

Sandia National Laboratories Energy Storage Projects



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U.S. DEPARTMENT OF
ENERGY



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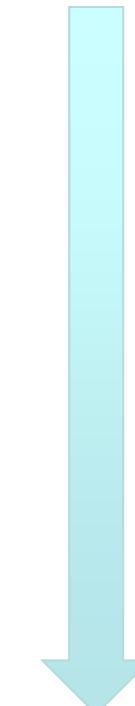
SAND Document

Five Sandia Thrust Areas to Meet Grid Challenges



- **Materials and Systems Development**
 - Leading the **development** of next-generation technologies
 - Improving current **technology** (flow batteries, flywheels, etc.)
- **Power Electronics**
 - **Developing** and testing new wide-bandgap power-electronic devices
- ***ES Systems Demonstrations and Testing***
 - ***Laboratory testing and analysis from individual cells to 1MW systems***
 - ***Field deployments***
 - ***State-Initiated Demonstration Project Development***
- **Grid Analytics and Policy**
 - Providing **assessments** of the impact of storage placement
- **Outreach** - Leading publications and meetings to **help** educate the Grid Energy community

Nanoscopic



Macroscopic

Energy Storage System Project Technical Support

- Conduct analysis, perform modeling, and provide data on applications, ES sizing, and technologies that best solve the client's problem.
- Assist in developing and reviewing a client's request for Information and Proposals (RFI & RFP).
- Assist in the design, procurement specifications, and construction of ESS'.
- Assist in the design of Data Acquisition Systems (DAS).
- Assist in developing the ESS commissioning plan.
- Analyze operational test data and develop system optimization algorithms.

SNL Industry Acceptance Capabilities (Contd.)



ES Testing and Analysis

- Cell and module analysis, up to 48 VDC 2000 A within a controlled environment (chamber)
- Spectral impedance measurement
- Test ESS up to 1.0 MW 480 V 3-phase AC
- On-site (Vendor) acceptance testing support
- Safety evaluations
- Provide third party independent ES system evaluations, analysis, and reports

Industry Outreach

- <http://www.cesa.org/webinars/>

Demonstration Program: Ongoing Programs

Clean Energy States Alliance – CESA

- Alaska – Cordova Electric Co-Op
- Connecticut DEEP
- Clean Energy Center – Division of Energy Resources
- Massachusetts
- NYSERDA
- Oregon Dept. of Energy
- Sterling Power
- Vermont

CEC/Hawaii

- California CEC/PUC
- Hawaii projects
- Sunpower
- UCSD

International Collaborations

- BELCO
- Bermuda Electric
- Grid Work Projects
- WEICan

Demonstrations/ Optimization/ Commissioning

- DCICON
- Electric Power Board
- Group Nire, TX
- GS Yuasa
- Helix
- Los Alamos, NM
- NY Board of Public Utilities
- Primus Power
- UET

FY16- 25 Projects

FY15- 25 Projects

FY14- 22 Projects

Industry Acceptance Program Overview



- **State initiatives and Public education**
 1. Through our Clean Energy States Alliance (CESA) partnership:
 - Provide Technical consulting to Various State Agencies
 - Connecticut DEEP; Massachusetts DOER, New York, California CEC, Hawaii DBEDT, New Mexico, and Vermont
 - Market rules, Policy and system monetization
 - Develop projects, provide technical consulting and provide limited cost share to innovative technologies
 - Vermont
 - Oregon Department of Energy
 - Hawaii Energy Office
 - Innovative technologies – Helix, Aquion, Ceramatech, UniEnergy Technologies (UET)
 2. Partner with the ES industry, Academia, Consumers and others to provide education and act as ES information **clearinghouse**:
 - Energy Storage Handbook
 - Various Sand Reports
 - Conduct ES related webinars

Industry Acceptance - Summary of EES Projects: Field Demonstrations



COMPLETED

- Fort Devens Base Camp Integration Lab (BCIL)
 - 30-75 kW 0.5-1hr Lead Acid
- SunPower ES Installation
 - 125kW 4hr Zinc Bromide
- University of California San Diego (UCSD) Energy Storage Initiative
 - 2.5 MW 2hr
- NELHA
 - Aqueous sodium - PV Support

Industry Acceptance - Summary of EES Projects: State Initiatives

COMPLETED

- Green Mountain Power
 - 4MW with 1MWh Li-ion, and 2.4MWh LA
- Connecticut Deep
 - Microgrid resiliency

- Cordova Electric Co-op
 - Energy Storage/Utility/Grid
- Clean Energy Center. - Division of Energy Resources
 - DOER \$40M grid resiliency
- Oregon Department of Energy
 - Utility resiliency and upgrade deferral
- California –CEC/PUC
 - 1.3 GW initiative
- New Mexico Dept. of Energy
 - Renewable integration

Industry Acceptance - Summary of EES Projects: Optimization, Testing, and Industry Support

COMPLETED

- Duke Rankin Site
 - FIAMM Sodium Nickel Chloride
- Enervault AMB2
 - Iron Chrome Flow
- SustainX
 - ICAES AMB4
- Aquion Energy
 - Aqueous Sodium
 - Cell Test Completed – System demonstration at HELCO
- Helix
 - Flywheel
 - Completed: GS Rescu Unit commercially available

GS Yuasa

- LA/Ruggedized ES mobile unit Li-Ion testing

Hawaiian Electric Company

- 60-200 MW ES

Electric Power Board

- 100kW 4hr Vanadium Flow

NYSENERDA

- \$40M NY prize – Grid Resiliency

NY Board of Public Utilities

- \$10M ES for critical infrastructure and \$200M NG Energy Resilient Bank

NM Los Alamos County

- 1.8MW/8.3MWh ES

Group Nire – TX

- 1MW 1hr Li-Ion

Slide 9

AMB2 Do you want Enervault deleted since they are out of business? Or should we leave it since its is complete?

Mollo, Ana-marie, 4/20/2016

AMB4 I could not read what you wrote for Sustain X...."AQ....."

Mollo, Ana-marie, 4/20/2016

Mention of our SNL Sponsor – DOE/OE -
Grid Energy Storage Program, managed by
Dr. Imre Gyuk

Thank You!

- **Dan Borneo** - drborne@sandia.gov
- **Ana-Marie Beare** – amollo@sandia.gov

Slide 10

AMB3 Want me to add Ben, Summer, David and Ray to this slide since they are PIs on your projects?
Mollo, Ana-marie, 4/20/2016