

BYD Corporate Vision: Governor's Utah Energy Development Summit



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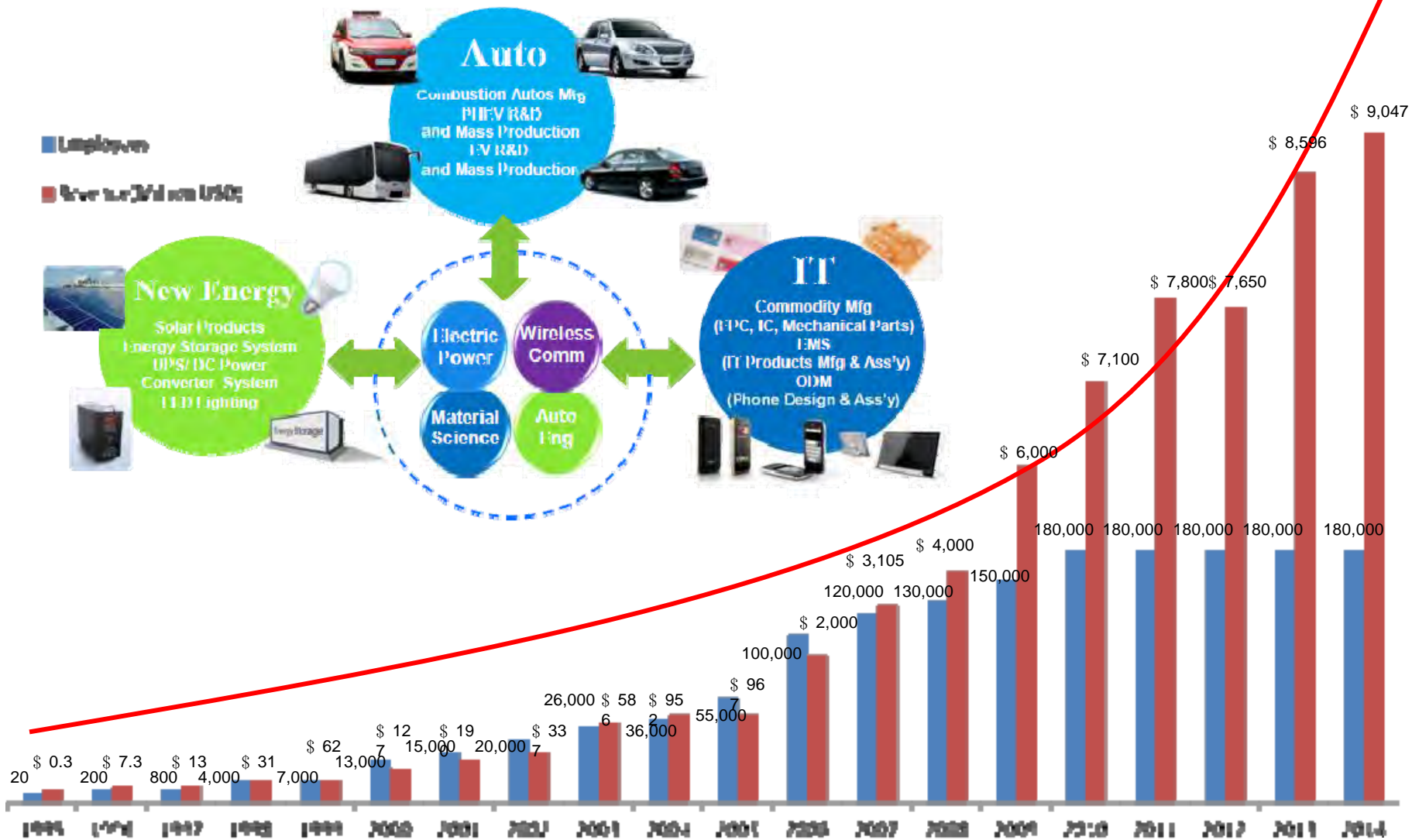


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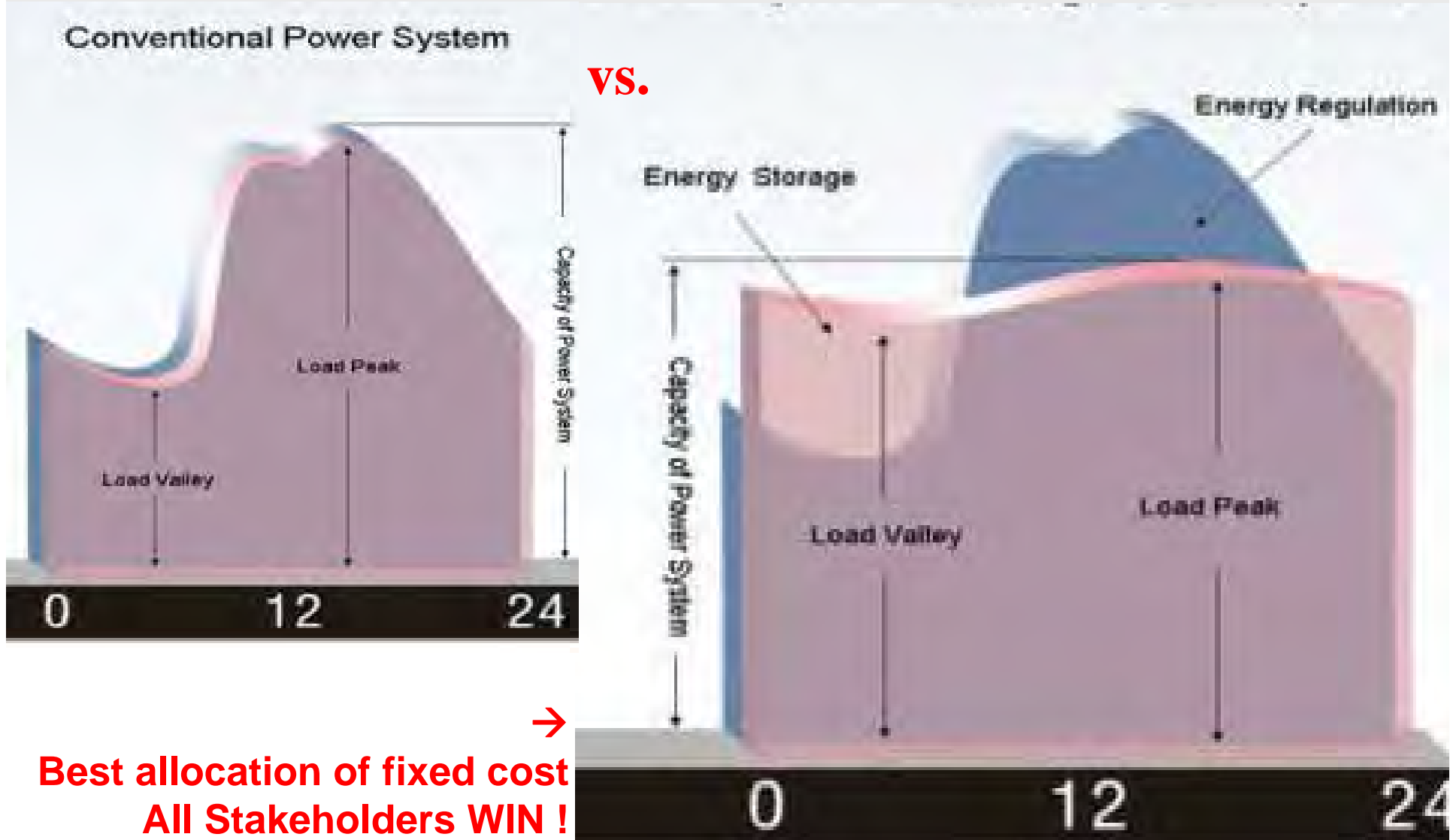
BYD Robust Growth and Business Areas



Build Your Dreams



Energy Storage: Balancing is key to Optimized Costs



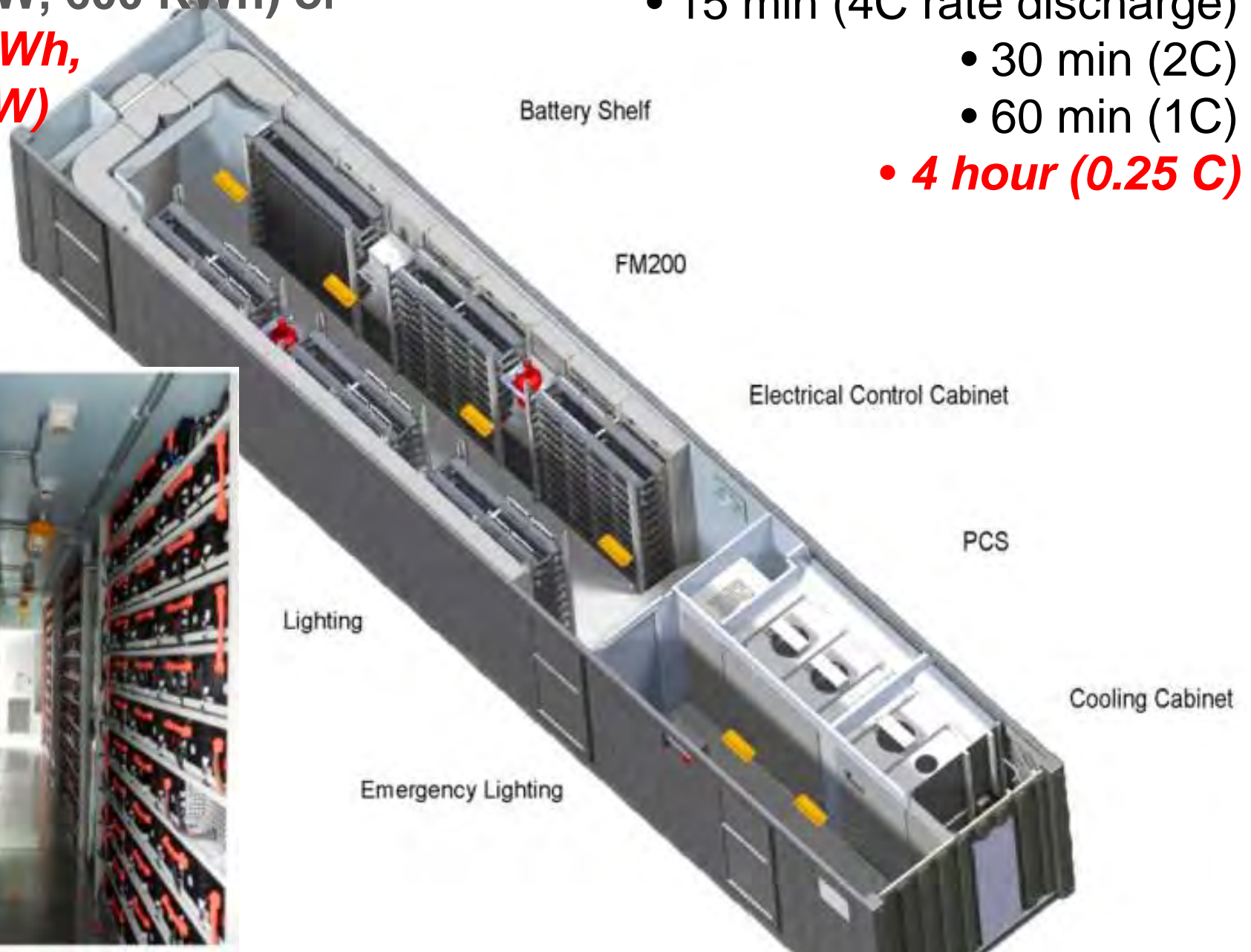
ESS 40-FT Containers

(1.8 MW, 600 KWh) or

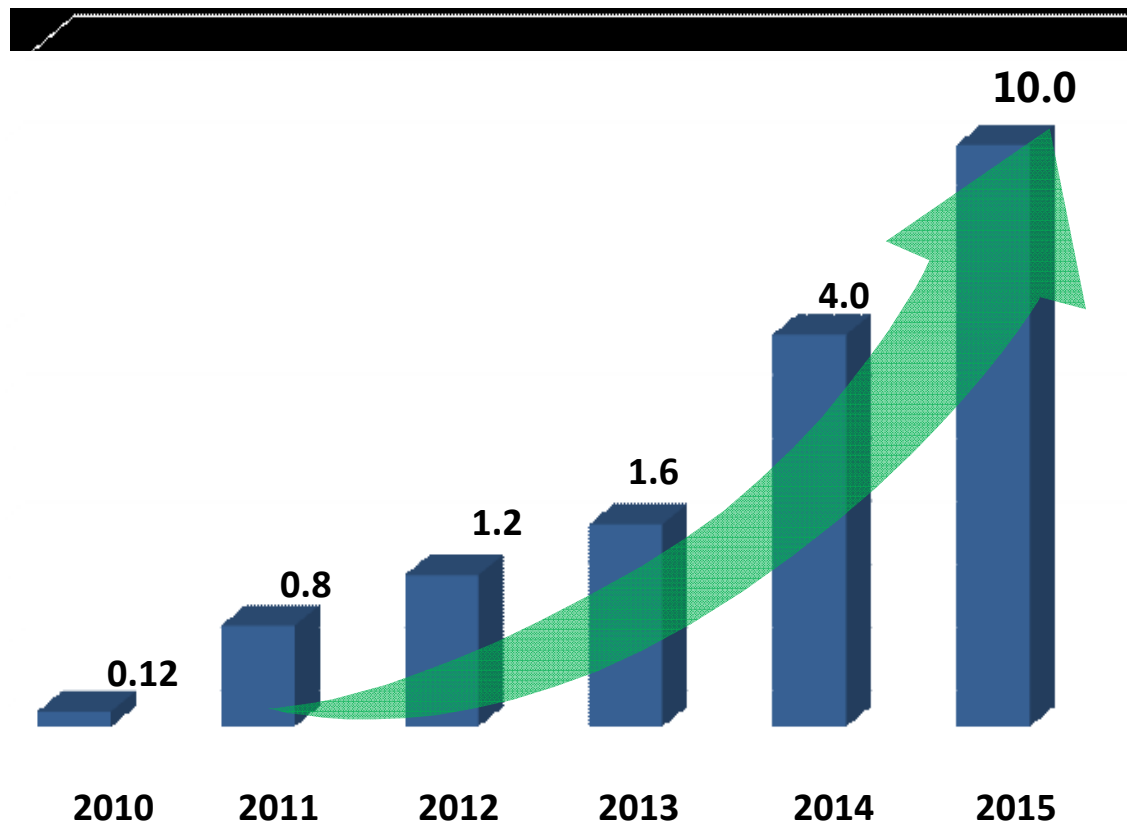
**(1.2 MWh,
250 KW)**

Common Options:

- 15 min (4C rate discharge)
 - 30 min (2C)
 - 60 min (1C)
- **4 hour (0.25 C)**



Production Capacity (Actual and Planned)



New production base in Shenzhen, PRC
Energy Module Assembly in Lancaster, CA



Reference Cases



Worldwide Installation – 250MWh ESS Installed



Italy Terna 2MW/2MWh



Canada RES 4MW/2MWh



Qatar Chevron 250kW/500kWh

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South Africa Eskom 200kW/1.2MWh

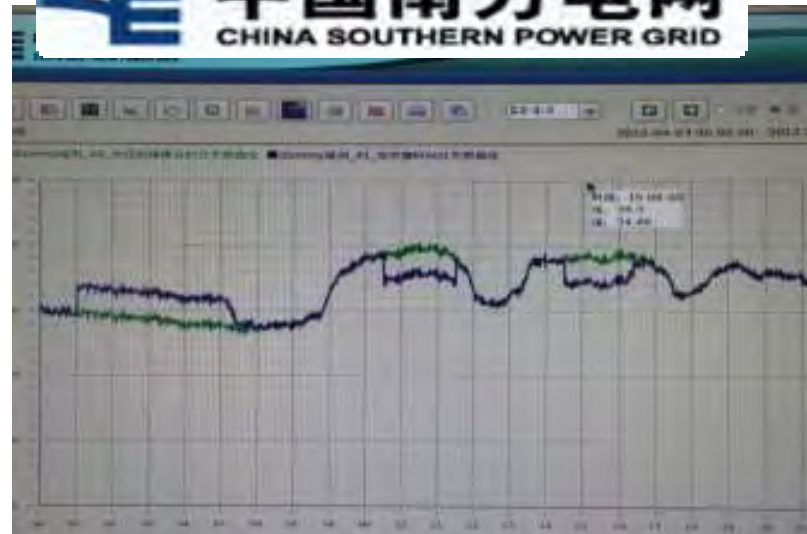
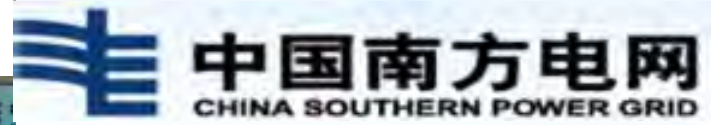


Southern Grid 4MW/12MWh ESS

System Parameters

- ▶Capacity – 3MW/12MWh
- ▶Voltage Grade – 380V/50Hz
- ▶Communication – Ethernet (Modbus)
- ▶Location – Shenzhen, China
- ▶Completion Time – May, 2011
- ▶Operation Time – Oct.30th ,2011
(3MW full load operation at SGCC.)
- ▶Owner - SC

**The 1st grid connection
ESS project in China**



Chevron 2MW/4MWh ESS – Container Type

System Parameters

- ▶Capacity – 2MW/4MWh
- ▶Voltage Grade – 480V/60Hz
- ▶Communication – Ethernet (Mod)
- ▶Location – California, US
- ▶Completion Time – Sept. 2011
- ▶Operation Time – Dec.2011
- ▶Owner - Customer



State Grid 6MW/36MWh ESS

System Parameter

- Capacity: 6MW / 36MWh
- Voltage Grade: 380V/50Hz
- Communication: Ethernet (modbus)
- Location: Zhangbei, China
- Finish Time: Finished at the end of 2011
- Owner: State Grid

World's **LARGEST** Iron Phosphate Battery Energy Storage with the largest Utility Company of China.



Chevron Energy 250kW/500kWh

The 250kW/500kWh containerized energy storage system is part of a Chevron Solar Testing Facility located at Qatar Science & Technology Park (QSTP). The main function of the ESS is as follows

- **Combine with PV and Diesel Generator**
- **On grid and off grid operation**
- **4 quadrant operation (Active and reactive power control)**
- **Frequency and voltage droop control**
- **Black start**



System Parameter

- ◆ System Capacity: 250kW(300kVa)/500kWh
- ◆ Nominal output: 415VAC/50Hz
- ◆ Round trip efficiency: $\geq 89\%$ (AC-DC-AC)
- ◆ Ambient Temperature: $-10^{\circ}\text{C} \sim +55^{\circ}\text{C}$
- ◆ Operation since December 9th, 2012
- ◆ Location: Qatar science and technology park(QSTP) Doha, Qatar



Duke Energy – 200KW/500KWh

System Parameters

- ▶Capacity – 200KW/500KWh
- ▶Voltage Grade – 480V/60Hz
- ▶Communication – Ethernet (Modbus)
- ▶Location – Charlotte, NC, US
- ▶Completion Time – Oct. 2012
- ▶Operation Time – Nov.2012



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RES Ohio 4MW/2MWh ESS

PURPOSE

- ✓ Designed to provide Fast Frequency Response to PJM Interconnection who are the Regional Transmission Organization for 13 states in the North Eastern US
- ✓ Driven by FERC 755 requirement to 'Pay for Performance' of fast acting and efficiently provided frequency regulation

DESIGN

- ✓ 4480 LiFePO₄ cells
- ✓ Specified minimum requirement 4MW for 15mins for a nine year period
- ✓ 2 x 1MWh battery 40ft containers and 1 x 4MW PCS 40ft container
- ✓ System response time <100ms
- ✓ System frequency range 57 - 60.5Hz
- ✓ Total harmonic distortion <4%



BYD 20MW/40MWh ESS

System Parameter

- System Spec: 20MW/40MWh
- Voltage: 400V (AC50Hz)
- Battery type: FV200 (3.2V/230AH)
- Established time: June, 2014
- Location: Shenzhen, China
- Owner: BYD

Function:

- Frequency regulation;
- Load shifting and peak shaving;
- Micro grid



Invenergy 62MW / 22MWh ESS

The Largest Grid-Connected ESS in US

System Parameters:

- ▶ Capacity – 62MW/ 22MWh:
 - 31.5 MW – Grand Ridge
 - 31.5 MW – Beech Ridge
- ▶ System response < 20 ms
- ▶ Communication – Ethernet (Modbus)
- ▶ Location – La Salle County, Illinois
- ▶ Completion Time – May, 2015
- ▶ Operation Time – Just commissioned
- ▶ Owner - Invenergy

