Presentation for

FPL/FESC

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G4 Synergetics
G4 Manufactures Ultra High Power, Bi-Directional NiMH Batteries
Company Overview

- **Snapshot**
  - 7 years in existence
  - Based in United States (Alachua, FL)
  - Former General Electric/Energizer/Moltech/Gates facility

- Team consists of battery veterans with over 150 years experience

Land: 103 acres
Facility: 40,000 sq. ft.
Why NiMH? Most proven battery technology for high power applications

- The HV battery, battery control module are covered for 8 years/100,000 miles.
- In states that have adopted the California Emission Control Warranty, the hybrid battery is covered for 10 years/150,000 miles.

Source (April 2014): www.toyota.com

Commercially Proven Chemistry for Safe and Long Cycle Life Performance
G4 Unique Safety Features

Common pressure
(alternates pressure equalization between cells and allows for proprietary pressure control operation)

Pressure Relief Valve
(additional safety feature that can exhaust excessive manifold pressure)

Flat Plate Design
(thermally optimized flat plate designs allows for latter thermal transfer using metallic current collectors)

Finned substrates
(increases cell heat removal, allows easy access for voltage/temperature monitoring)

Heat Sinks
(Optional: allows for extreme high power operation/extended overcharge)

Washer spring stacks
(accommodates dynamic movements during cycling)
Customized Energy Storage Solutions

- Turnkey Solution Provider:
  - Custom battery module manufacturer tailored to meet specialty requirements
  - Fully integrated customizable battery management system (BMS)
Target Markets and Applications

Current markets include, but are not limited to:

• Military
• Transportation
  • Hybrid Vehicles – presently integrated
  • Vehicle Start/Stop – latest data on G4 website
• Utility and Electrical Grid Services
  • Frequency Regulation
  • Renewables Firming
• Any application(s) requiring high rate charge/discharge acceptance in a safe, NiMH chemistry
DUTY CYCLE OF G4 ADVANCED NICKEL METAL HYDRIDE BATTERIES vs LITHIUM-ION

1) SINGLE CELL G4 = 30 Wh (25 Ah)
   ADVANCED NIMH 4.5SO26
   16C Charge x 16C Discharge (480 W)

2) TWO PARALLEL CELLS - KOKAM MODEL
   HDXTWSH23A = 17.75 Wh (2 x 2.4 Ah)
   2C Charge x 30C Discharge (532 W)

17.75 Wh x 1 TIME = 17.75

16 Wh x 8 TIMES = 128 Wh

ADVANCED NICKEL METAL HYDRIDE WILL DELIVER 721% MORE ENERGY (128 Wh) IN 32 MINUTES THAN THE DOW-KOKAM LITHIUM ION (17.75 Wh) IN THE SAME TIME
D1301: High Rate, 6 Cell, 25Ah rated Battery at 400A, 30 Cycles Test (fans on)

2 min pulses at 400 Amps, 5 minute dwell period between pulses
D1251:12 Cell G4 25Ah rated Battery: 400A/2 Minute Test (Fans on) for 200 Cycles
G4 25Ah Cell - Capacity vs. Cycles
RT Cycle Life - 40% Depth of Discharge (DoD)

Capacity Check Every 120 Cycles

Capacity (Ah)

Cycles
G4 25Ah Cell - Capacity vs. Cycles
RT Cycle Life - 60% Depth of Discharge (DoD)

Capacity Check Every 80 Cycles

Capacity (Ah)

0  5  10  15  20  25

Cycles

0  200  400  600  800  1000  1200  1400

D1307-4