Company Overview

• Large format lithium ion prismatic cells and batteries

• Founded 2004

• Headquarters & plant - Allentown, PA
  - 92,000 sq ft facility
  - State-of-the-art laboratory and testing facilities
  - Current capacity 20,000 kWh/year, expansion capacity to 120,000 kWh/year

• Unique, environmentally friendly water-based manufacturing process
Market Forecast ($B)

Sources: CLSA, Deutsche Bank, Frost & Sullivan, Lux Research, Company Estimates.
Areas of Advancement

• Chemistry and Materials

• Manufacturing Process
  - Water-based

• Format
  - Large Format prismatic cells
Large Format Prismatic Cells
“When Energy Really Matters”

Lithium Nickel Cobalt Manganese

- 185 Wh 3.7V, 50 Ah
- 333 Wh 3.7V, 90 Ah
- 740 Wh 3.7, 200 Ah

Lithium Iron Phosphate

- 128 Wh 3.2V, 40 Ah
- 192 Wh 3.2V, 60 Ah
- 512 Wh 3.2V, 160 Ah

Economy of Scale

- Relative Cost per Whr
- Total Whr per Cell

Cell Type (NCM)
Energy Storage for the Smart Grid
Why is Storage Needed?

• International Comparisons
  - Japan 15%
  - Europe 10%
  - United States 2.5%

• Increasing renewable integration
Where is Storage Needed?

Migratory Path of Utility Energy Storage – in AEP

This Migration Trend is Driven by Popularity of Customer-Owned Distributed Generation and Customers’ demand for higher service quality.
Many Storage Options

- Pumped hydro, CAES, flywheels

- Batteries
  - Lead acid, sodium sulfur, lithium ion

- Why Lithium Ion?
  - 98-99% Efficiency
  - 50 msec response time
  - Energy Density
  - Scalability to > 1 MWhr
  - Enables Multiple Services
  - Cost Reduction Roadmap (Adoption by other industries)
  - Continuous Investment and innovation
Distributed Energy Storage
(Li-ion: 50KWh in a pad mounted enclosure)

- Energy Capacity from 50 KWh - 150KWh
- Tailored to the location and duty cycle
- No/low maintenance
- Multiple configurations
  (inverters, chargers, switching hardware, etc)

International Battery Prototype
Summary

• Need for Energy Storage increasing dramatically

• Care must be taken to match the application requirements to the storage technology

• Li-Ion batteries are proving to be a versatile solution

• Industry partnerships are the key to make this happen
Thank you !

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