Grid Energy Storage

DOE Perspective

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Li-ion: Convenient solution offered by Pacific Rim
  Tied to EV, Safety issues, no recycling

L/A, Lead Carbon: The Sleeping Giant!
  Good safety record, 98% recycled

Flow batteries: True **energy** storage
  V/V Cost reduced by ½, 10MW/4hr deployed,
  still tied to commodities market

The frontier: Na-batteries, molten metals
  -> aqueous soluble organics
V/V Redox System with Mixed Acid Electrolyte

- Temperature stability + 80%
- Energy density + 70%
- Projected system cost of $300kWh for 4 hour system
- 5 Licenses

Following consistent Performance Enhancement, and Reduction in System Costs, Redox Material and Membrane Costs now predominate.

New Technology:
Aqueous Soluble Organics
Frequency regulation business case established
Courtesy 20MW Beacon plant and FERC

California 1.3 GW Mandate – the Duck curve
Lots of activity, effectiveness?

Solar PV industry becoming increasingly friendly

Storage as peaker? Yes please!!!

Behind the meter market active but effectiveness?

Resilient micro-grids, military bases being explored

Smaller states becoming involved
Vermont Public Service Dept. – DOE - Green Mountain Power

Resilient microgrid in Rutland, VT
4MW / 3.4MWh of storage
Integrated with 2MW PV
Integrator: Dynapower

Groundbreaking: Aug. 12, 2014
Commissioning: Sep. 15, 2015

Storage: Reduces demand charges by high load peak shaving
PV: Green power for the grid. Situated on Brown Field area

System can be islanded to provide emergency power for a resilient microgrid serving a highschool / emergency center.
Washington State Clean Energy Fund:

Solicitation for $15M for Utility Energy Storage Projects

Selected projects with UET vanadium flow battery:

- Avista (1MW / 4MWh) -- PNNL -- WA State U
- Snohomish (2MW / 8MWh) – PNNL -- 1Energy -- U of WA

Under a DOE / WA MOU, PNNL will participate in both projects, providing use case assessment and performance analysis.

Vanadium technology with 1.7x Energy density developed at PNNL for DOE

->OR

Ribbon Cutting Avista, April 2015