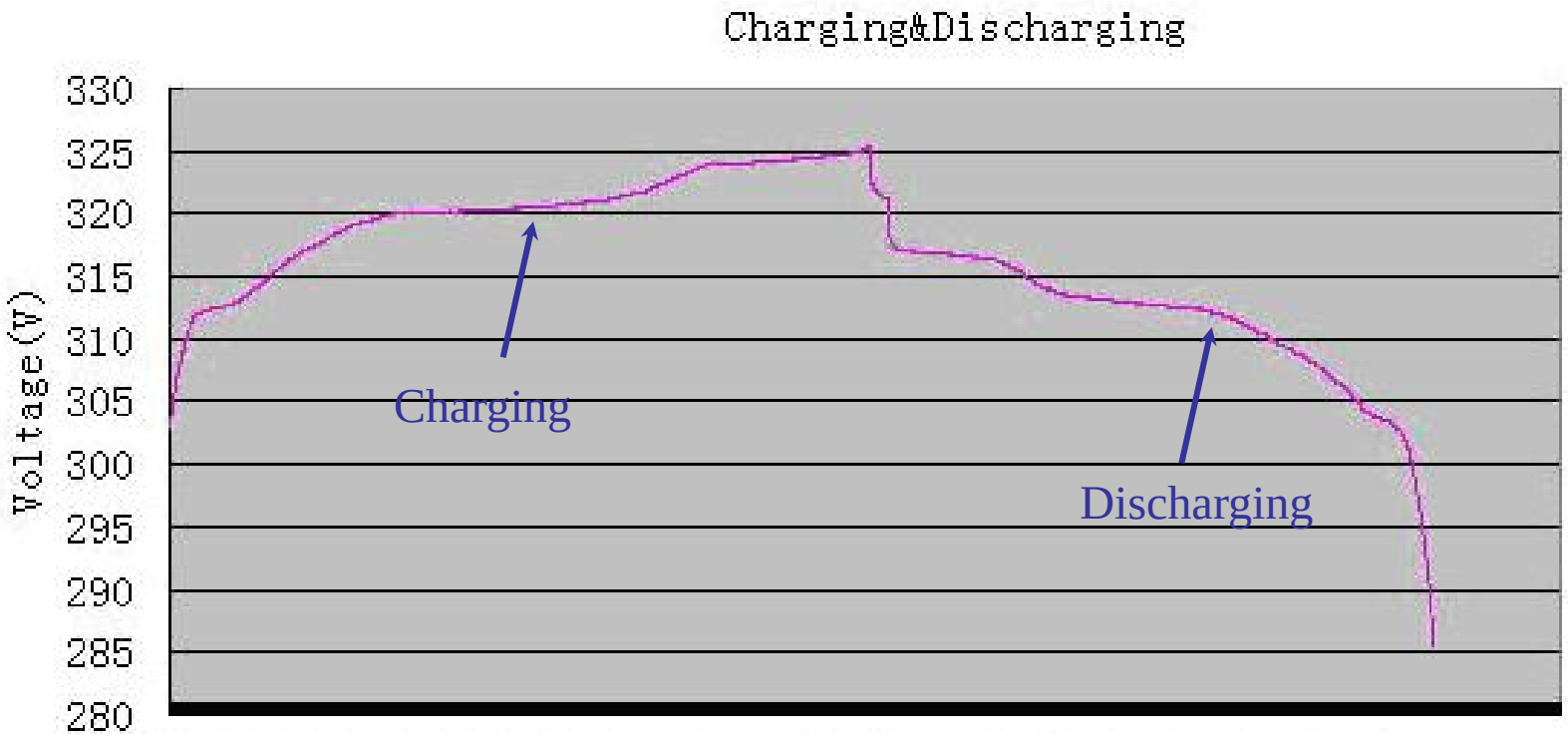
Application of Lishen Power battery for ESS

Current System Running Profile



Application of Lishen Power battery for ESS

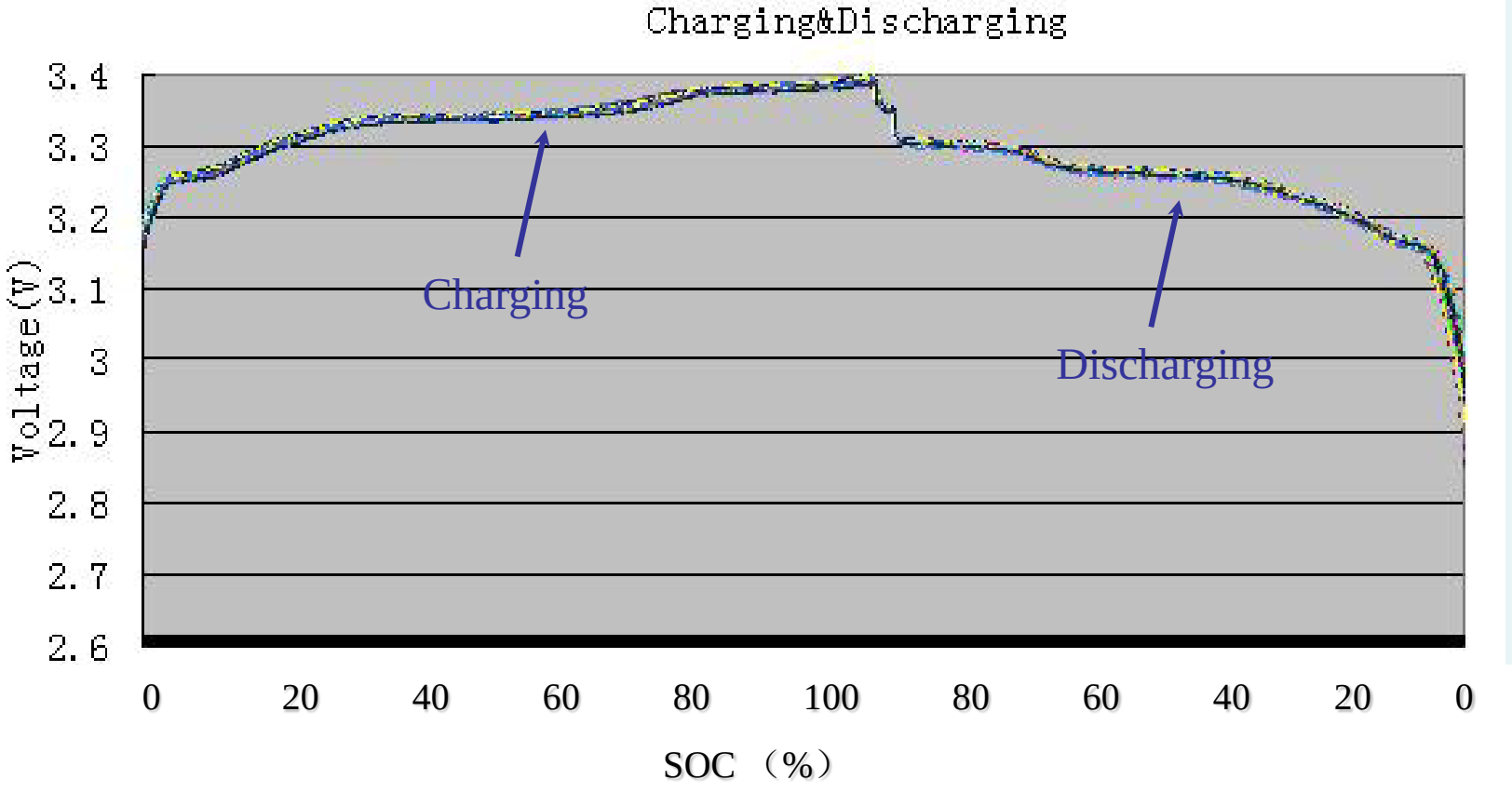
System Voltage & SOC Curve



96 Series System Running Graph

Application of Lishen Power battery for ESS

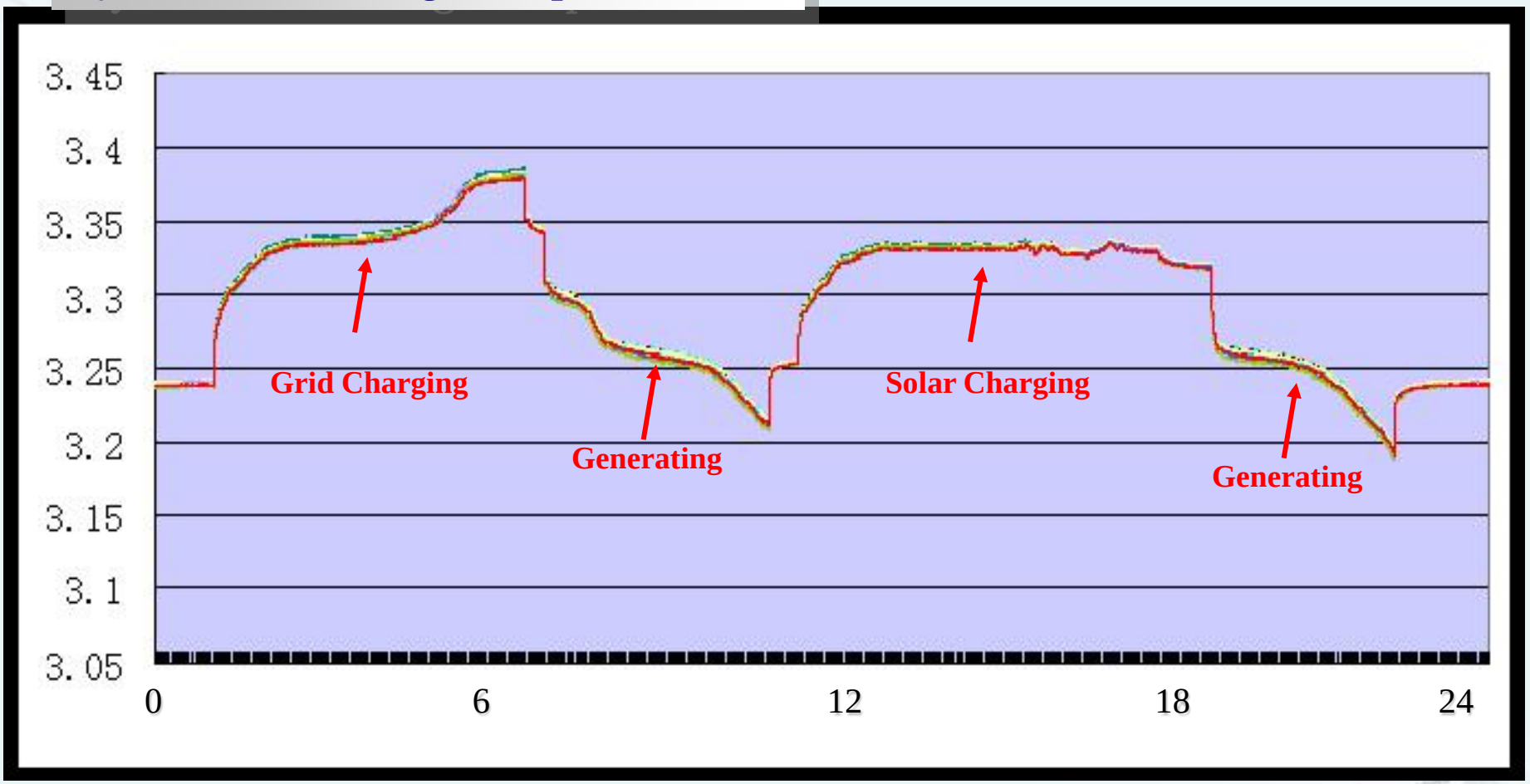
Cell Voltage & SOC Curve



96 Series System Running Graph

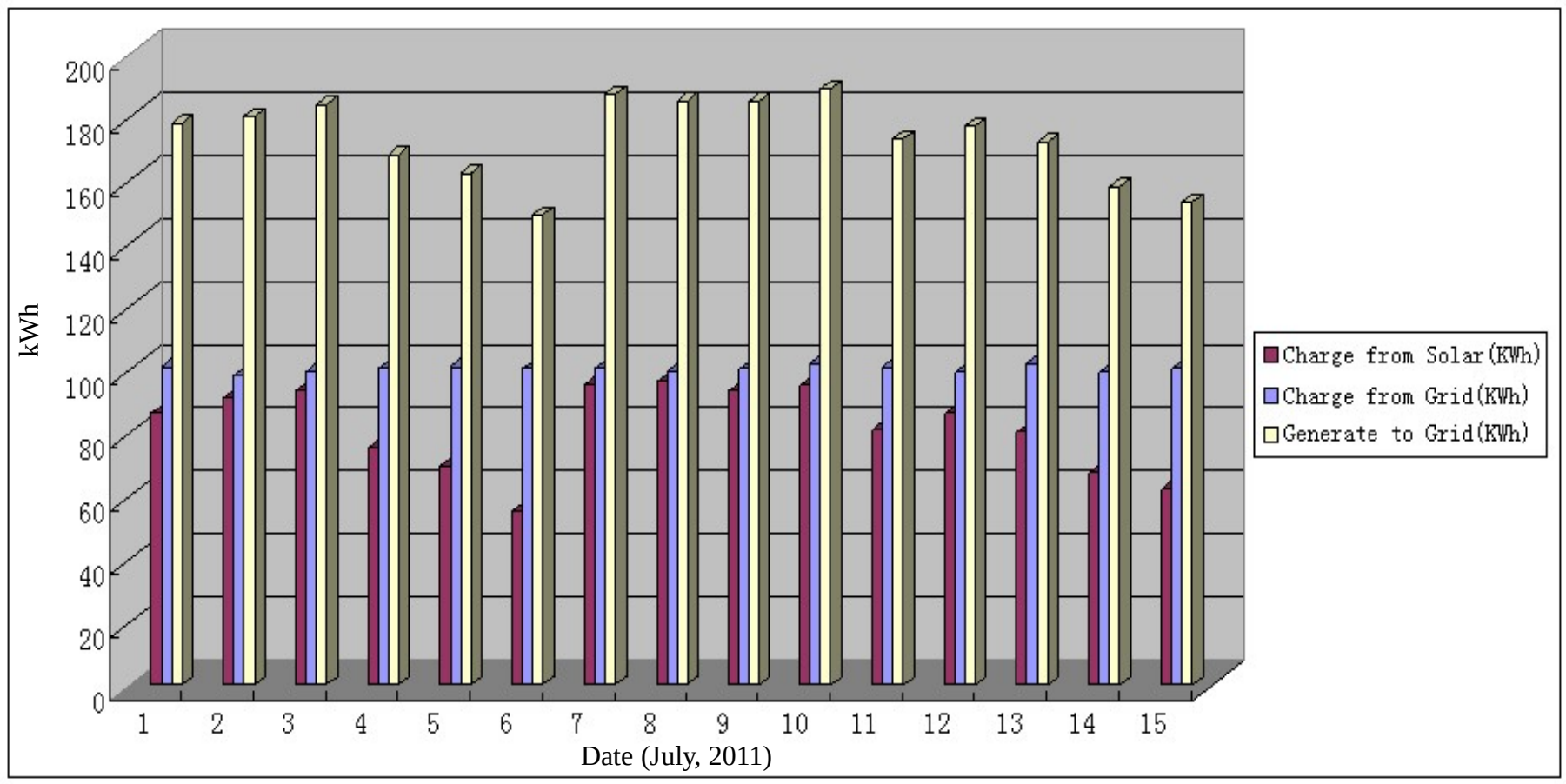
Application of Lishen Power battery for ESS

System Running Graph



Application of Lishen Power battery for ESS

System Energy Data



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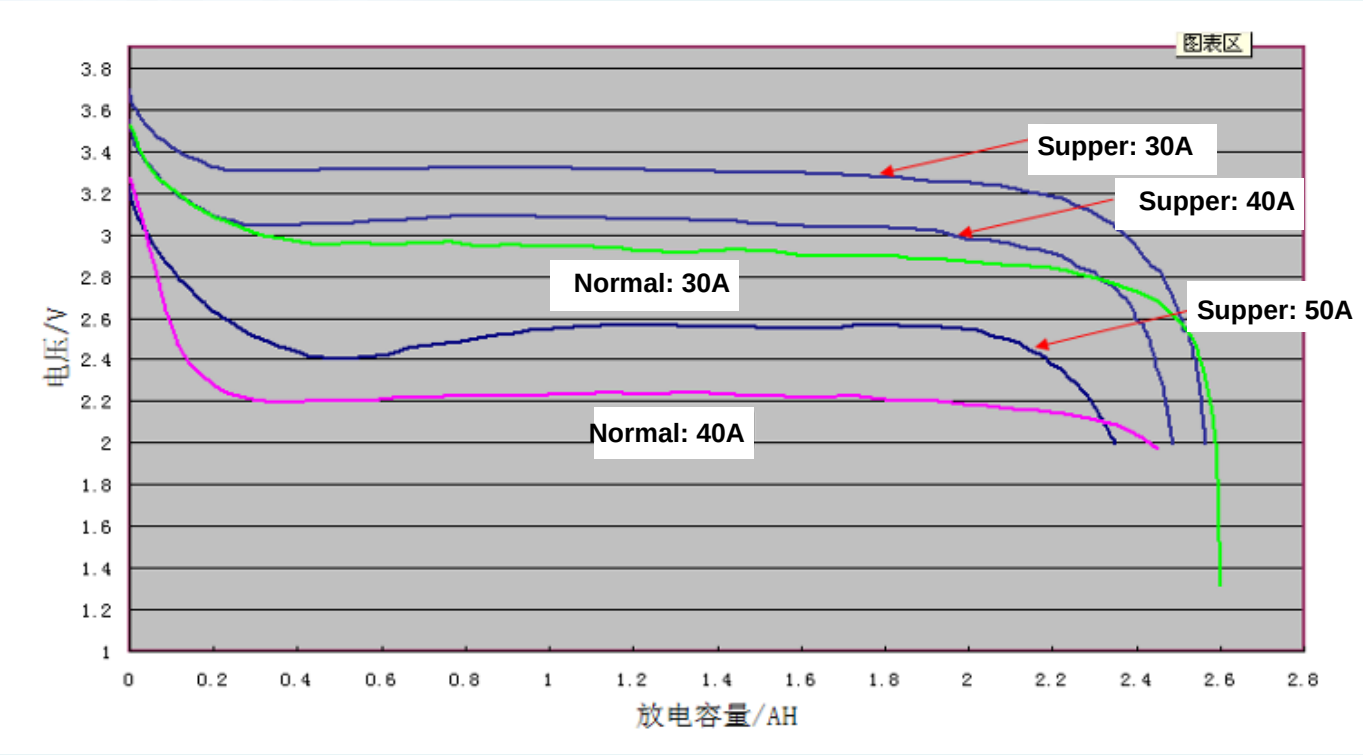
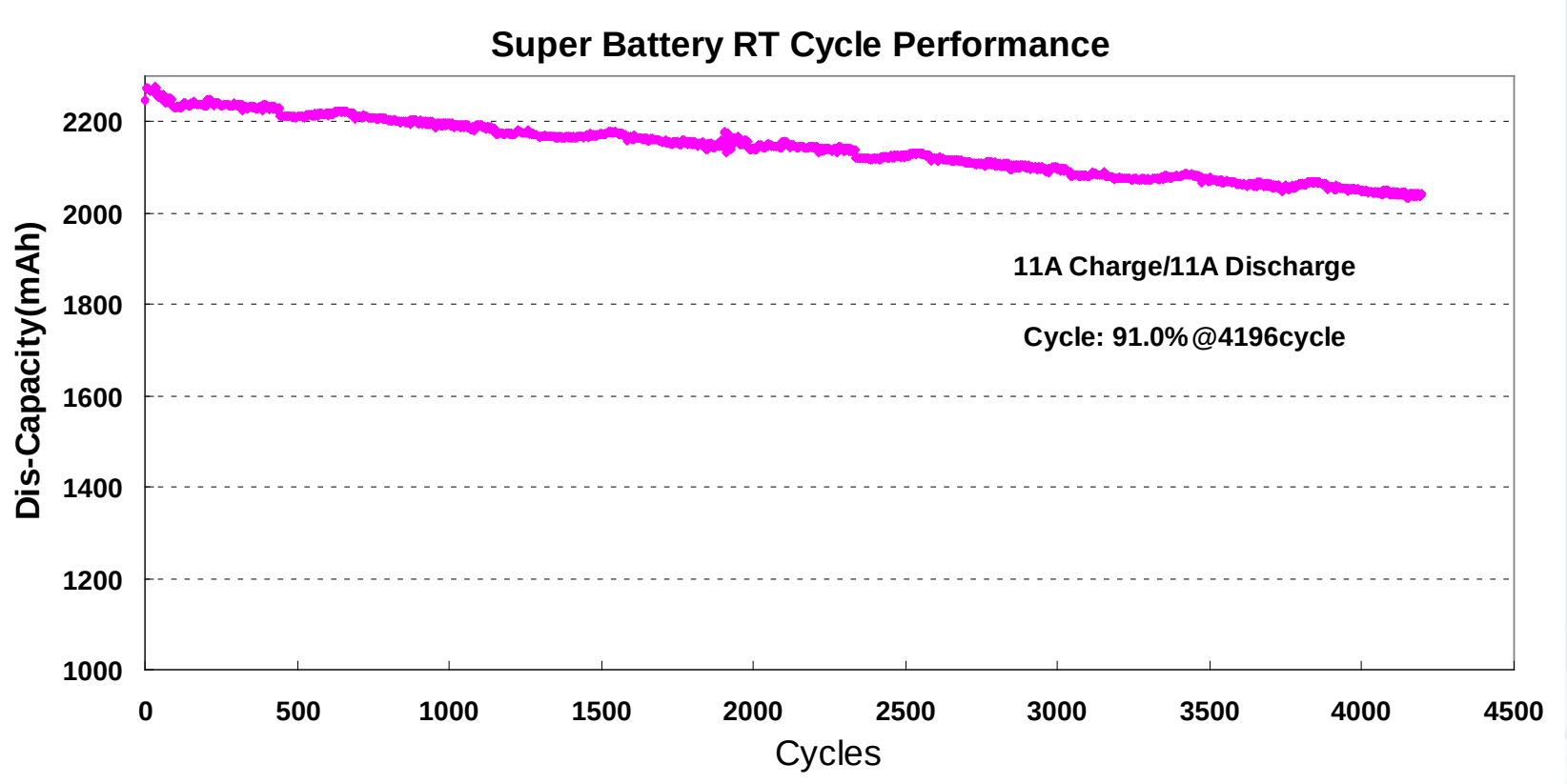
I. Super Li-ion Battery - Excellent Rate Performance

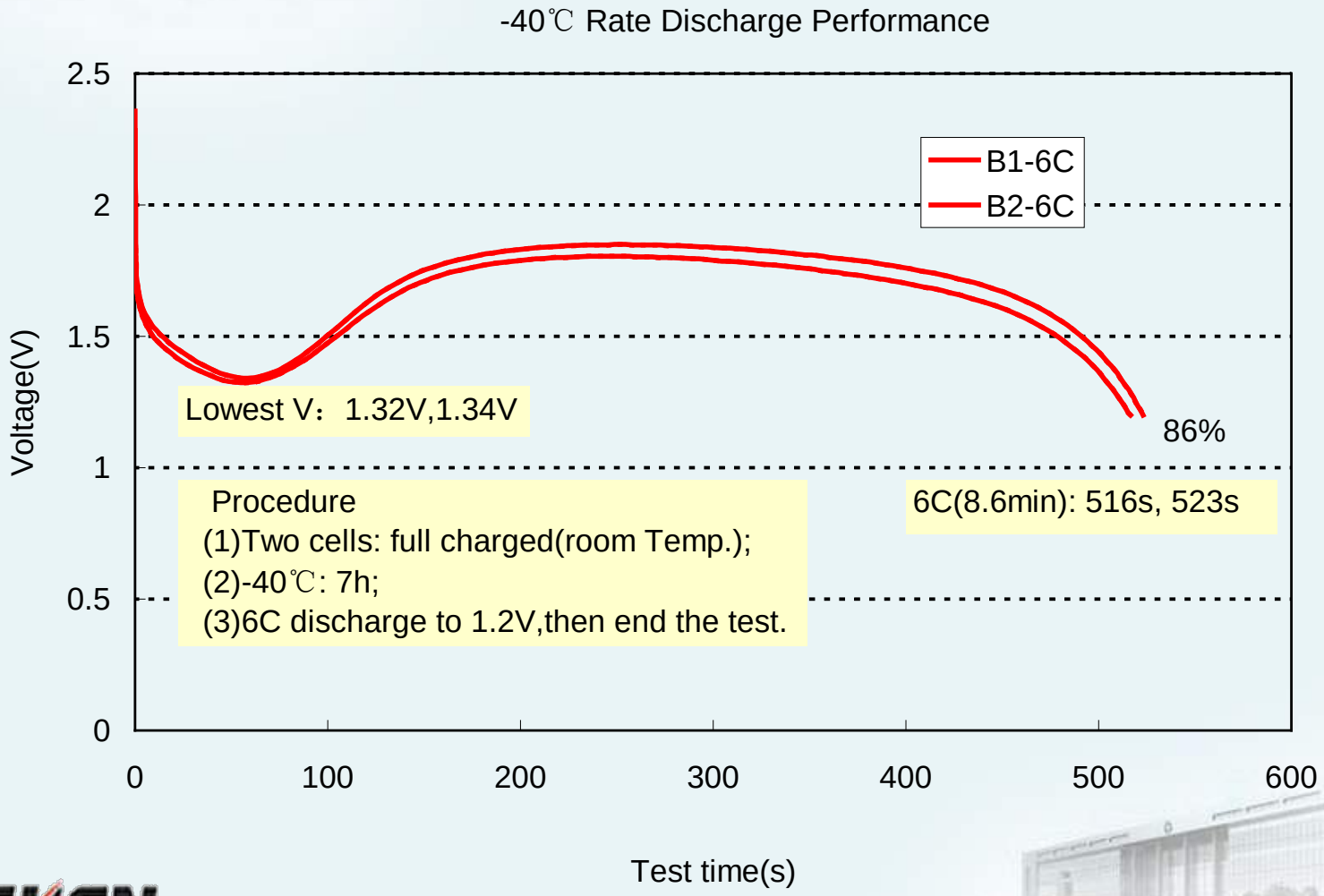


I. Super Li-ion Battery - Excellent Cycle Life



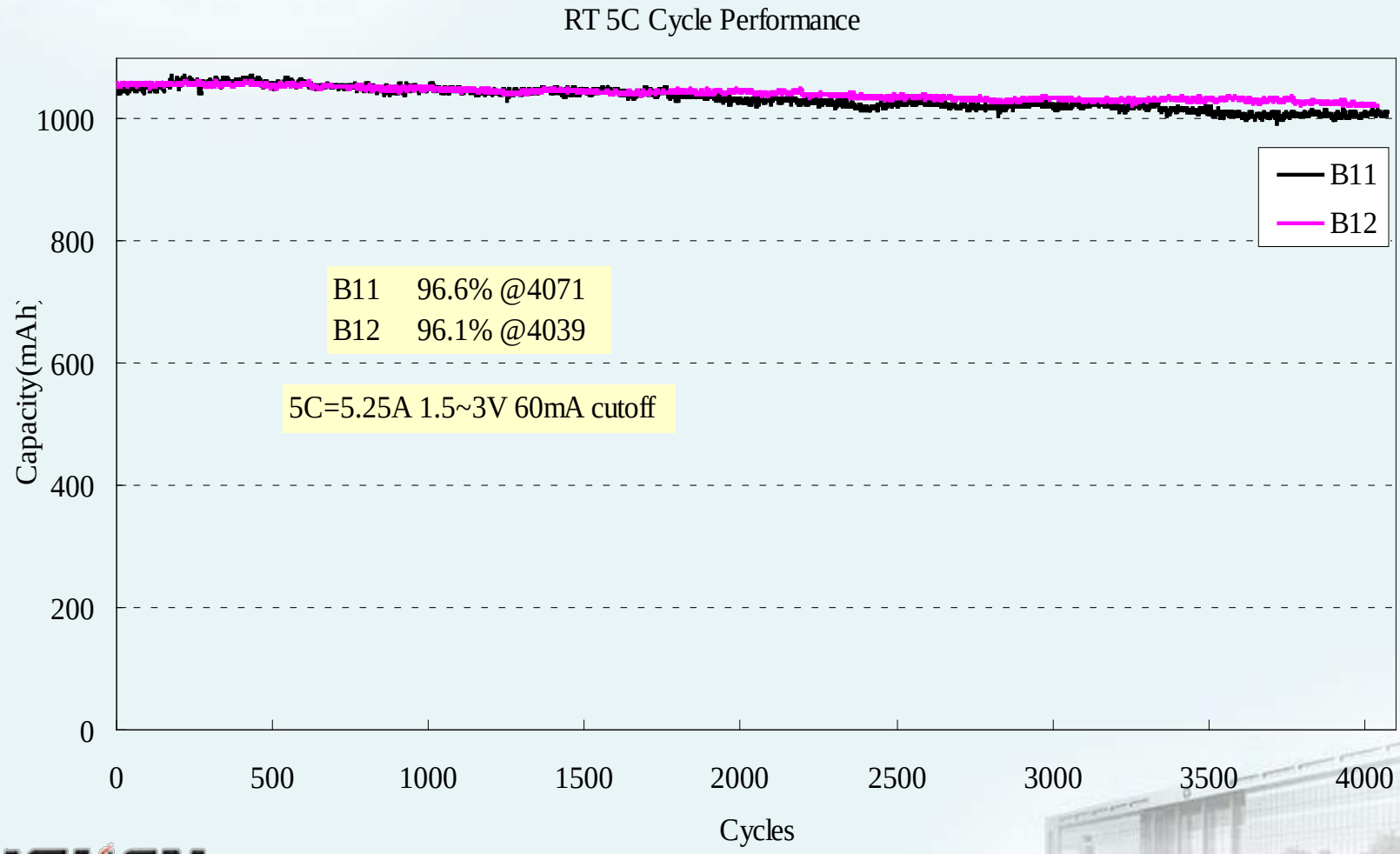
II. 2.5V 18650 Li ion battery

-Excellent Low Temperature (-40ºC) Performance



II. 2.5V 18650 Li ion battery

–Excellent Rate Cycle Performance



Lishen EV Advanced Battery Development Outlook

What Factors We Care About for EV Application?

Necessary Condition:

Safety ;

Reliability (vibration and Shock) ;

Rate Ability(3C rate);

Temperature Performance(-20 to 60C degree);

Long Calendar Life (10-15 Years);

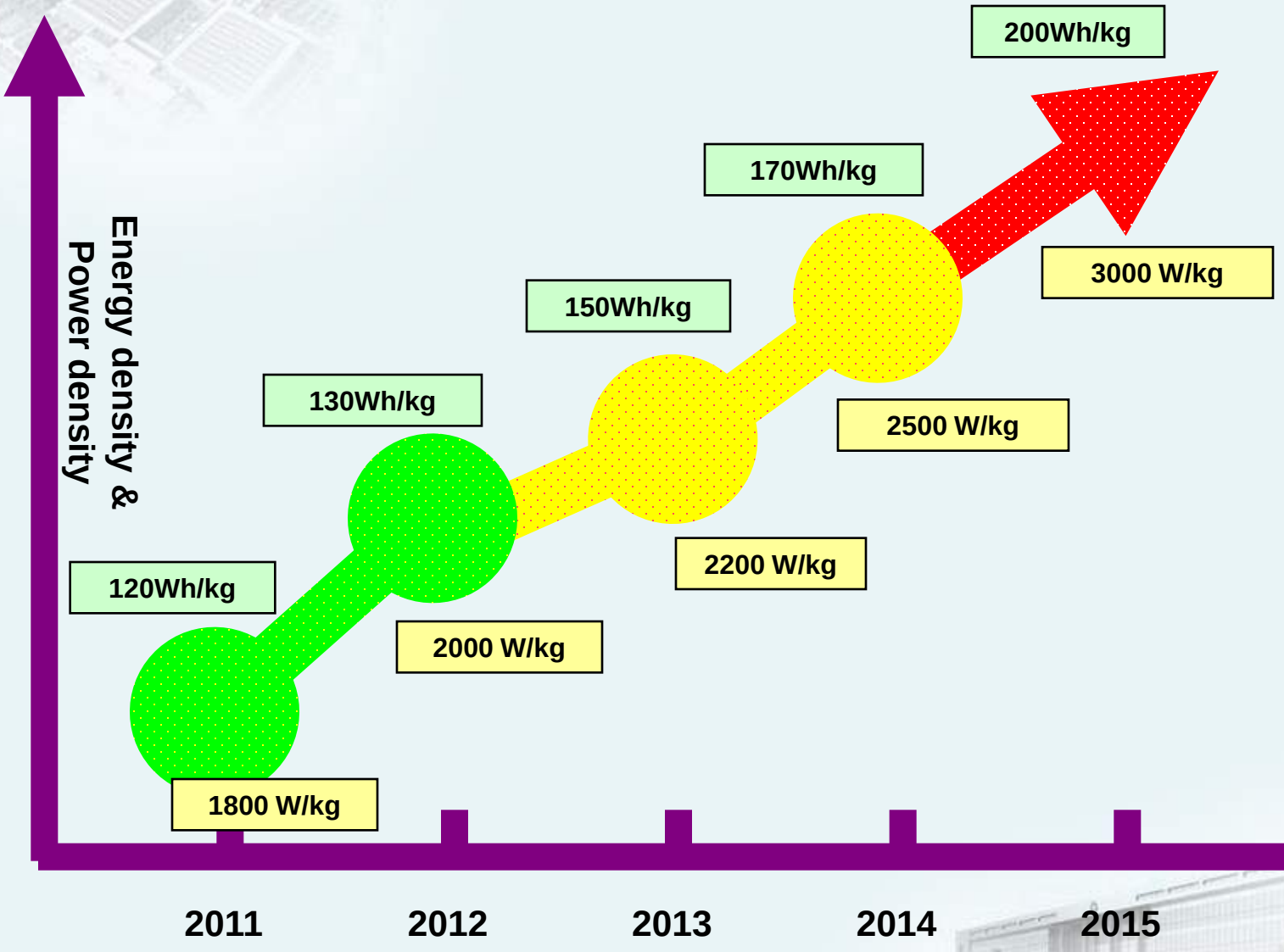
Long Cycle Life (150-200K Km).

Competitive Condition:

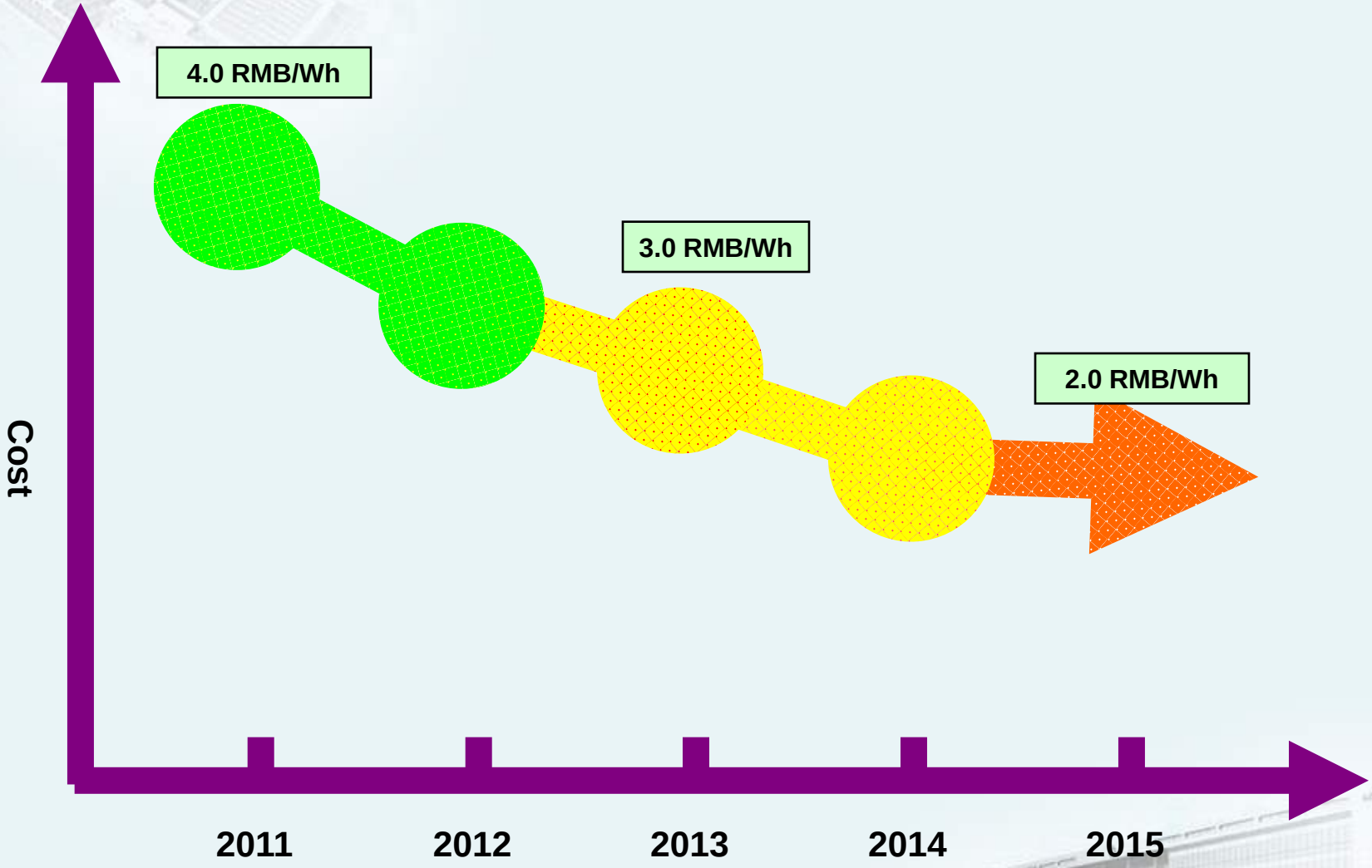
Energy Capacity Density;

Cost.

EV Energy & Power Density Roadmap



Cost Down Roadmap for EV Application



Lishen ESS Advanced Battery Development Outlook

What Factors We Care About for ESS Application?

Necessary Condition:

Safety ;

~~**Reliability (vibration and Shock) ;**~~

~~**Rate Ability(3C rate); Temperature**~~

~~**Performance(-20 to 60C degree);**~~

Long Calendar Life (15Years);

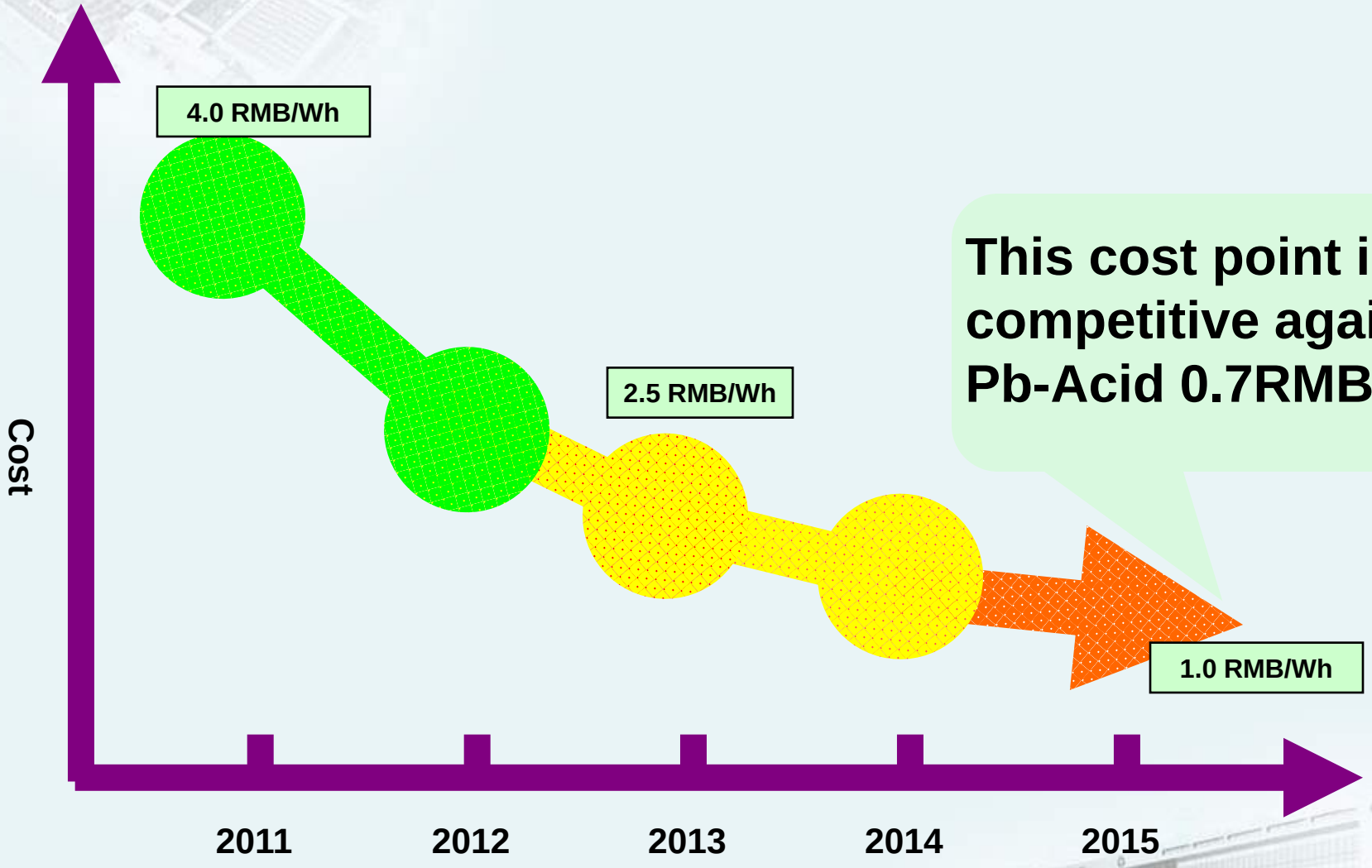
Long Cycle Life (~3000 times).

Competitive Condition:

~~**Energy Capacity Density;**~~

Cost.

Cost Down Roadmap for ESS Application



This cost point is competitive against Pb-Acid 0.7RMB/Wh

Lishen Production Development - Power LIB

20K/Y
in 2011

100K/Y
in 2013

200K/Y
in 2015

20k units Power System
300 M Ah Cells
2011

40k units Power System
600 M Ah Cells
2012

100k units Power System
1.2 B Ah Cells
2013

150k units Power System
1.6 B Ah Cells
2014

200k units Power System
20 B Ah Cells
2015

LISHEN
Power Your Life !

Summaries

- Lishen, as a world scale Li ion battery manufacturer has made their big efforts in advanced battery development for EV & ESS and some products have been already put into applications.
- Lishen has set their new target for both production scale and technology innovation of advanced batteries for EV & ESS.

Thank you for your attention!