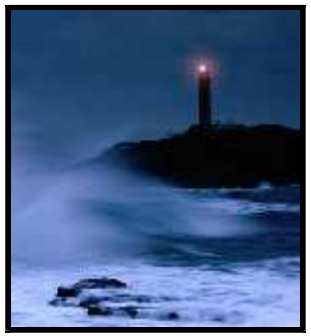
Real World Advanced Energy Storage: Beyond Chemistry



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Integrity

Innovation

Dependability

Sustained Growth of Advanced Energy Storage Technologies

- Everyone Wants Growth!
  - » To reinvigorate the Economy
  - » To spur on new high value jobs
  - » To stimulate the manufacturing sector
  - » To improve the balance of imports/exports
  - » To regain control over our energy costs
- Growth of New Energy Technologies are all tied to advancement of Energy Storage Technologies
- However, Much more is needed than just novel cell chemistries, and battery designs!

Modeling Sustainable Energy

- More efficient battery chemistries *are* needed, however, *more* battery developments will only mean *more* unproven options are available.
- New Battery technology developments by themselves cannot spur sustained economic or industrial growth.
- All future batteries and storage devices will need sufficient monitoring and controls. Battery interface to applications and applications development will be the ***REAL*** engine of sustained economic growth.
- Every facet of Energy Development from Wind to Solar to fuel cells to hybrid vehicles all will require advanced energy storage controls and applications development.

Real World Storage Applications

- Automotive
  - » Electric Vehicles (EV)
  - » Plug in Hybrid Electric Vehicles (PHEV)
- Smart Rail
  - » Regeneration storage in mass transit
- Smart Grid
  - » Integration of distributed green energy generation into grid
  - » Off peak storage
- Portable systems

Advanced Storage Goals

- Design Goals
  - » Energy Density
  - » Cycle Life
  - » Cost
- Realization
  - » Specific Chemistries
  - » Battery Management Systems (BMS)
    - Charge/Discharge
    - Equalization
    - Temperature

System Development & Verification

- Performance Measurement
  - » Regulation
  - » State of Charge (SOC)
  - » Charging
  - » Cycle Life
  - » Energy Density
- Operational Environment
  - » Vibration
  - » Shock
  - » Temperature
  - » EMI/EMC
- Standards
  - » Transport/Safety
  - » Performance – For specific chemistries and applications

Summary

- The growth and proliferation of advanced storage systems will only be realized when battery management systems can be designed and verified against real world requirements
- Standards must be developed that document application specific environmental parameters and provide comparable test and verification methods