



ELECTRIC DRIVE TRANSPORTATION ASSOCIATION
**CONFERENCE
& EXPOSITION**

DECEMBER 2-4
WASHINGTON DC
CONVENTION
CENTER • USA

battery • plug-in • hybrid • fuel cell

Electro Energy Technology Update

Michael E. Reed
President & CEO
Electro Energy Inc.

Hosted By:



In partnership with:

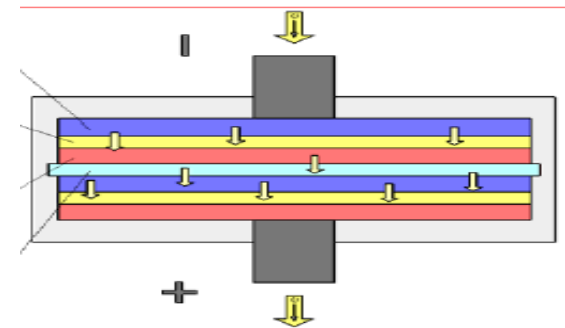
SAE International

Company Profile

- Developer and Manufacturer of Advanced Rechargeable Batteries
- Founded in 1992 as Battery R&D Company
- Headquarters in Danbury, CT
- Facilities: Colorado Springs, CO and Gainesville, FL
- Targeting the two fastest growing battery chemistries
 - Nickel-metal hydride (NiMH)
 - Lithium-ion (Li-Ion)
- R&D with over \$30 million in US government funding over 15 years
- Domestic Manufacturer

Proprietary Technology

- Patented thin, flat, wafer cell technology
- Bipolar battery cell incorporates a positive and negative electrode into one sealed wafer cell
 - Reduces the current path and resistance which reduces the heat generated
 - Sealed to contain liquid electrolyte and gases
 - Stackable to create a powerful, light weight battery
- Major benefits
 - Compact, flexible design
 - Higher power
 - Scalable to large format, high energy and high voltage
 - Battery module part count and complexity reduced



NiMH Bipolar Wafer Cell

- Successfully demonstrated HEV and PHEV



- HEV battery pack 30% smaller than Panasonic Prius OE battery
- PHEV battery pack – 6kWh providing 25 mile all-electric range

**Received 2007 Frost & Sullivan
Emerging Technology of the Year Award**

- Nickel metal price spike discouraged NiMH adoption
- Nickel metal price has dropped below 2005 level



EEl Li-Ion Battery Roadmap

- High Energy Batteries
 - Advanced nickel manganese cobalt (NMC) and nickel cobalt aluminum (NCA) cathode technologies
 - 18650 cells, wafer (prismatic) cells
- High Power Batteries
 - 18650 and 26650 cells with NMC cathode
 - Wafer cells with NMC cathode
- Large format batteries with nano materials
 - Graphite/ LiFePO_4
 - Li-titanate anode with Mn spinel (LiMn_2O_4) or other oxides
 - LiFeFx cathode

Manufacturing & Operations – Gainesville, FL

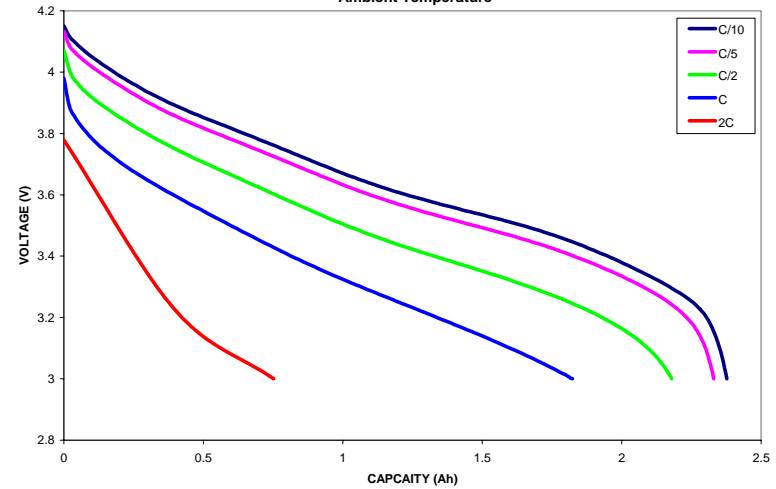


- Acquired in 2006
- Built by Energizer for \$112 million
 - State-of-the-art facility for 18650 cells
 - 36 million cells per year capacity
 - Electrode manufacturing capacity >1 million kWh/yr
 - Adaptable to large format cylindrical and prismatic cells
- Introduced 2.2Ah and 2.4Ah 18650s in 2008
 - UL and UN certified
 - Early adopters were military OEM's
 - US Dept. of Defense concern on battery supply security

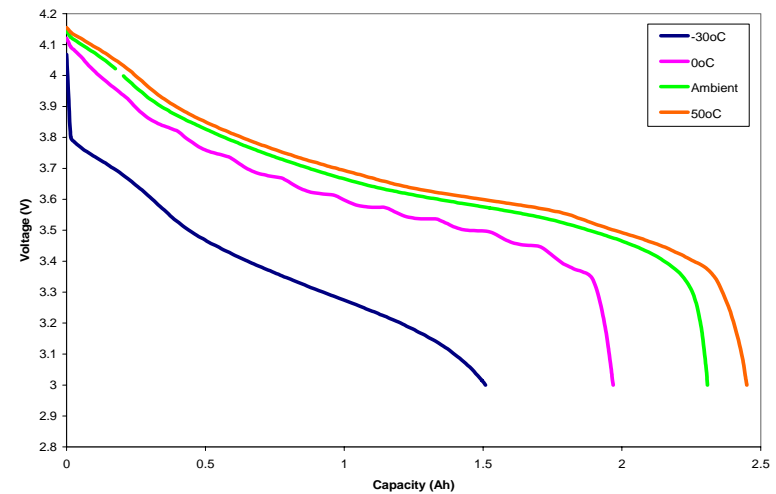
USA18650 2.4Ah Energy Cell



Discharge Profiles at Various Rates
Ambient Temperature



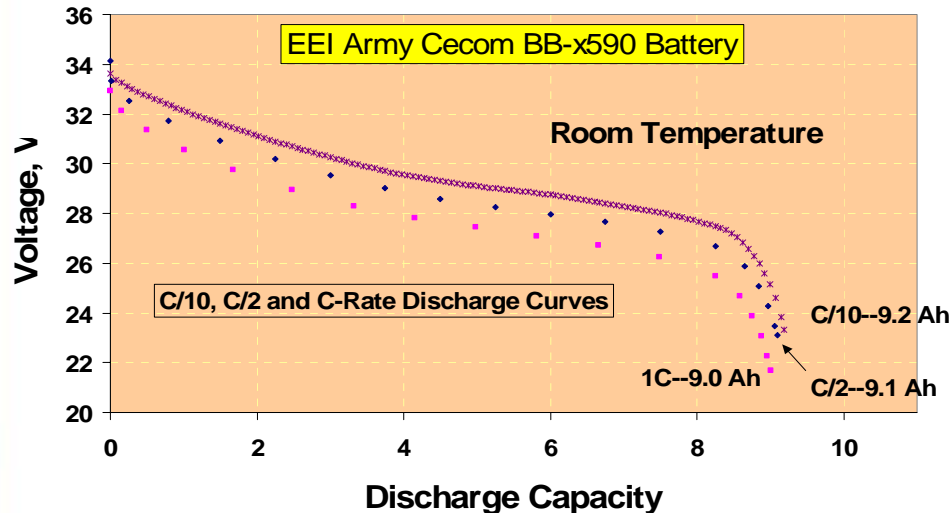
Discharge Profiles at Various Temperatures



EEl High Energy Li-Ion Cells

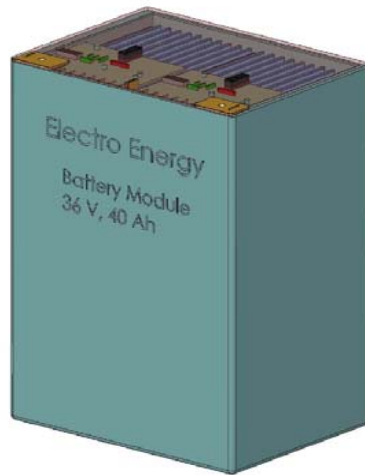
BB-X590 with NMC Wafer Li-Ion Cells

- Eight 9.2 Ah NMC cells in series
- 28 V Nominal voltage battery
- 175 Wh/kg, 325 Wh/l
- 200 Wh/kg, 450 Wh/l at cell level



~ 30 % increased energy than with 18650 cells

Design for a Li-Ion PHEV Battery with NMC Cathode



36 V/ 40 Ah
PHEV MODULE

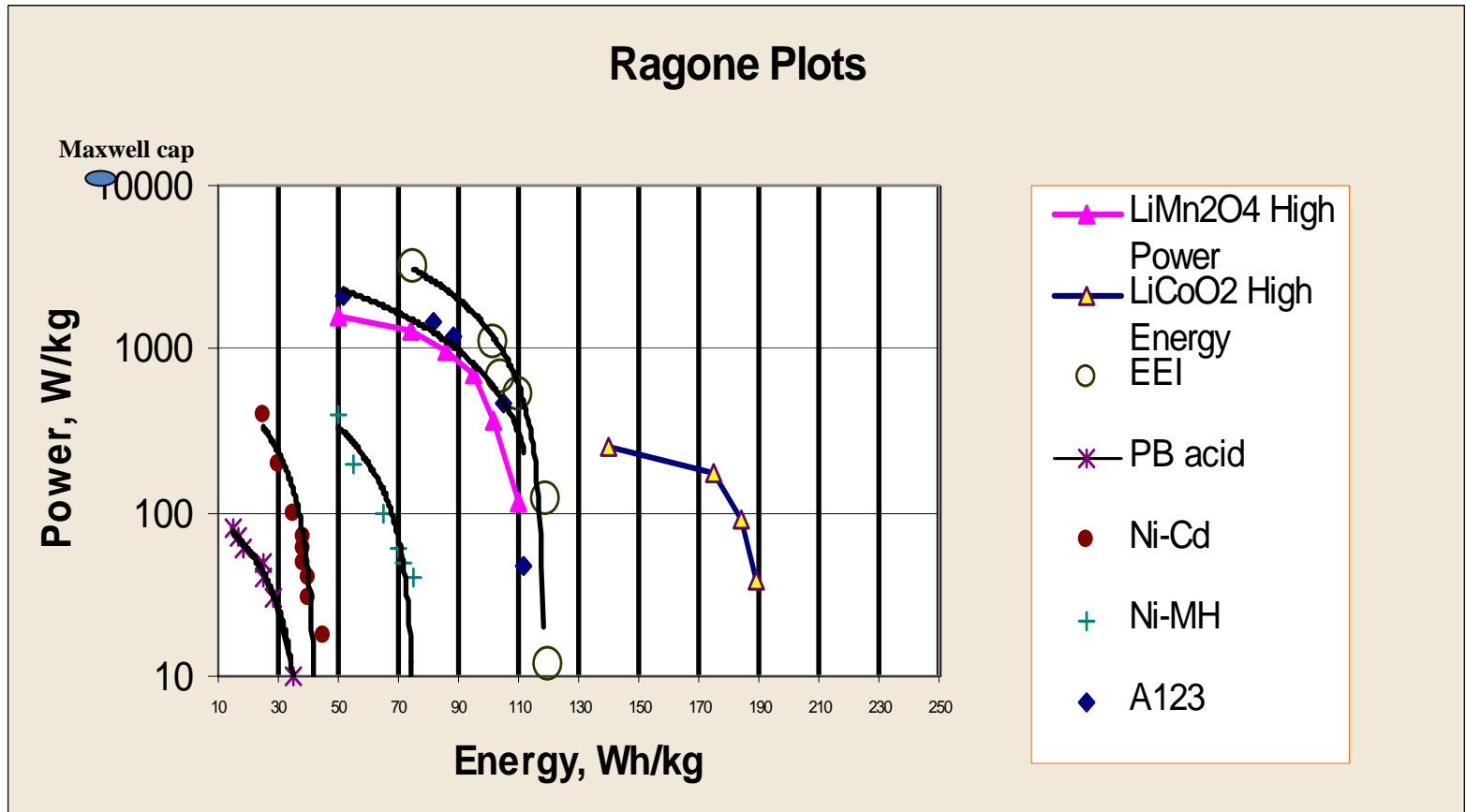
2P/10 S Module,
10 Ah cells

<u>Table 1</u>	
No. of Cells	20
Nominal Voltage, V	36
Capacity, Ah	40
Energy, kWh	1.44
Volume, liter	5.2
Weight, kg	10.5
Dimensions, cm	24.1 x 12.7 x 17
Specific Energy, Wh/kg	135
Energy Density, Wh/l	275
Specific Power, kW/kg	~ 1

Battery Pack

<u>Table 2</u>	
No. of Modules	10
Nominal Voltage, V	360
Capacity, Ah	40
Energy, kWh	14.4
Volume, liter	< 85
Weight, kg	< 130
Dimensions, cm	TBD
Specific Energy, Wh/kg	> 110
Energy Density, Wh/l	> 170
Specific Power, kW/kg	~ 1

Ragone Plots for Rechargeable Batteries



Electro Energy Recap

- Focused on fastest growing **Rechargeable Battery** segments
- Strong **Intellectual Property** position
 - 9 domestic, 11 foreign patents for bipolar wafer cell
 - \$3 million in 2008 US DOD and DOE R&D funding
- **State-of-the-art Domestic Manufacturing** facilities
 - Gainesville is the largest Li-Ion battery plant outside Asia
- Products target key rechargeable battery market segments
 - EEEL is positioned to be the supplier of choice of **18650 Li-Ion cells** to the **U.S. military and domestic OEM's**
 - EEEL has made important technological advances in HEV and PHEV batteries for the **Transportation** industry
- **Operations have been suspended due to inability to raise capital**