Narada®

An Expert of Energy Storage Solutions.

Narada high temp. battery

For telecom and energy storage

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The HTB series battery

High temp. battery series

Product definition

About High Temperature Battery

Narada HTB series batteries are especially deigned for extreme high temperature, to save power consumption from cooling system, consequently it contributes to less expenditure of operation

- Safe and reliable under high temp.
- Low consumption to save expense
- Better deep cycling performance
- Best charge acceptance at PSOC
- Design life above 15 years (35ºC)

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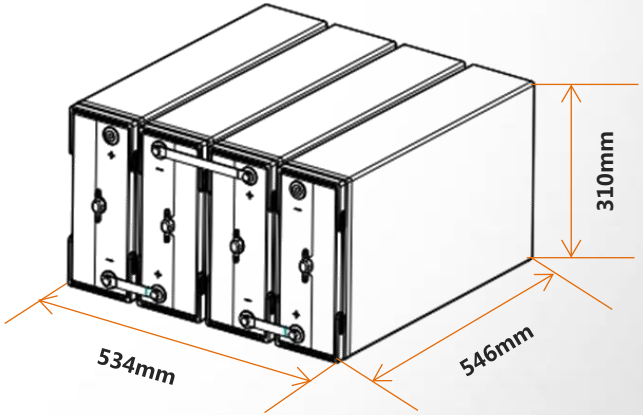
High temp. battery series

Product overview of 12V HTB

Model	Voltage	Rated capacity	Dimension (L*W*H)	Weight
12HTB100	12V	100Ah	390.0*108.0*287.0mm	35.0kg
12HTB150	12V	150Ah	546.0*125.0*310.0mm	56.0kg
12HTB170	12V	170Ah	546.0*125.0*310.0mm	58.0kg

12ICS100

12ICS150



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High temp. battery series

Product overview of 2V HTB

Model	Voltage	Rated capacity	Dimension (L*W*H)	Weight
HTB-200	2V	200Ah	227.0*96.0*303.0mm	17.0kg
HTB-400	2V	400Ah	227.0*170.0*303.0mm	31.0kg
HTB-600	2V	600Ah	231.0*180.0*408.0mm	46.0kg
HTB-800	2V	800Ah	231.0*231.0*408.0mm	61.0kg
HTB-1000	2V	1000Ah	231.0*282.0*408.0mm	76.0kg
HTB-1500	2V	1500Ah	232.0*322.0*514.0mm	110.0kg
HTB-2000	2V	2000Ah	232.0*456.0*514.0mm	155.0kg

HTB-1000

HTB-600

HTB-200

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Batteries comparison

Parameter	2V-HTB	REXC	OPzV	Conventional
Technologies	AGM	AGM	Gel	AGM
Service life (35℃)	15 years	10 years	10 years	7.5 years
Temp. Range	-40℃ to 80℃	-40℃ to 55℃	-40℃ to 55℃	-40℃ to 55℃
Initial Capacity	★★★	★★★	★★	★★
Internal resistance	★★★	★★★	★★	★★★
High current	★★★	★★★	★★	★★★
Fast charging	★★★	★★★	★	★★
PSOC performance	★★★	★★★★	★★	★
Anti-water loss	★★★★	★★★	★★	★★
Anti-therm. runaway	★★★★	★★★	★★★	★★
Cycle life >80%DOD	★★	★★★★	★★★	★
Cycle life <80%DOD	★★★	★★★★	★★★	★★
Float life	★★★★	★★★	★★★	★★

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Product award of gold metal

- **Golden Award at China Green Telecom innovation 2013**

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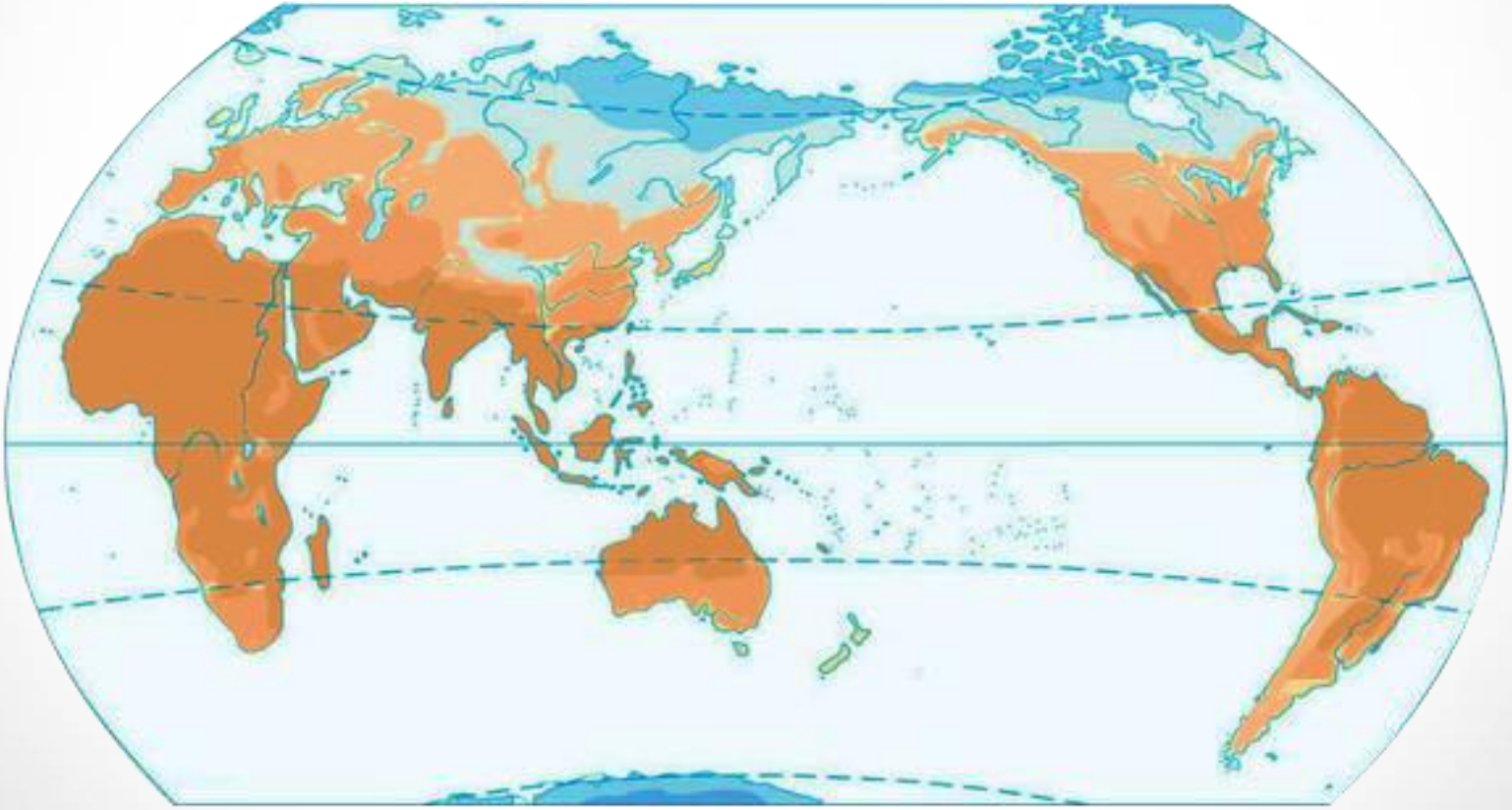
The background of HTB

Why choose HTB battery?

Average global temperature



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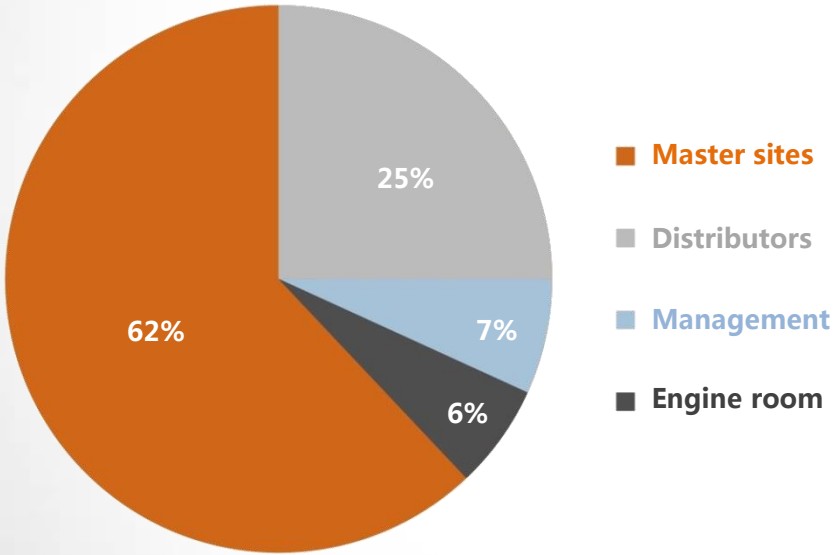
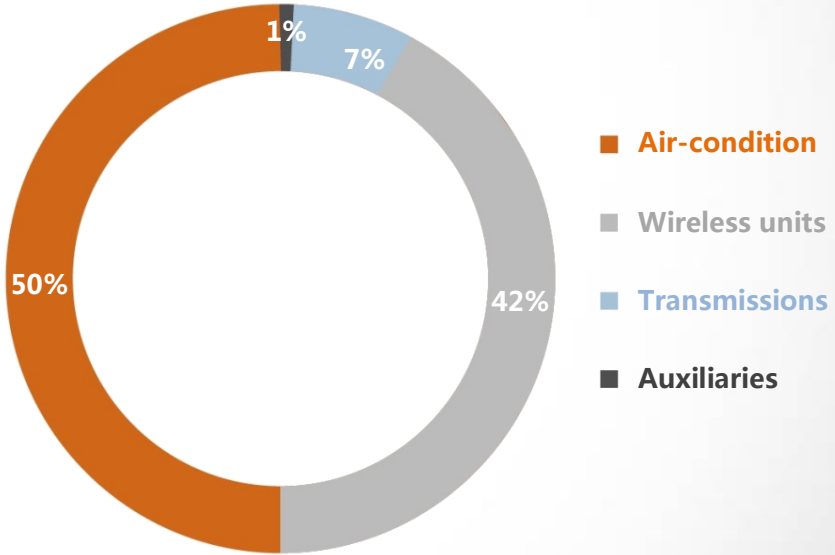
Why choose HTB battery?

Power consumption problem

62% power consumption from master sites



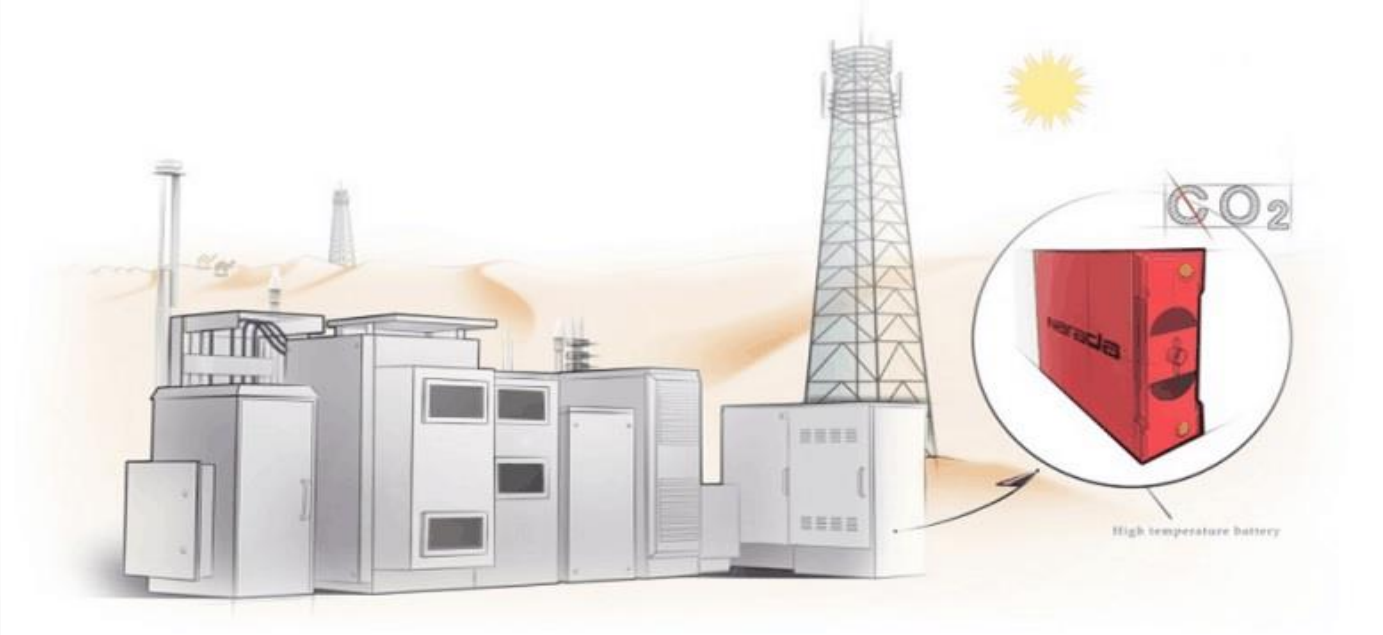
50% power consumption from air condition



The task of energy conservation is tough and huge for telecommunication industry, among which the consumption of air-conditions is a principal factor, that would require battery against high-temperature

Why choose HTB battery?

For energy conservation



The electrical power of air-condition for telecom sites can be reduced by 60%~80% when the ambient temperature increase **10°C**, consequently the power conservation from telecom sites would annually contribute about 1 billion US dollar in China, will also save 537,500 ton of coal consumption or 7,400,000 ton CO_2 emission

Why choose HTB battery?

The operation temperature

Most those appliances applied in telecom sites could be operated under higher temperature, such as: wireless units (5℃～55℃); power supply (-5℃～40℃); A/C equipment (5℃～55℃). However for batteries, the suggested temperature should be 25ºC, otherwise battery life will be reduced by 50% per each additional increased **10ºC**

Why choose HTB battery?

Cost saving of CapEx & OpEx

Cost saving comparison for Telefónica project in Spain

Site Type	Scenario	Year	Calculation for CapEx and OpEx				
			Battery Investment	Cooling Investment	Cooling Cost	Maintenance	Other Costs
With conventional Batteries	Floating application in Europe with Air Condition (2*150Ah)	1st year	USD 1700	USD 1000	USD 1150	Same	Same
		2nd year	0	0	USD 1150	Same	Same
		3rd year	0	0	USD 1150	Same	Same
With HTB Batteries	Floating application in Europe with fan cooling (2*150Ah)	1st year	USD 2500	USD 100	USD 100	Same	Same
		2nd year	0	0	USD 100	Same	Same
		3rd year	0	0	USD 100	Same	Same
Total saving from CapEx and OpEX		All 3 years	**-USD 800**	**+USD 900**	**+USD 3150**	**Total save=**	**+USD 3250**

Note:

1. Annual cooling cost with conventional batteries: 15KWh/D*365D*0.21USD/kWh = USD1150
2. Annual cooling cost with Narada HTB batteries: 0.05KWh/D*365D*0.21USD/kWh = USD100
3. Air Conditioning equipment would be replaced for each 3 years, which increases extra cost

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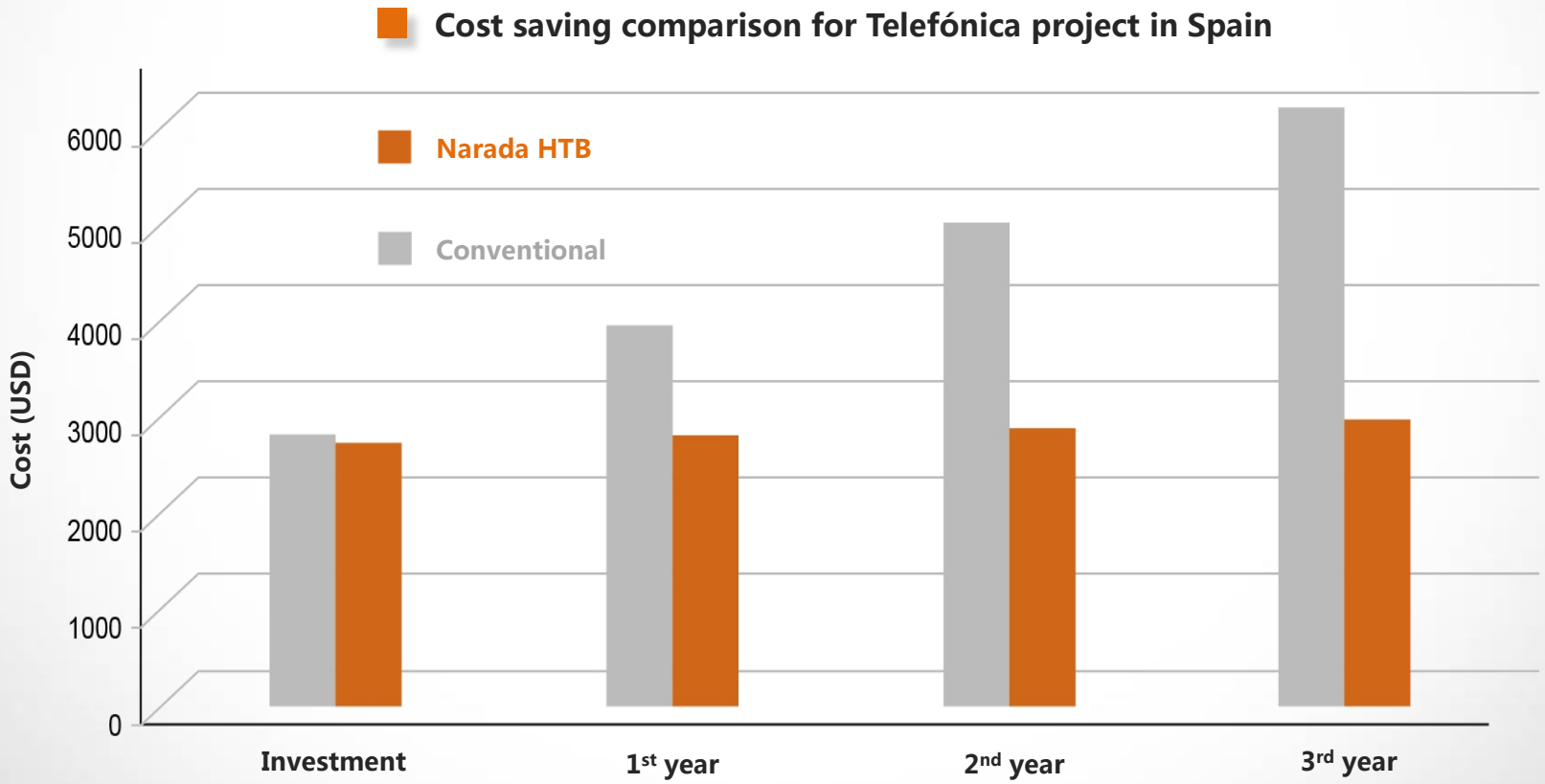
Why choose HTB battery?

Cost saving comparison



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Why choose HTB battery?

Diverse configurations

Applications	Configuration	Energy conservation	Remarks
Indoor telecom site	HTB batteries + air conditioning	The power consumption will be reduced by **80%** at 35°C, so 4kwh power can be saved	The site temperature can be set up at **35°C**
Outdoor telecom site	HTB batteries + fan cooling	The operation cost of the site can be reduced by **58%** for less replacement of batteries	**Longer** cyclic life than conventional battery
Hybrid telecom site (with DG and grid)	HTB batteries + fan cooling + diesel generators	The diesel consumption can be reduced by **55%,** which is nearly USD 5225 per year	**Deeper** and **longer** discharge performance
Hybrid telecom site (with solar system)	HTB batteries + fan cooling + solar system	The standby time of batteries can be prolonged to reduce around **33%** battery cost	**Longer** cyclic life than conventional battery

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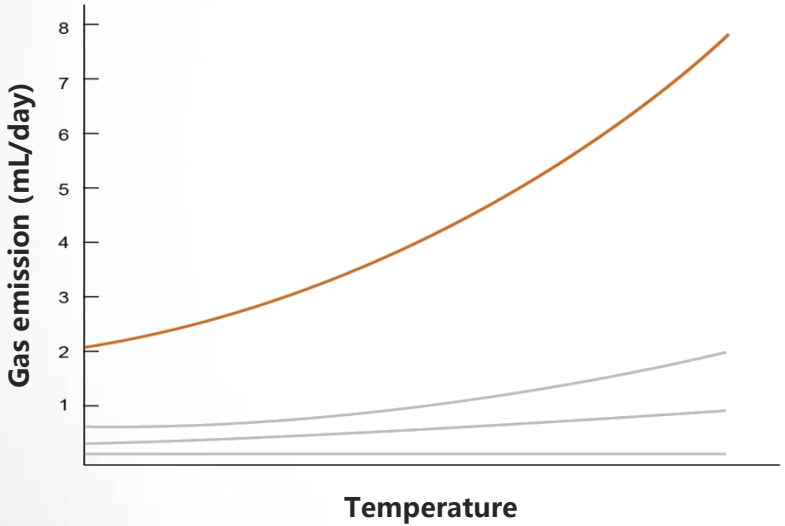
HTB Core Technology

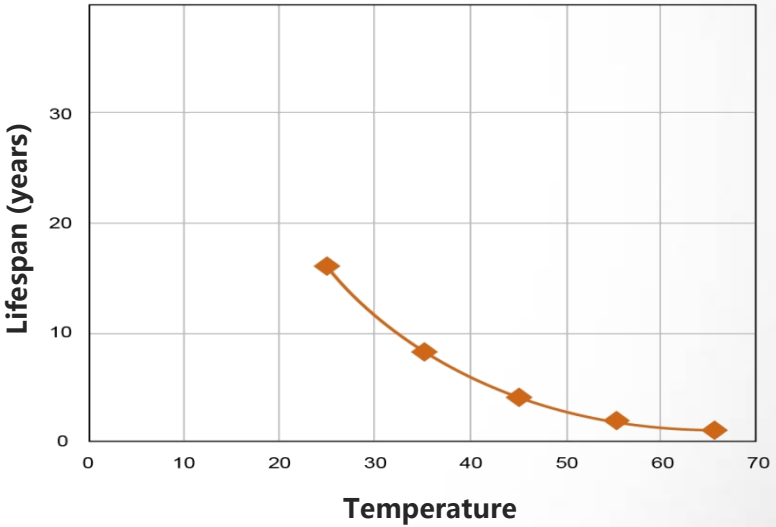
HTB battery technology

Impact factors of high temp.

Gas emission impacted by high temp.



Service lifespan impacted by high temp.



- Thermal runaway
- Water loss of battery
- Negative plate sulphation
- Positive grid erosion

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HTB battery technology

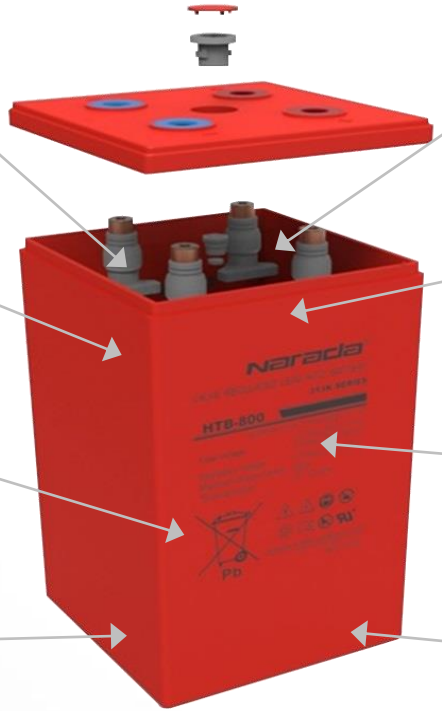
Corresponding solutions

Positive grid alloy

Electrolyte density

Electrolyte quantity

Polarization of cells



Positive grid alloy

Positive mass load

Negative mass load

AGM compress

How to solve:

- Thermal runaway
- Water loss of battery
- Positive grid erosion
- Negative plate sulphation

For extended calendar and cycle life

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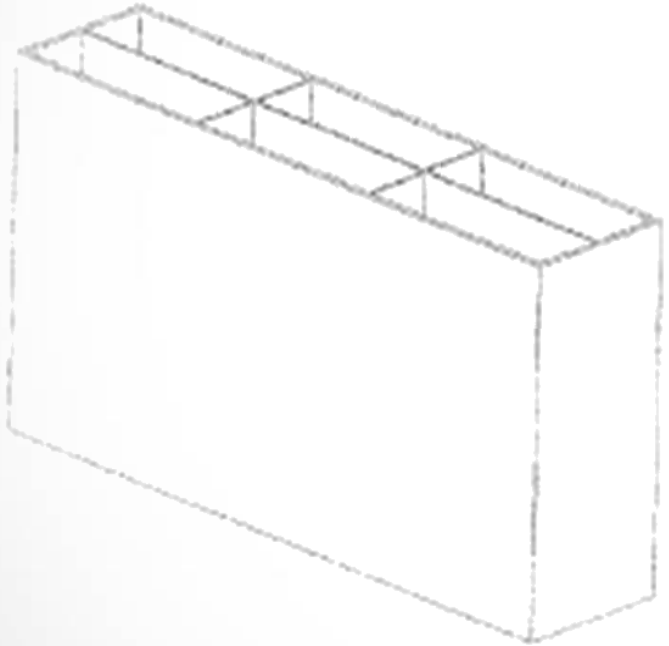
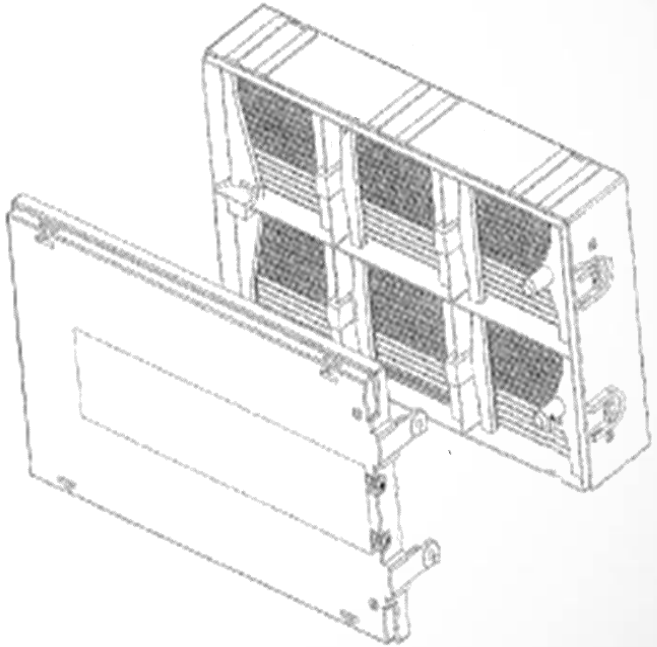
HTB battery technology

Innovative housing structure



Ordinary structure of conventional 12V battery



Innovative structure of 12V HTB battery

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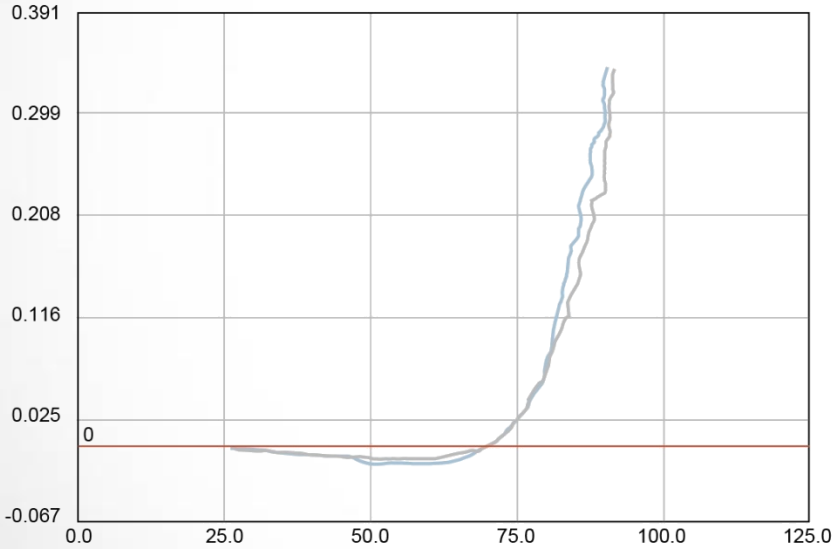
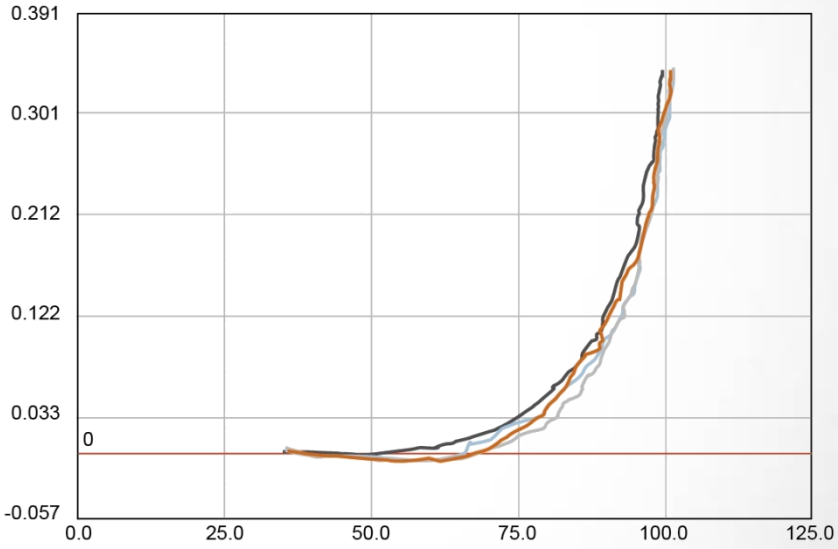
HTB battery technology

Anti-heat material of case

Deformation curves under high temperature test



Conventional plastic material



Anti-heat material of Narada HTB

Innovative case material of HTB battery against high temperature (Patent of invention: **200810059699.3**)

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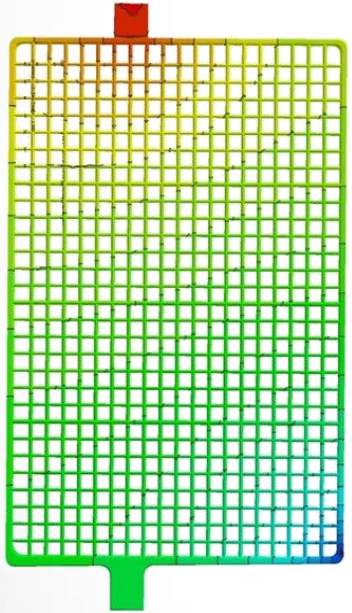
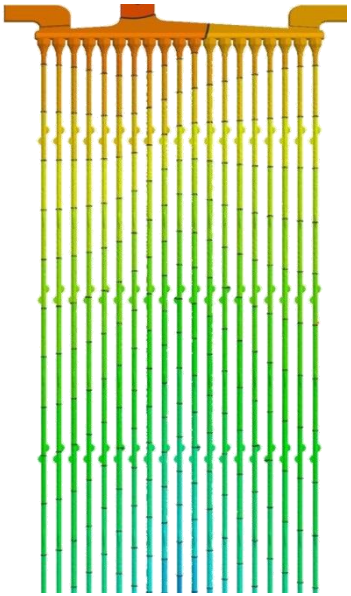
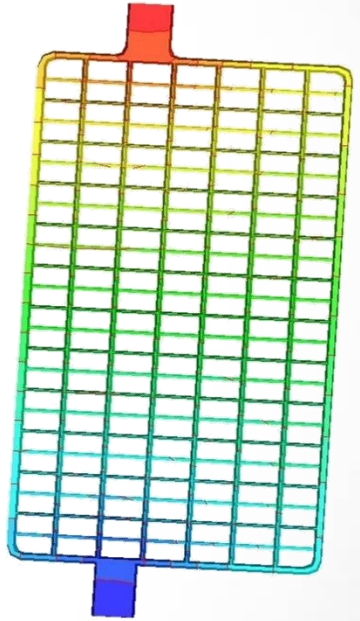
HTB battery technology

Special structural design



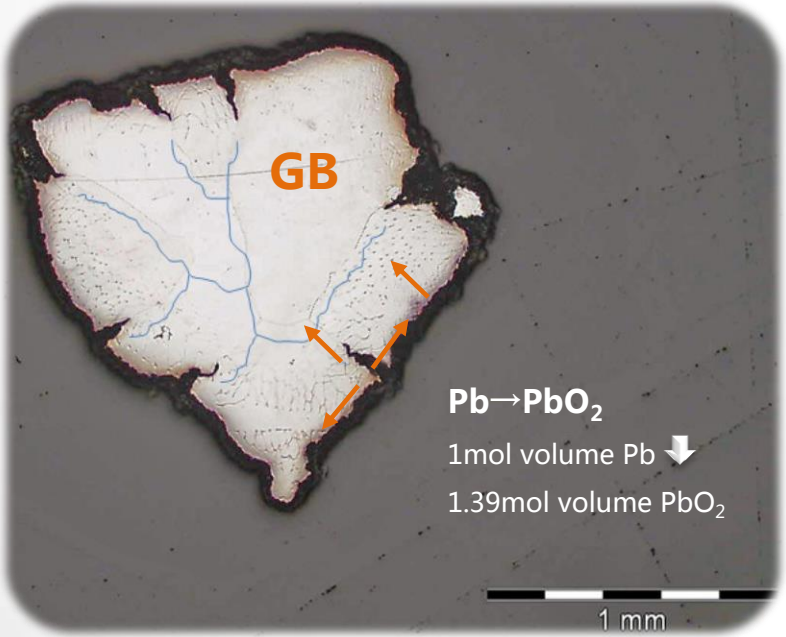


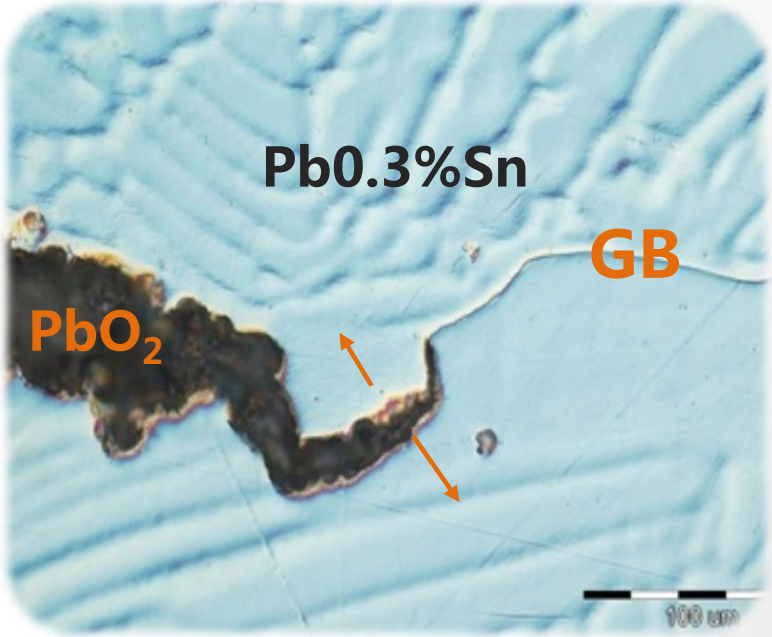


The structural design of positive plate has been modified and adapted in thickness in order to achieve lower a lower Pavlov γ factor, so that the cyclic performance and charging acceptance can be improved

HTB battery technology

Special alloy for positive grid

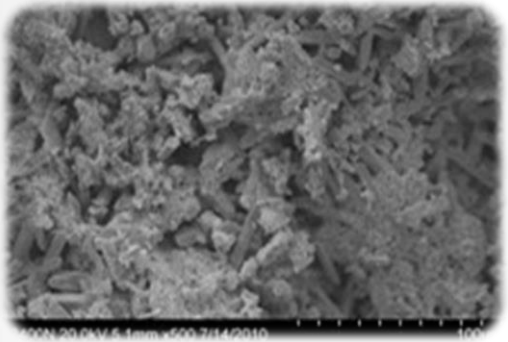




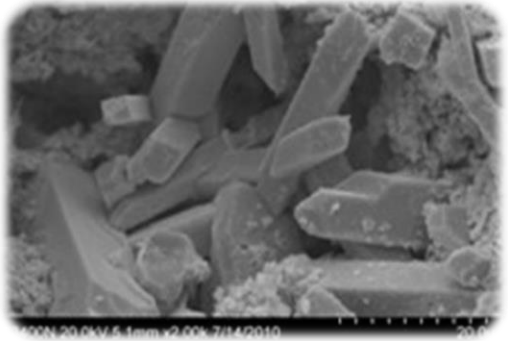
Special alloy innovation with superior anti-erosion performance (Patent of invention: **200810162171.9**)

HTB battery technology

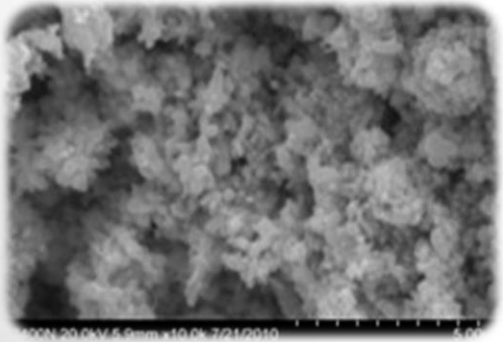
Active materials at negative



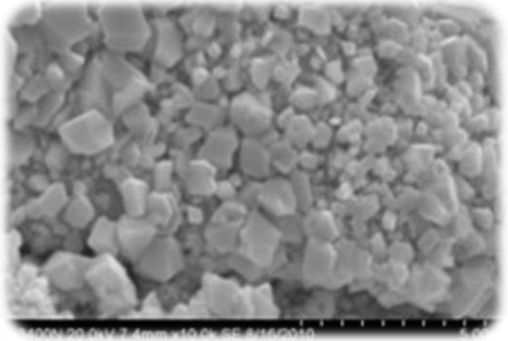
Uncharged plate (500times)



Uncharged plate (5000times)



Charged plate (1000times)



Charged plate (10000times)

Anti-sulphation

--- To increase component activity by charging active materials

--- To reduce the recombination happened on negative plates

--- Then the ability will be enhanced to prevent sulphation at negative

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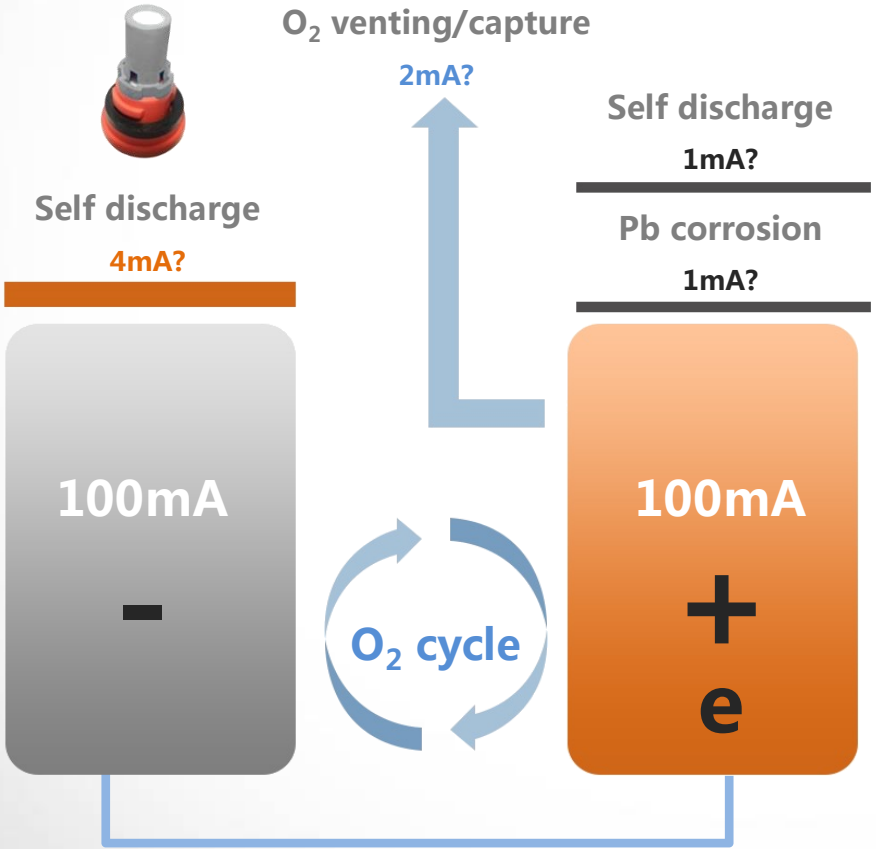
HTB battery technology

Innovative catalyst valve



Valve functions

--- The catalyst valve can be served to slow down fluent current rise

--- Any secondary reaction can be found and reduced by the valve

--- The temperature can be reduced negative plate can be protected

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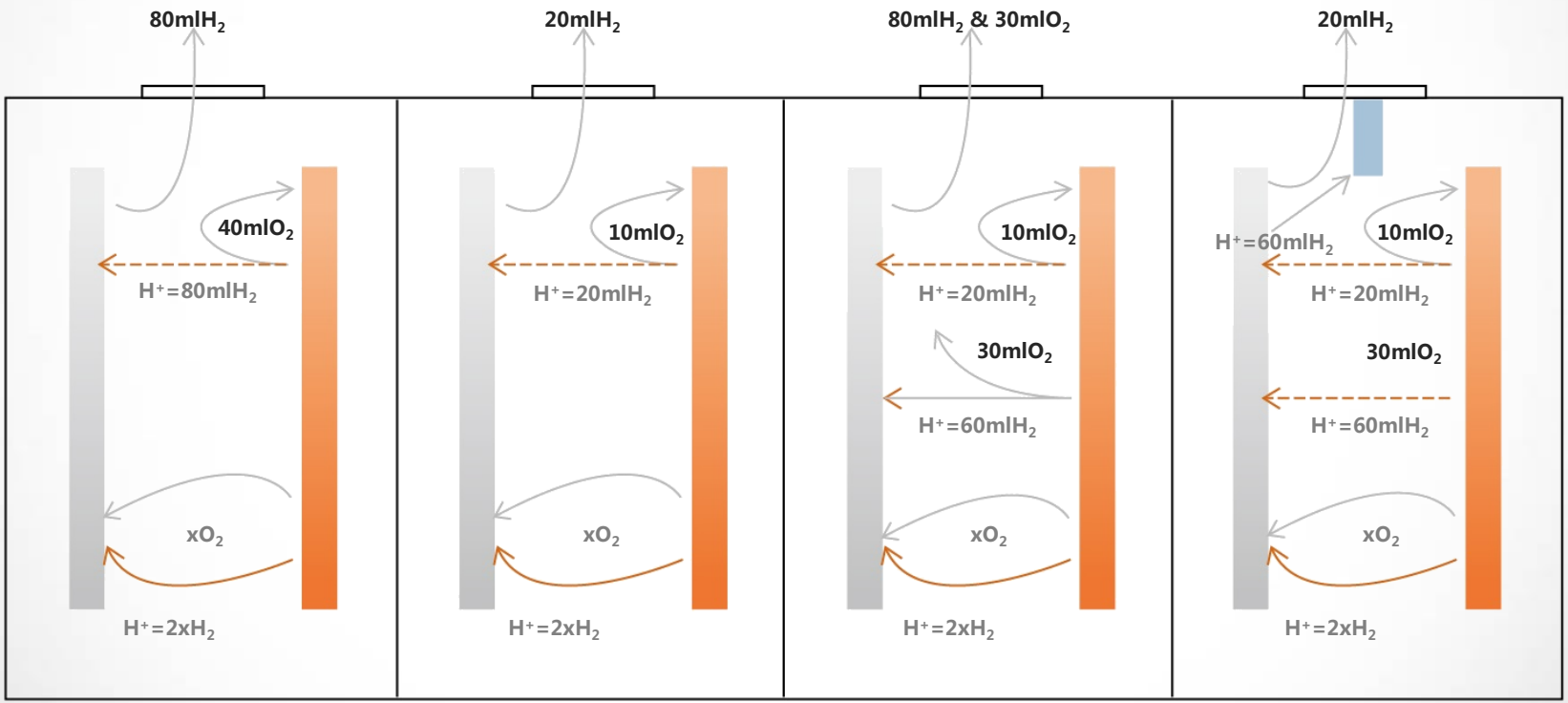
HTB battery technology

Function of catalyst valve



- High recombination at room temperature
- Normal recombination at room temperature
- High recombination at high temperature
- Normal recombination at high temperature

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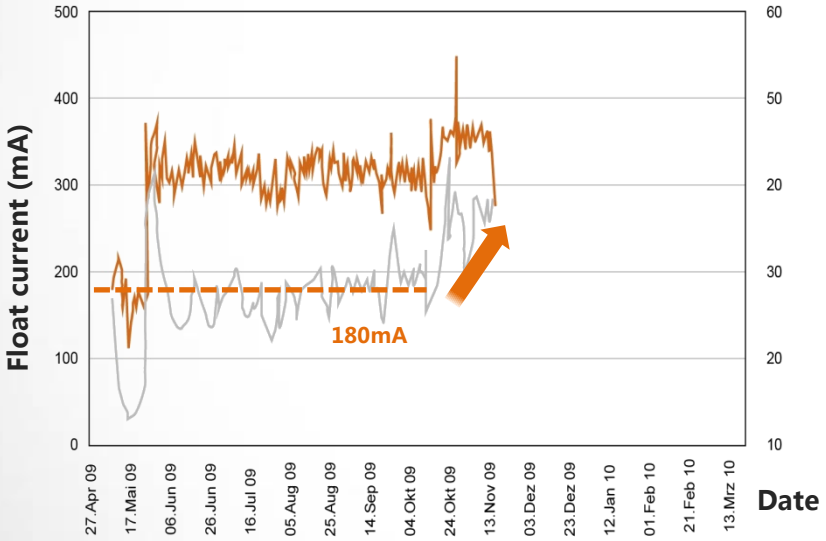
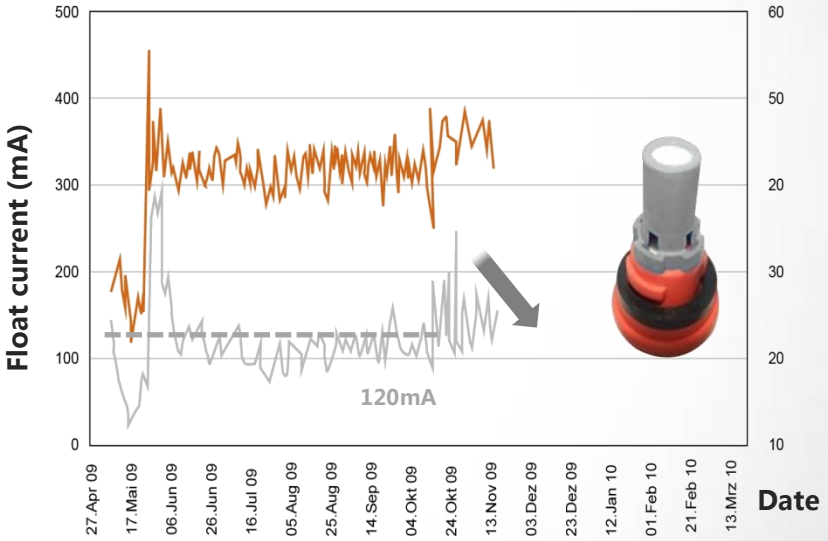
HTB battery technology

Less float current by catalyst

Float current of conventional battery



Float current of HTB with catalyst valve



Under elevated operating temperature (above 40°C), the float current and temperature of 12V100Ah conventional monobloc is much higher than the one that is equipped with catalyst valve in each cell

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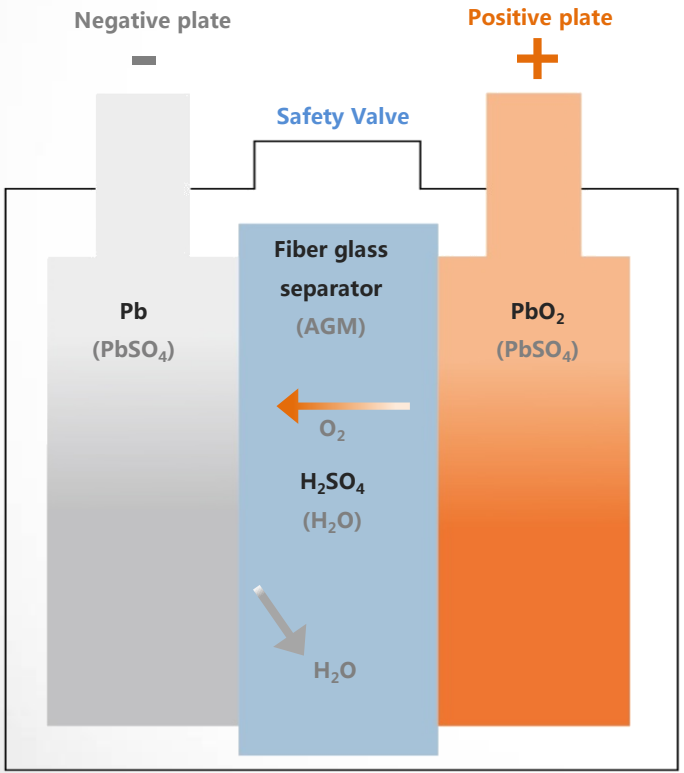
HTB battery technology

Benefits from catalyst valve



Main advantages

The catalyst valve relieves sulphations at negative, and maintain capacity as well as prolong battery life

- Reduced flow current
- Minimized water loss
- Low thermal runaway
- Less plate corrosion
- Energy conservation

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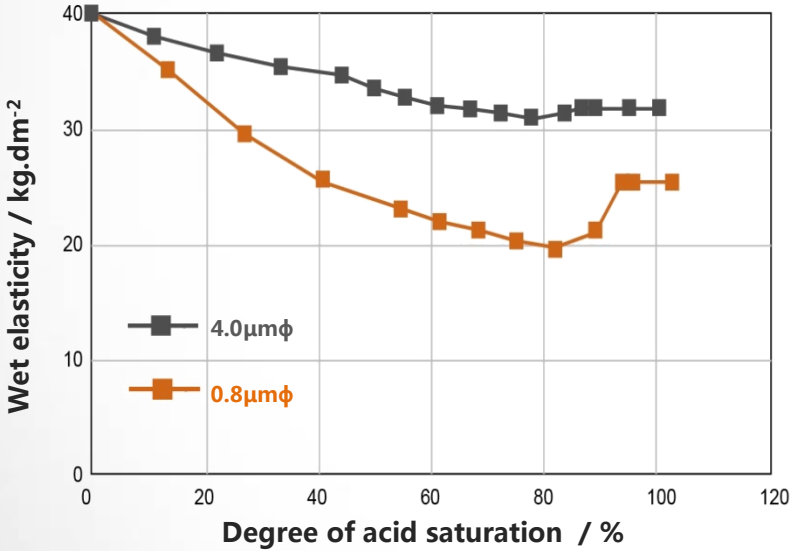
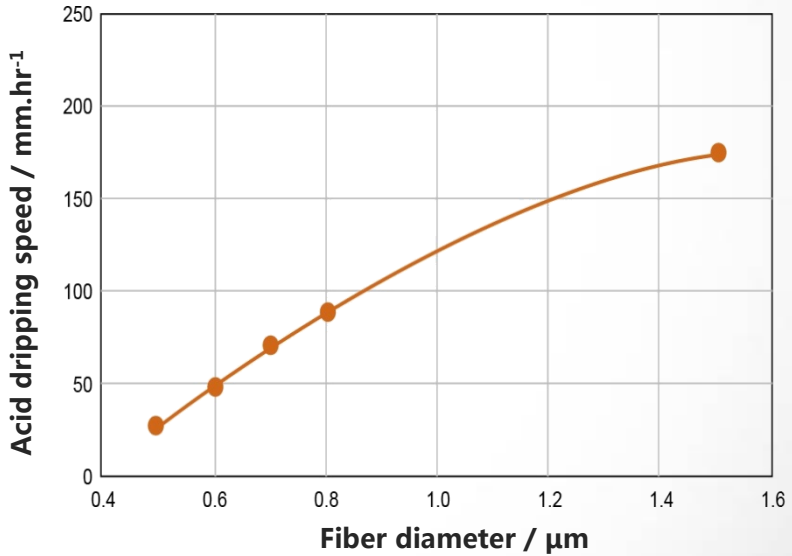
HTB battery technology

Precise design for separator

Big diameter for keeping wet elasticity



Small diameter good for acid dripping



The diameter of fiberglass on separator is an important factor: bigger diameter is good for keeping wet elasticity, while smaller one is good for acid dripping. We found most rational proportion by many tests

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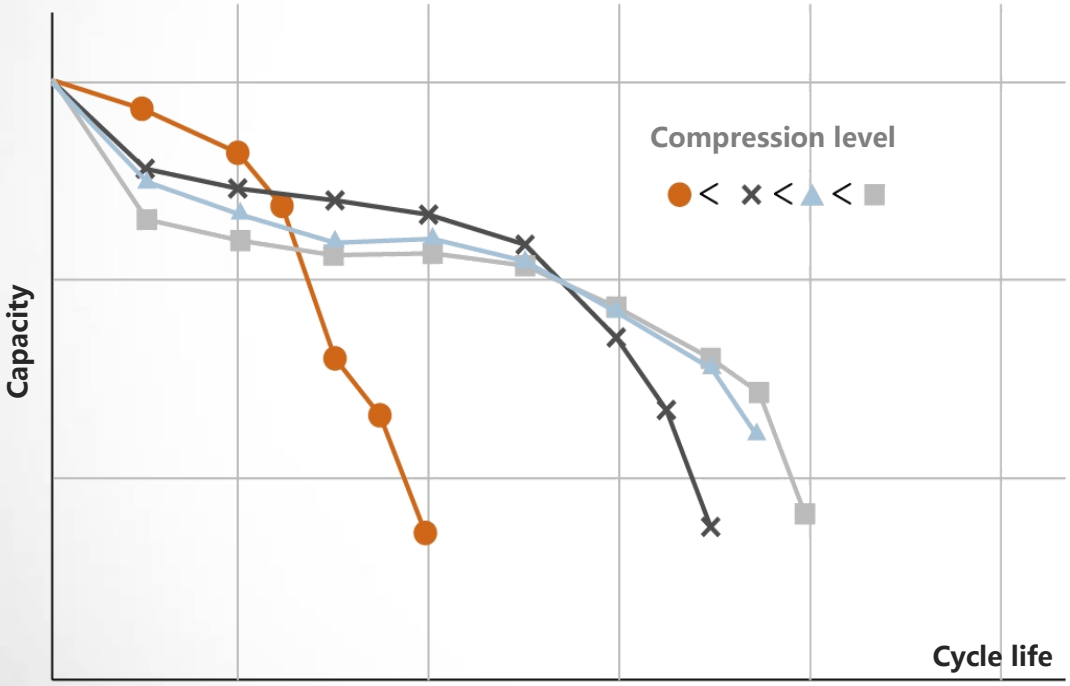
HTB battery technology

Best compression & density



Comparison among various compression levels

Main advantages

--- Optimized AGM compression will reduce resistance and extend life

--- Low electrolyte density reduces plate corrosion and extends life

--- Low electrolyte density will help to recover capacity of the battery

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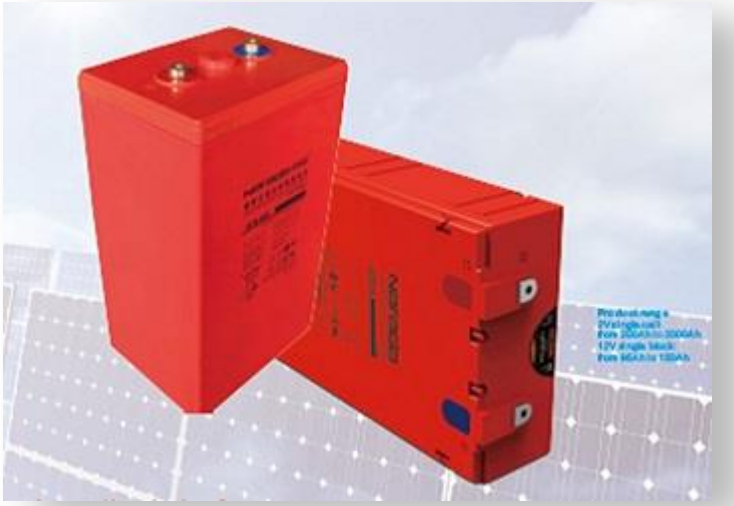
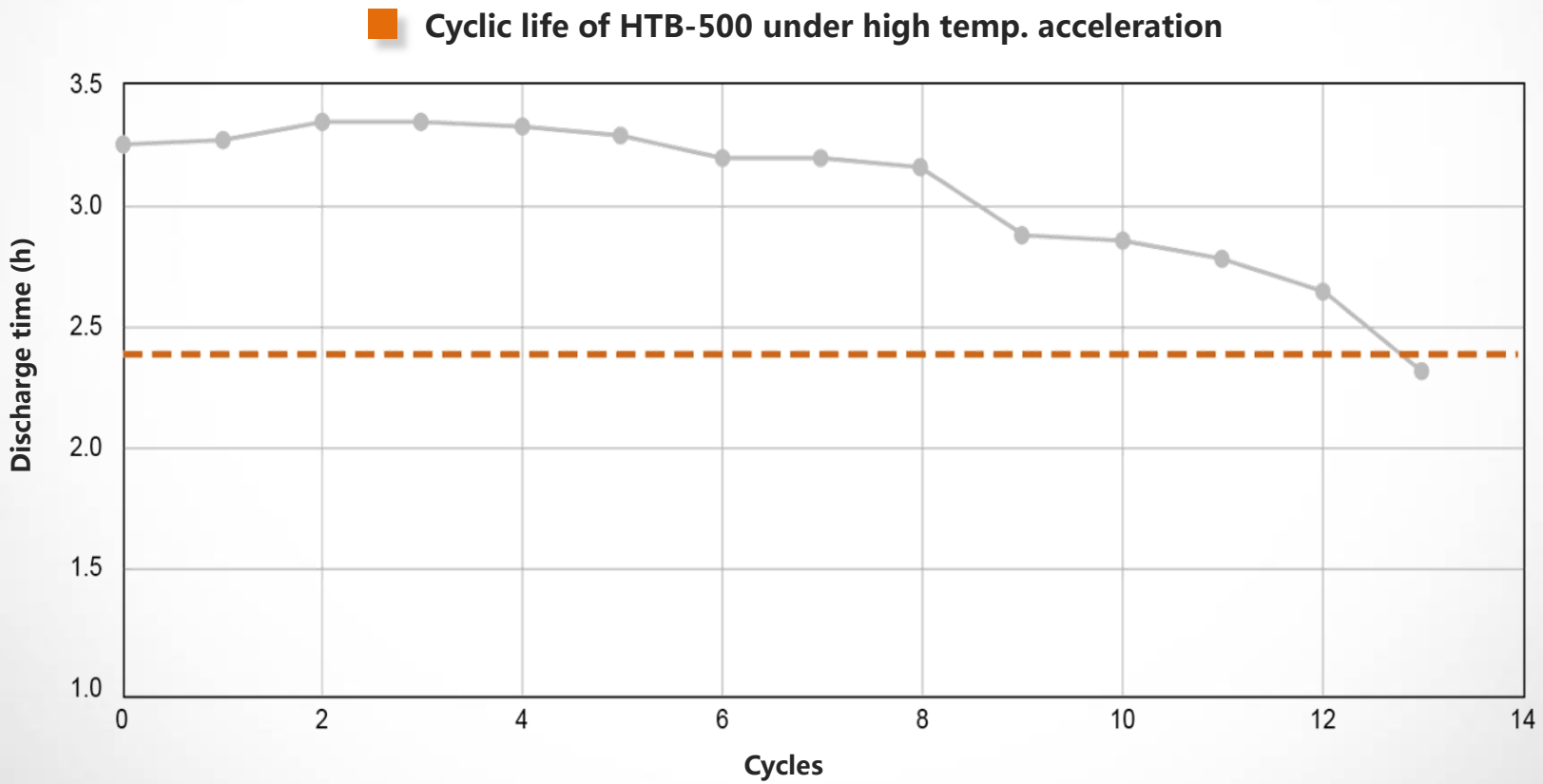


HTB battery performance

HTB battery performance

High temperature performance



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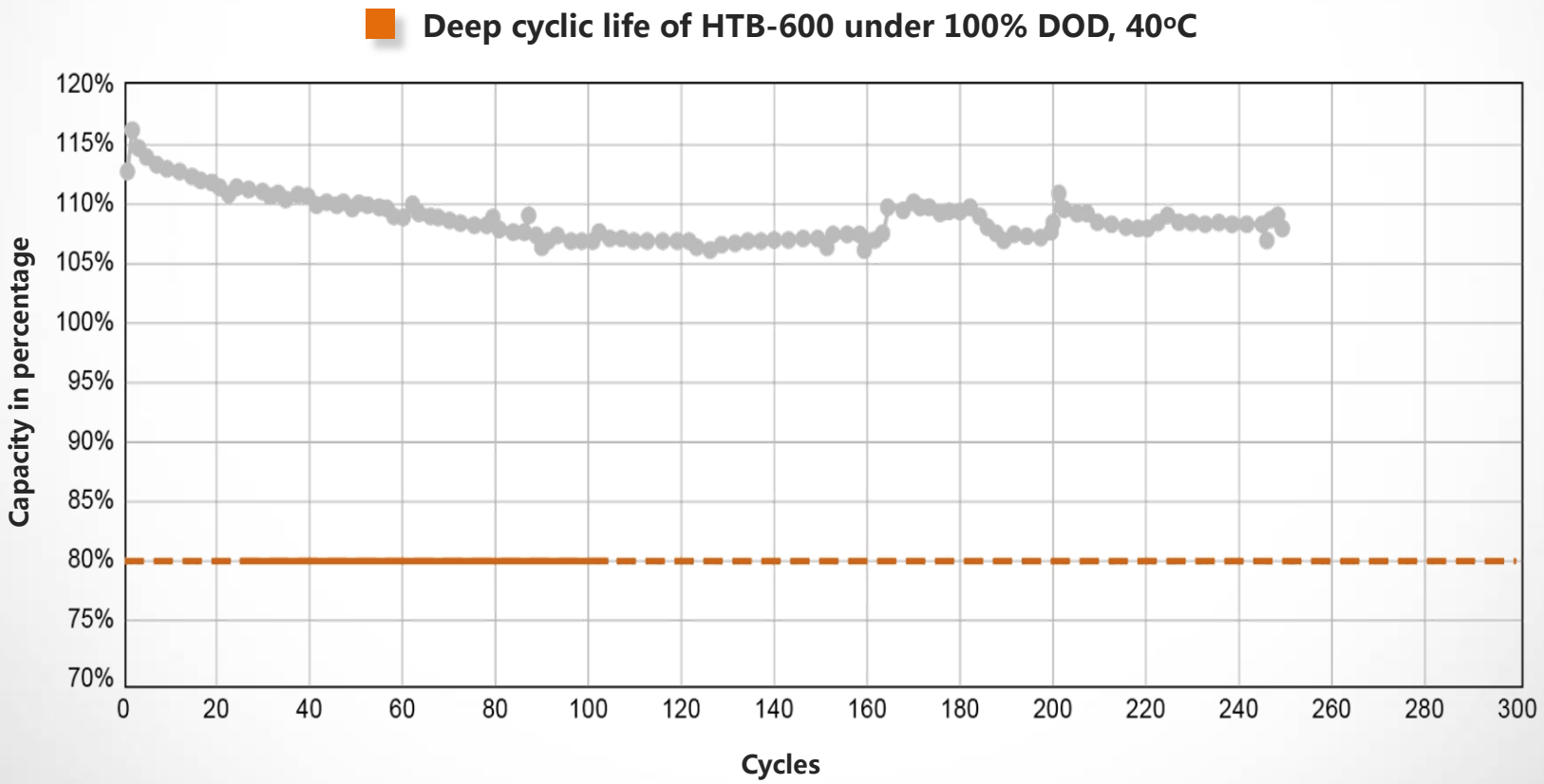
HTB battery performance

High temperature performance



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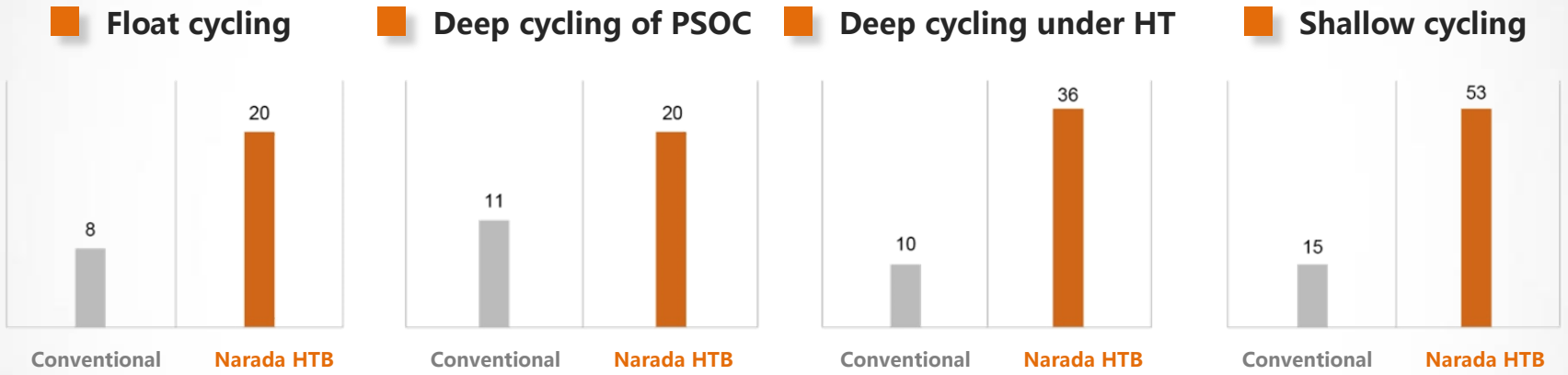
HTB battery performance

Performance under high temp.



NO.	Performance	Conventional	Narada HTB	Improved
1	Float cycling under high temp.	8 cycles	20 cycles	150%↗
2	Deep cycling under PSOC status	11 cycles	20 cycles	82%↗
3	Deep cycling under high temp.	10 cycles	36 cycles	260%↗
4	Shallow cycling when over charging	15 cycles	53 cycles	250%↗
5	Temperature limit for operation	55°C	75°C	20°C↗

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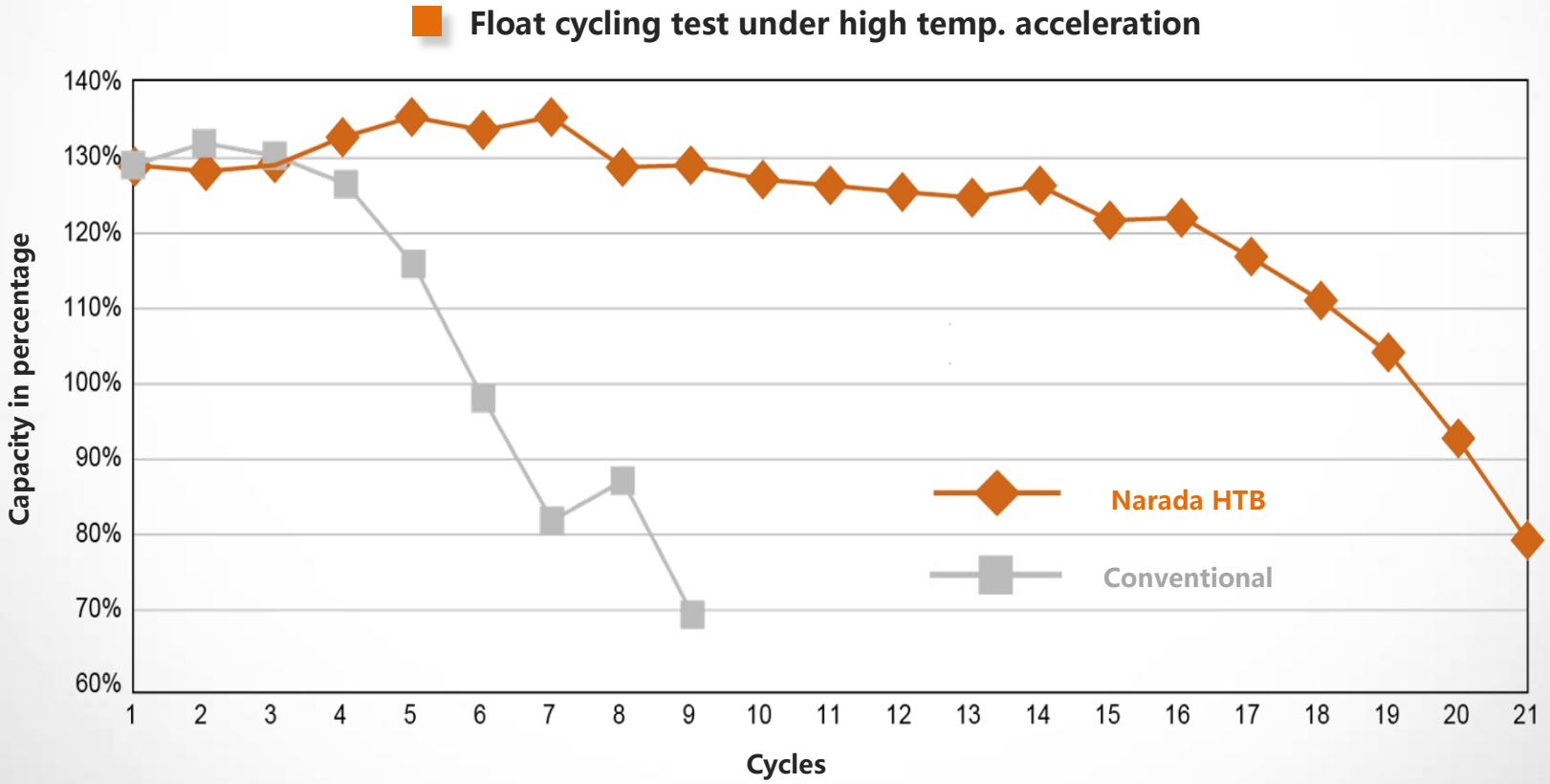
HTB battery performance

Performance under high temp.



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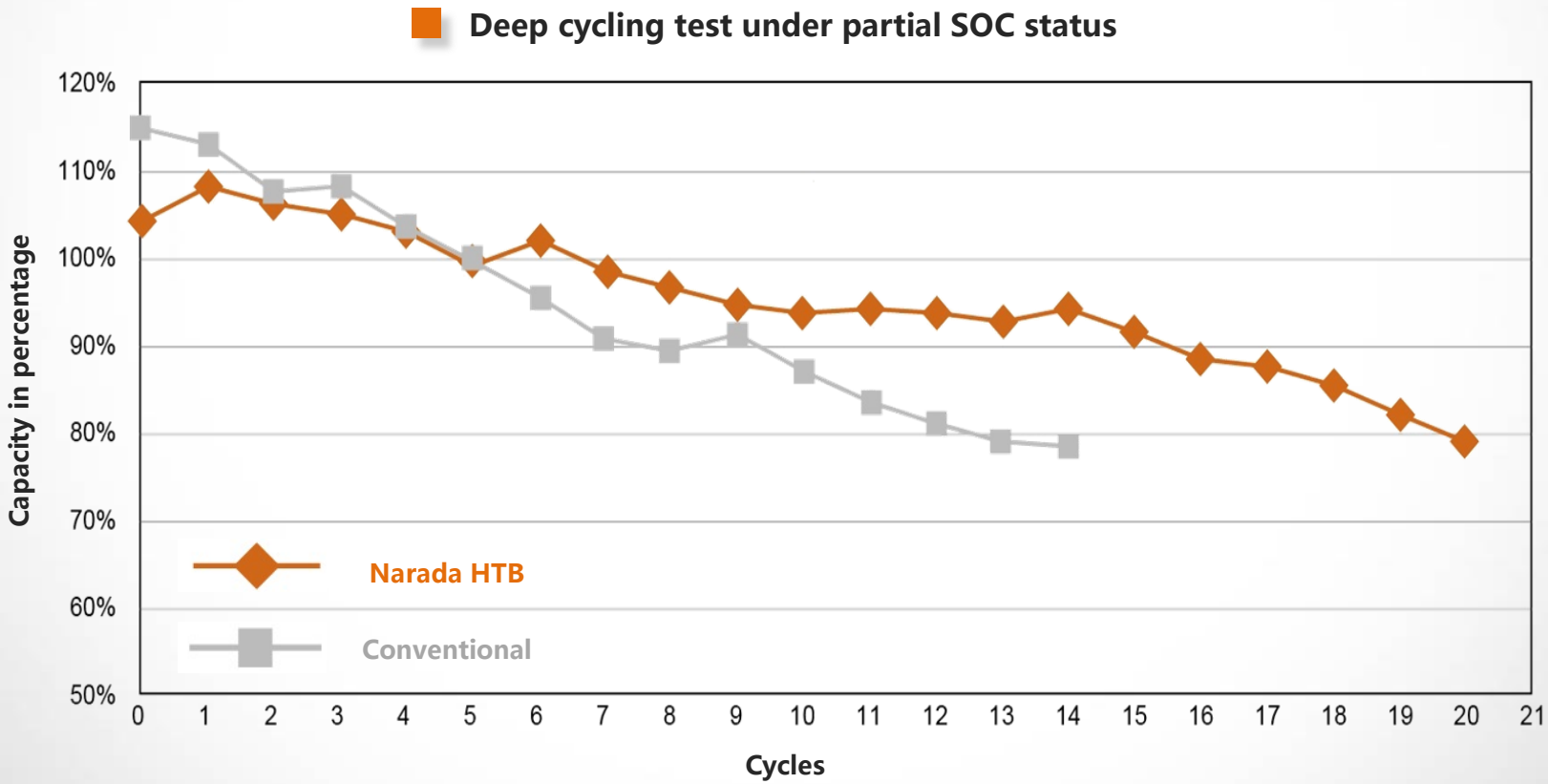
HTB battery performance

Performance under high temp.



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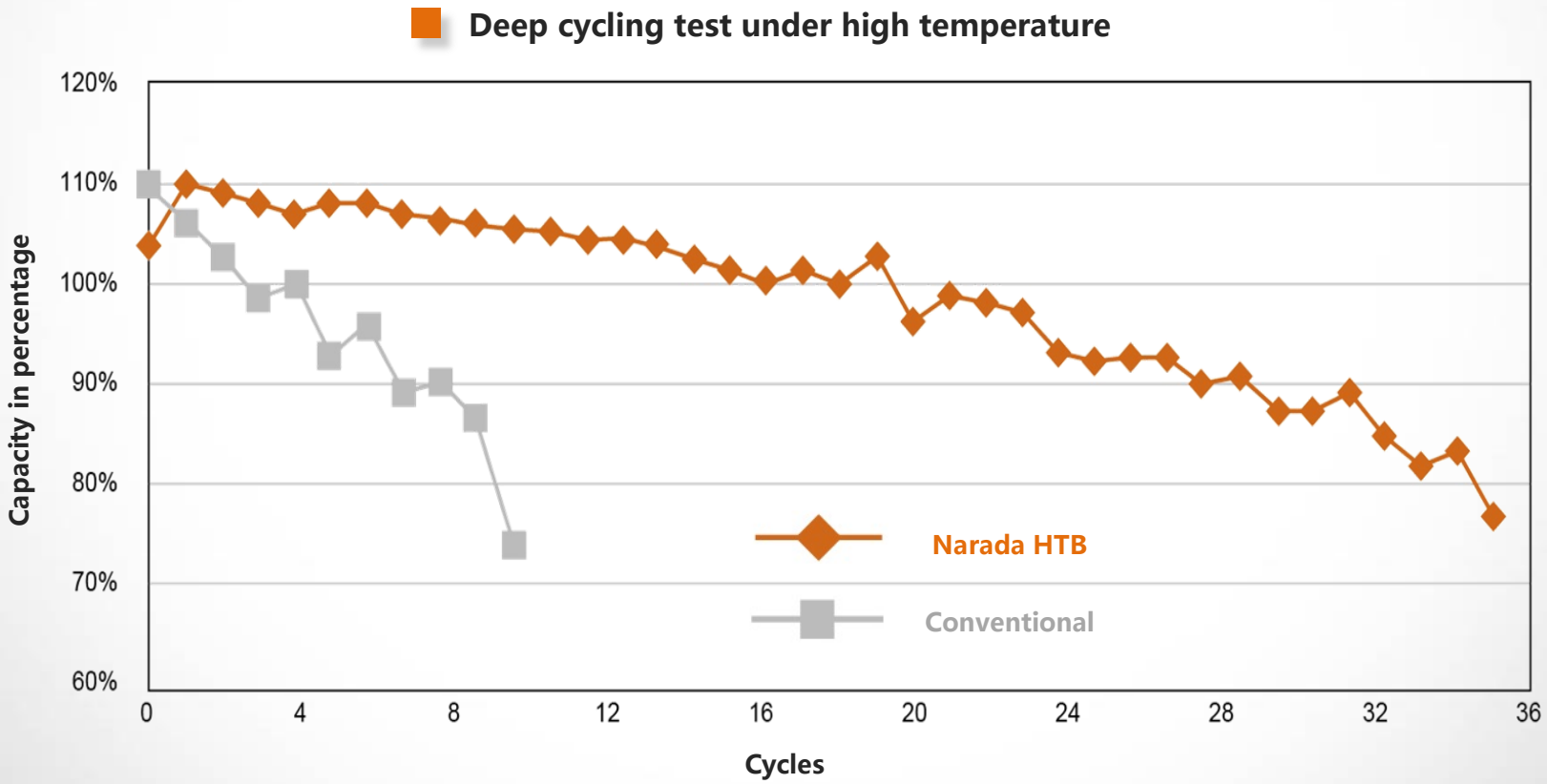
HTB battery performance

Performance under high temp.



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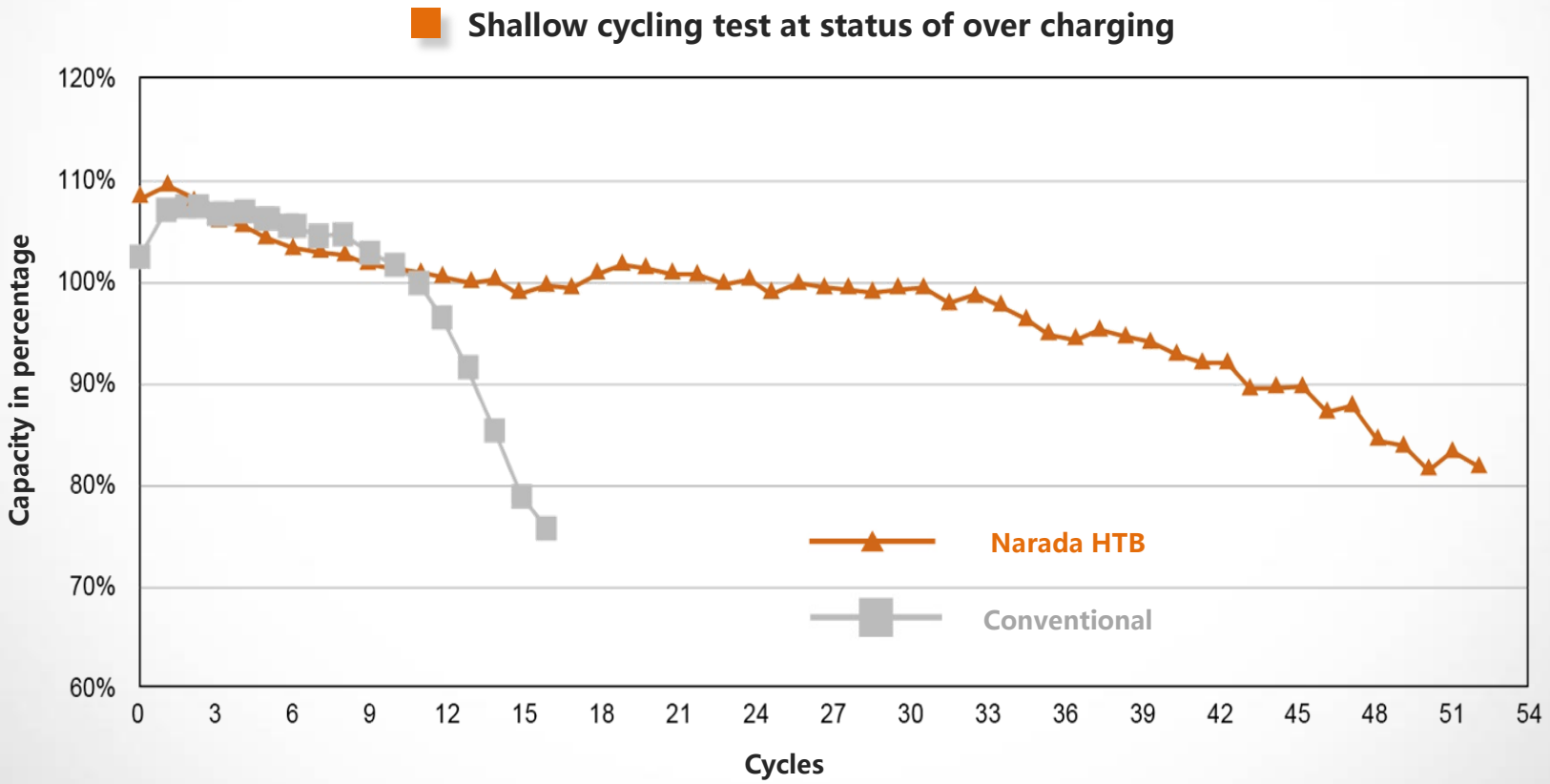
HTB battery performance

Performance under high temp.



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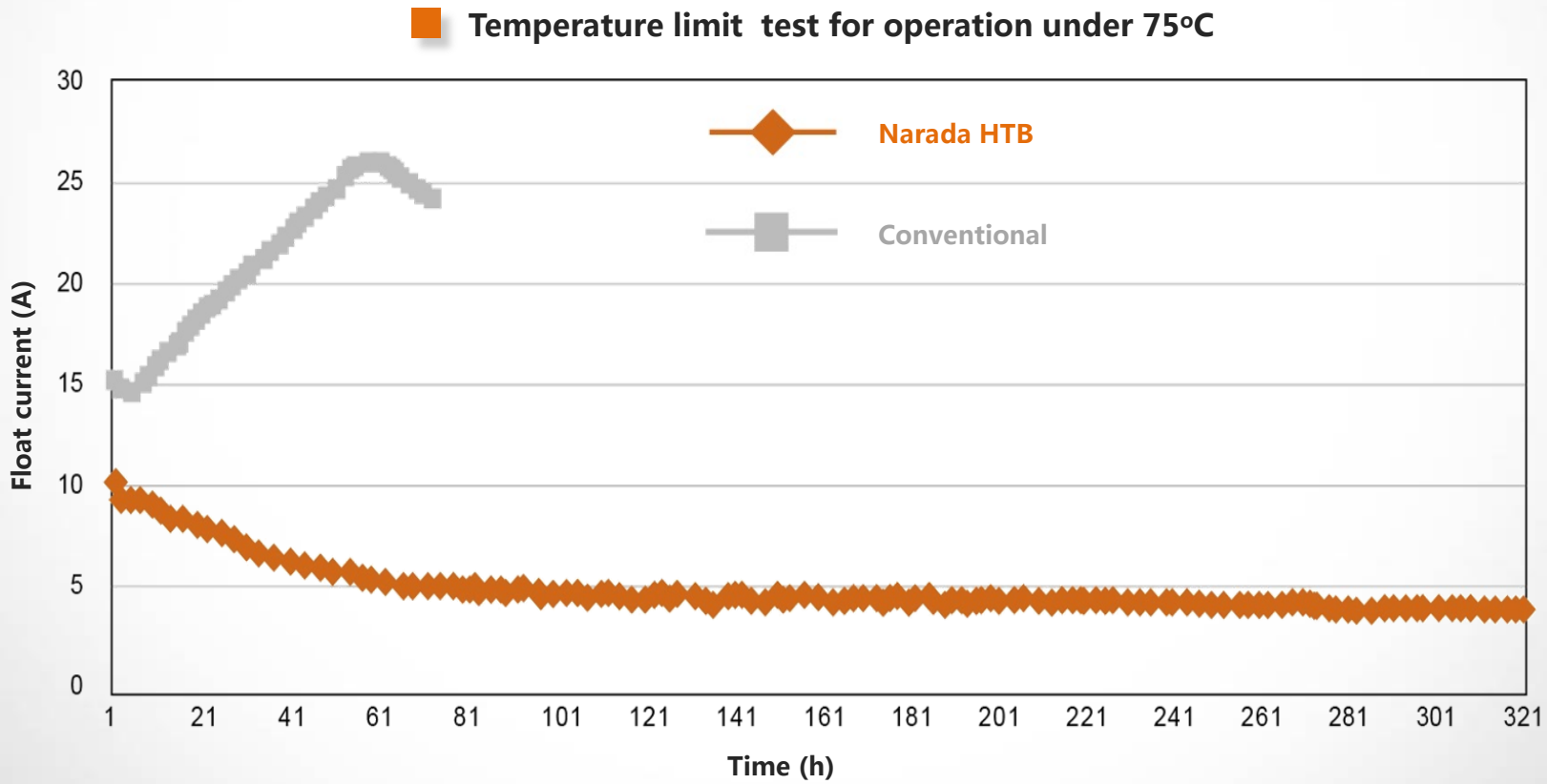
HTB battery performance

Performance under high temp.



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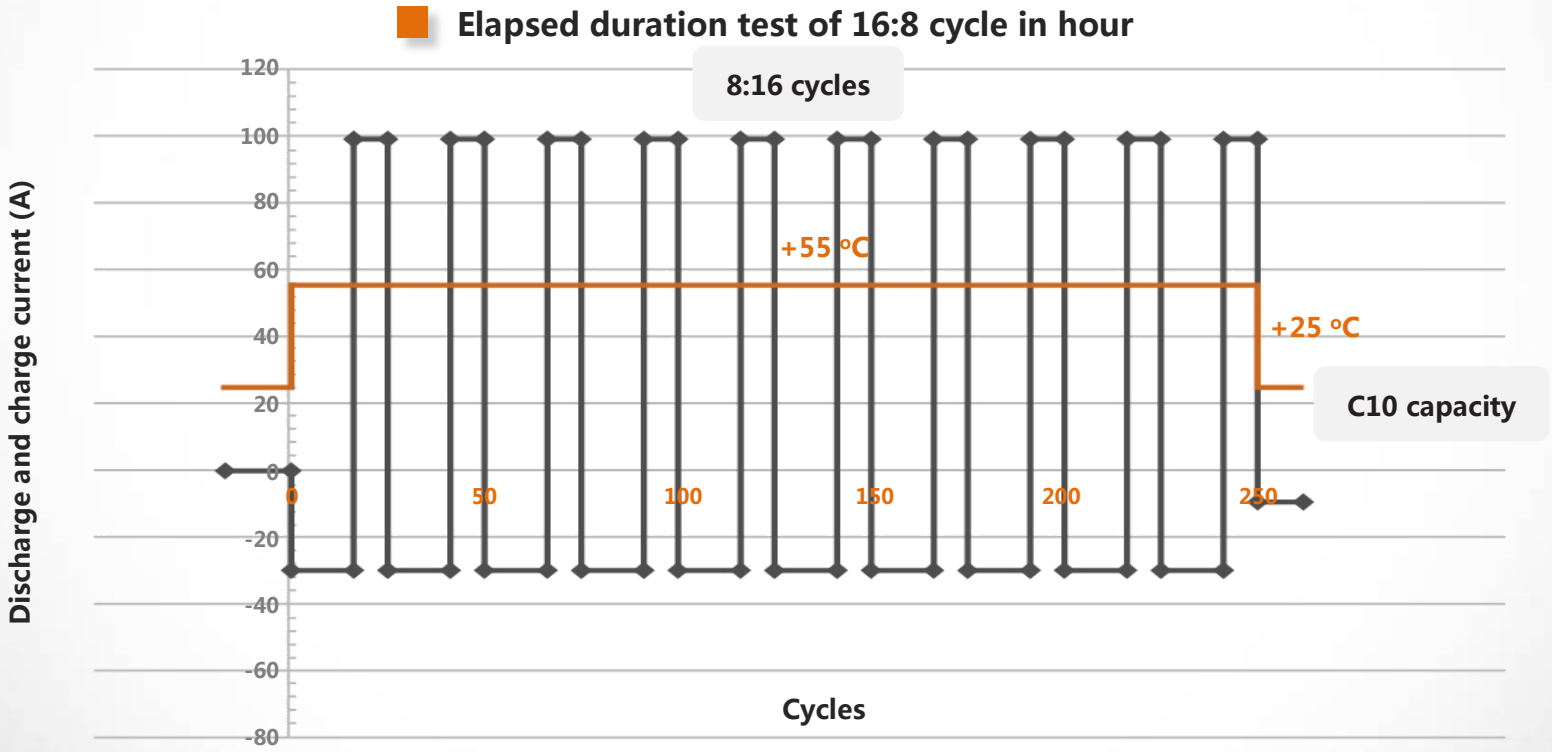
HTB battery performance

Vodafone test scenario



Test condition: under 55 degrees, 80% DOD, and recharge time of 8 hours

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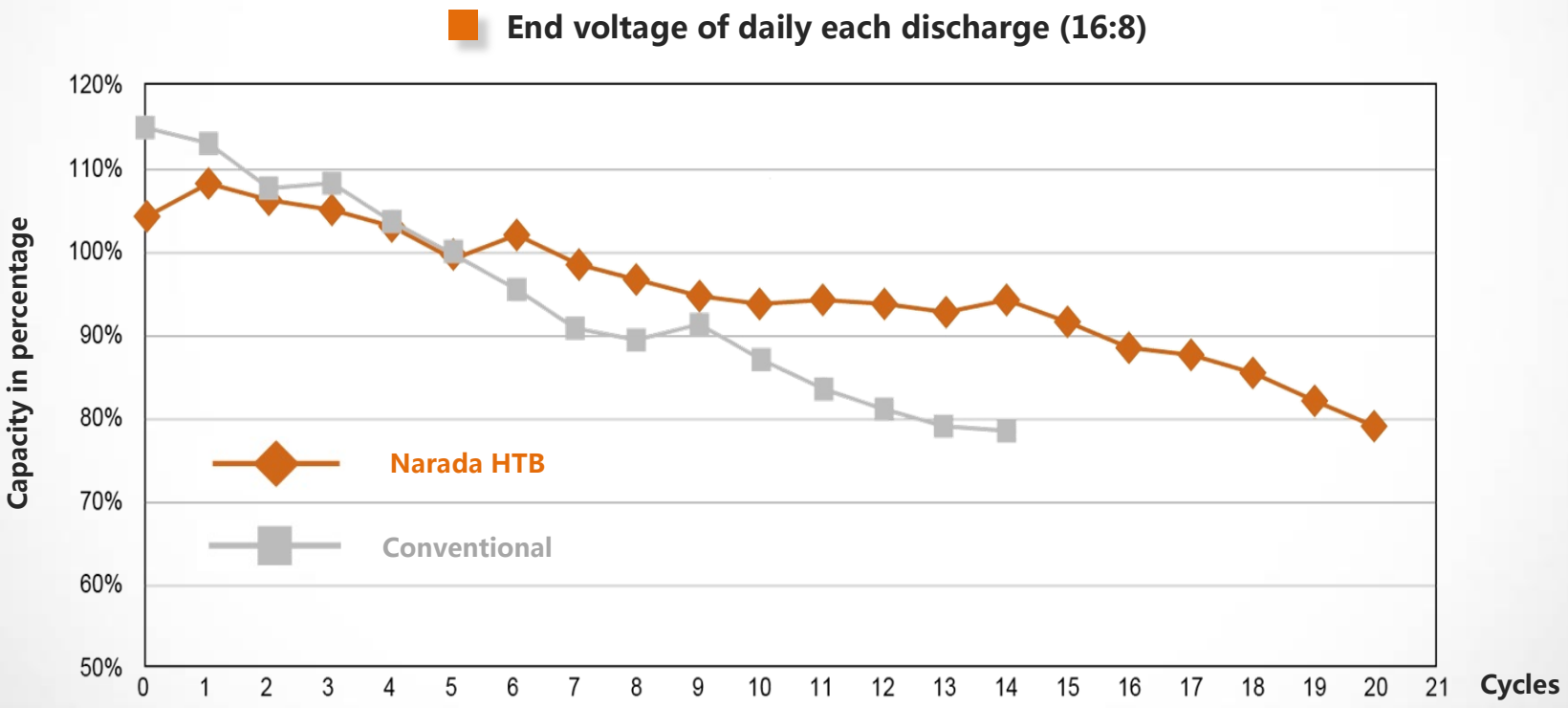
HTB battery performance

Daily discharge(16:8) test



Note: The batteries have been tested for 10 months (20 daily discharge cycles and 21 times residue

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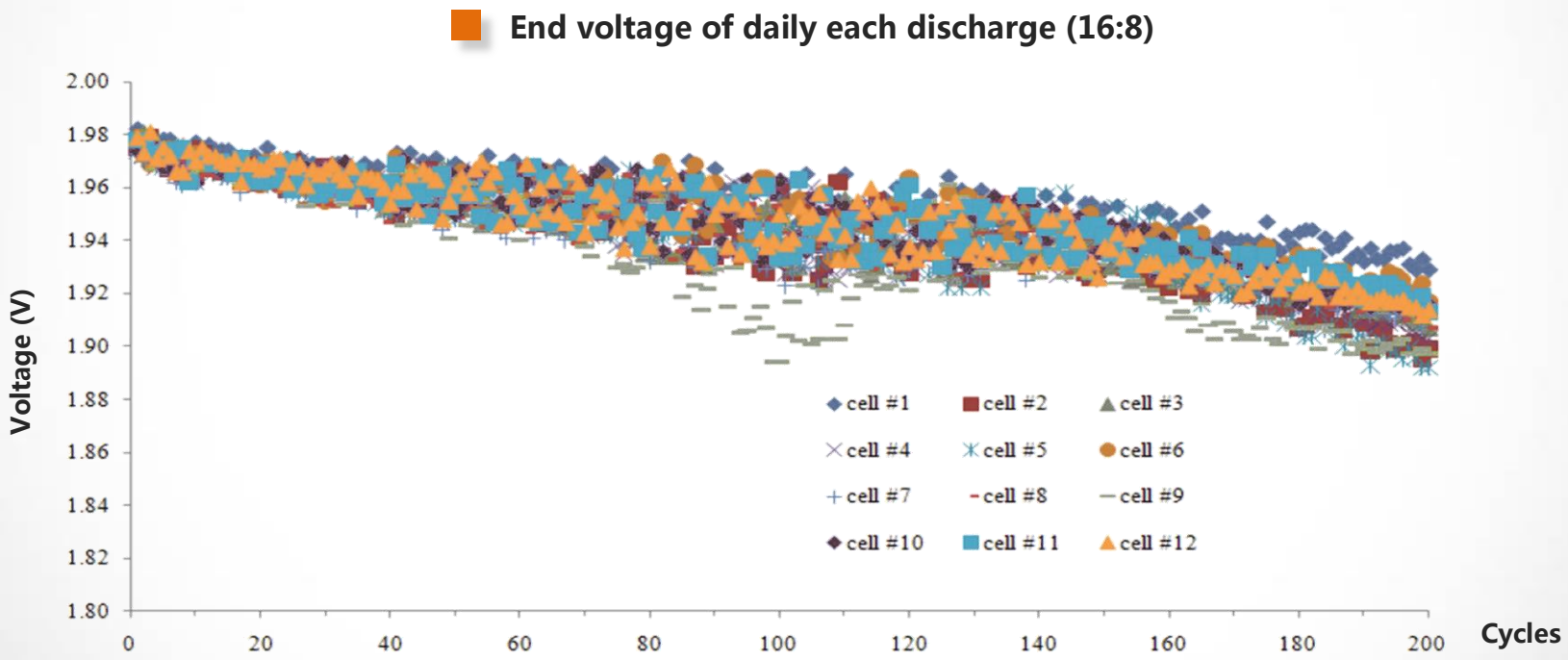
HTB battery performance

Daily discharge(16:8) test



Note: The batteries have been tested for 10 months (20 daily discharge cycles and 21 times residue capacity determination) by InterTek Test Report – An international recognized authority of the 3rd party

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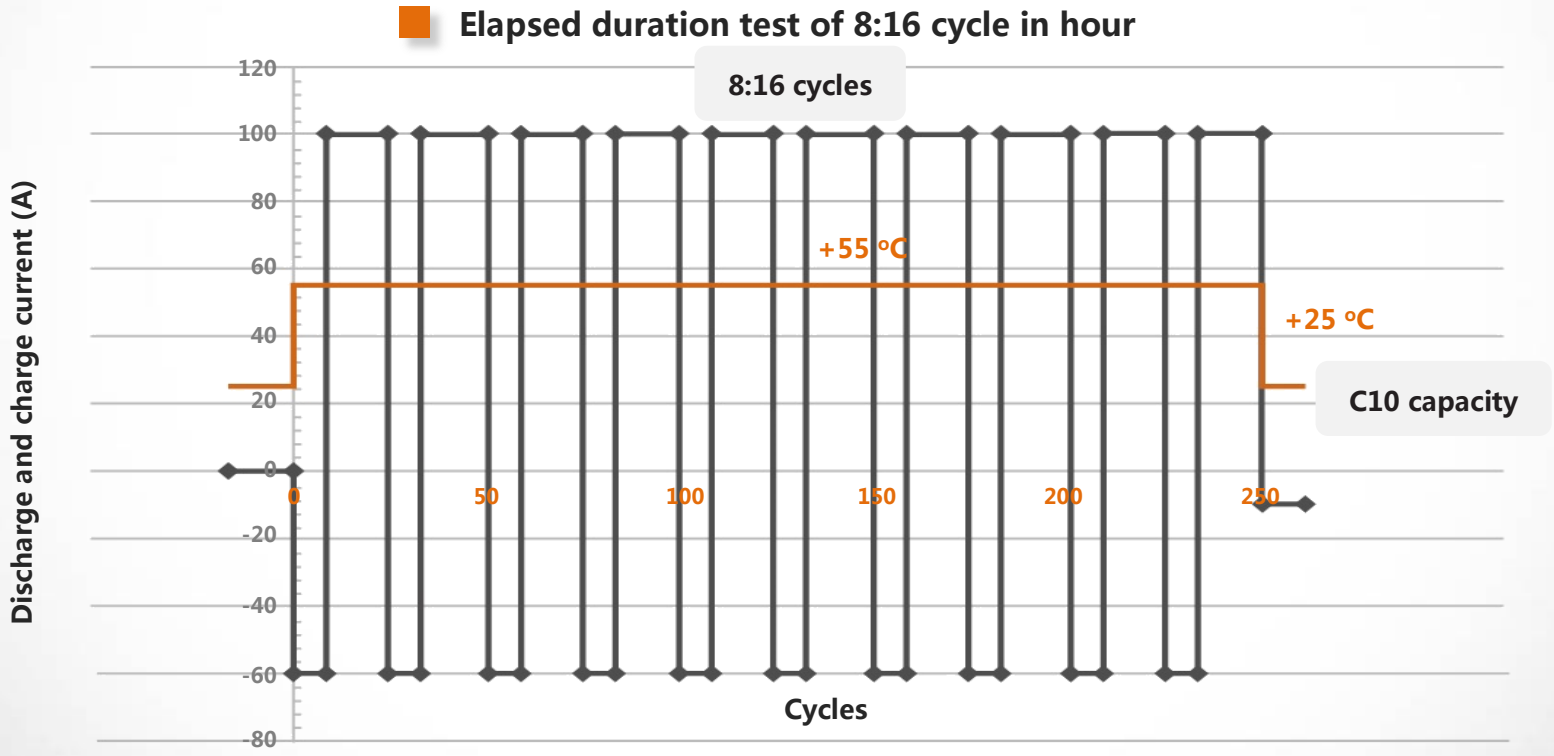
HTB battery performance

China Mobile test scenario



Test condition: under 55 degrees, 80% DOD, and recharge time of 16 hours

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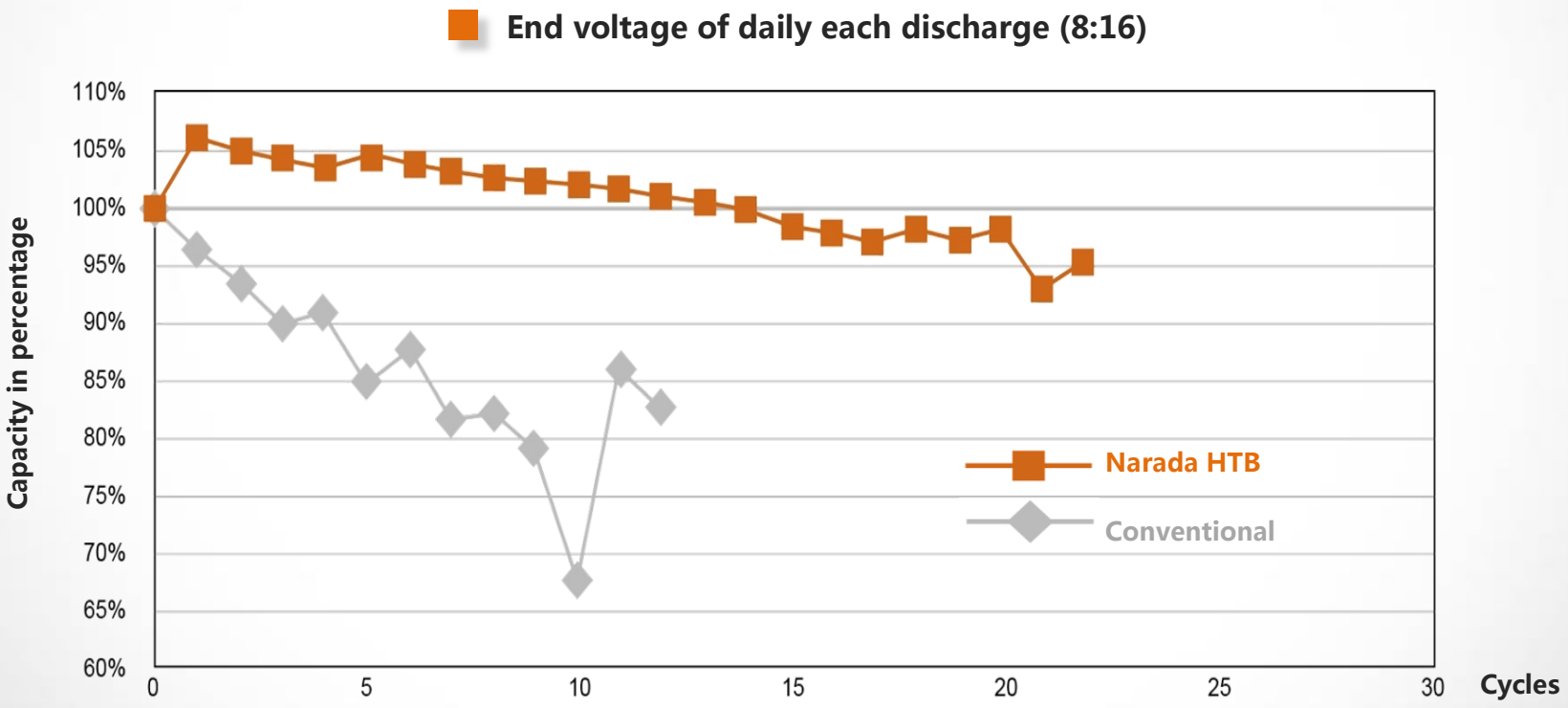
HTB battery performance

Daily discharge(8:16) test



Note: The batteries have been tested for 10 months (20 daily discharge cycles and 21 times residue

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Projects of telecom

Telecom base of Vodafone Italy

Bari region, Italy

vodafone

- System: **48V/100Ah**
- Ambient: **Outdoor**
- Battery type: **12HTB100**
- Battery quantity: **4pcs**
- Project date: **2011.06**

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Stored Energy Solutions for a Demanding World!

Telecom base of Vodafone Italy

Bari region, Italy

More references

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Stored Energy Solutions for a Demanding World!

Telecom base of Avea İletişim

Maltepe, Istanbul, Turkey

- System: **48V/300Ah**
- Ambient: **Indoor**
- Battery type: **12HTB150**
- Battery quantity: **8pcs**
- Project date: **2012.05**

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Stored Energy Solutions for a Demanding World!

Telecom base of Avea İletişim

Maltepe, Istanbul, Turkey

- **More references**

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Stored Energy Solutions for a Demanding World!

Telecom base of NSN Dubai

Dubai, The United Arab Emirates

- System: **48V/300Ah**
- Ambient: **Outdoor**
- Battery type: **12HTB150**
- Battery quantity: **8pcs**
- Project date: **2014.07**

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Telecom base of NSN Dubai

Dubai, The United Arab Emirates

- More references

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Stored Energy Solutions for a Demanding World!

Telecom base of Vodafone India

Ghosrawa village, India

vodafone

- System: **48V/600Ah**
- Ambient: **Indoor**
- Battery type: **HTB-600**
- Battery quantity: **24pcs**
- Project date: **2012.05**

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Stored Energy Solutions for a Demanding World!

Telecom base of Vodafone India

Ghosrawa village, India

- More references

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Stored Energy Solutions for a Demanding World!

Telecom base of Telefónica S.A.

Toledo city, Spain

- System: **48V/300Ah**
- Ambient: **Outdoor**
- Battery type: **12HTB150**
- Battery quantity: **8pcs**
- Project date: **2012.10**

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Stored Energy Solutions for a Demanding World!

Telecom base of Telefónica S.A.

Toledo city, Spain

- **More references**

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Stored Energy Solutions for a Demanding World!

Telecom base of China Telecom

Hefei area, China

CHINA TELECOM

- System: **48V/600Ah**
- Ambient: **Indoor**
- Battery type: **HTB-600**
- Battery quantity: **24pcs**
- Project date: **2013.07**

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Stored Energy Solutions for a Demanding World!

Telecom base of China Telecom

Hefei area, China

More references

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Projects of power storage

PV storage for water-pump project

Madina, Saudi Arabia

Project Details

- PV generation: **9KWp**
- Storage capacity: **21.6KWh**
- Battery type: **12HTB150**
- Battery quantity: **12pcs**
- Project date: **2016.3**

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Stored Energy Solutions for a Demanding World!

PV storage for water-pump project

Madina, Saudi Arabia

- More references

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Stored Energy Solutions for a Demanding World!

Solar-DG hybrid storage project

Penang area, Malaysia

Project Details

- PV generation: **15KWp-1Φ**
- Storage capacity: **44KWh**
- Battery type: **12HTB150**
- Battery quantity: **24pcs**
- Project date: **2011.07**

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Stored Energy Solutions for a Demanding World!

Solar-DG hybrid storage project

Penang area, Malaysia

- **More references**

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Stored Energy Solutions for a Demanding World!

Solar-DG hybrid storage project

Johor Bahru, Malaysia

Project Details

- PV generation: **30KWp-3Φ**
- Storage capacity: **65KWh**
- Battery type: **12HTB150**
- Battery quantity: **36pcs**
- Project date: **2012.05**

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Solar-DG hybrid storage project

Johor Bahru, Malaysia

- **More references**

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Stored Energy Solutions for a Demanding World!

Solar-Grid hybrid storage project

Bukit Panjang, Singapore

Project Details

- PV generation: **68KWp-3Φ**
- Storage capacity: **260KWh**
- Battery type: **12HTB150**
- Battery quantity: **144pcs**
- Project date: **2010.04**

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Solar-Grid hybrid storage project

Bukit Panjang, Singapore

- More references

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Stored Energy Solutions for a Demanding World!

Solar-Grid hybrid storage project

Myitkyina area, Myanmar

Project Details

- PV generation: **10KWp-1Φ**
- Storage capacity: **28KWh**
- Battery type: **12HTB150**
- Battery quantity: **16pcs**
- Project date: **2011.09**

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Stored Energy Solutions for a Demanding World!

Solar-Grid hybrid storage project

Myitkyina area, Myanmar

- More references

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Thanks!