DOE-OE FY12 Electrical Energy Storage Demonstration Projects

Presented by
Dan Borneo

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Sandia National Laboratories

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U.S. DEPARTMENT OF ENERGY

NNSA National Nuclear Security Administration

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EES Emerging Technology Demonstrations Presentation Outline

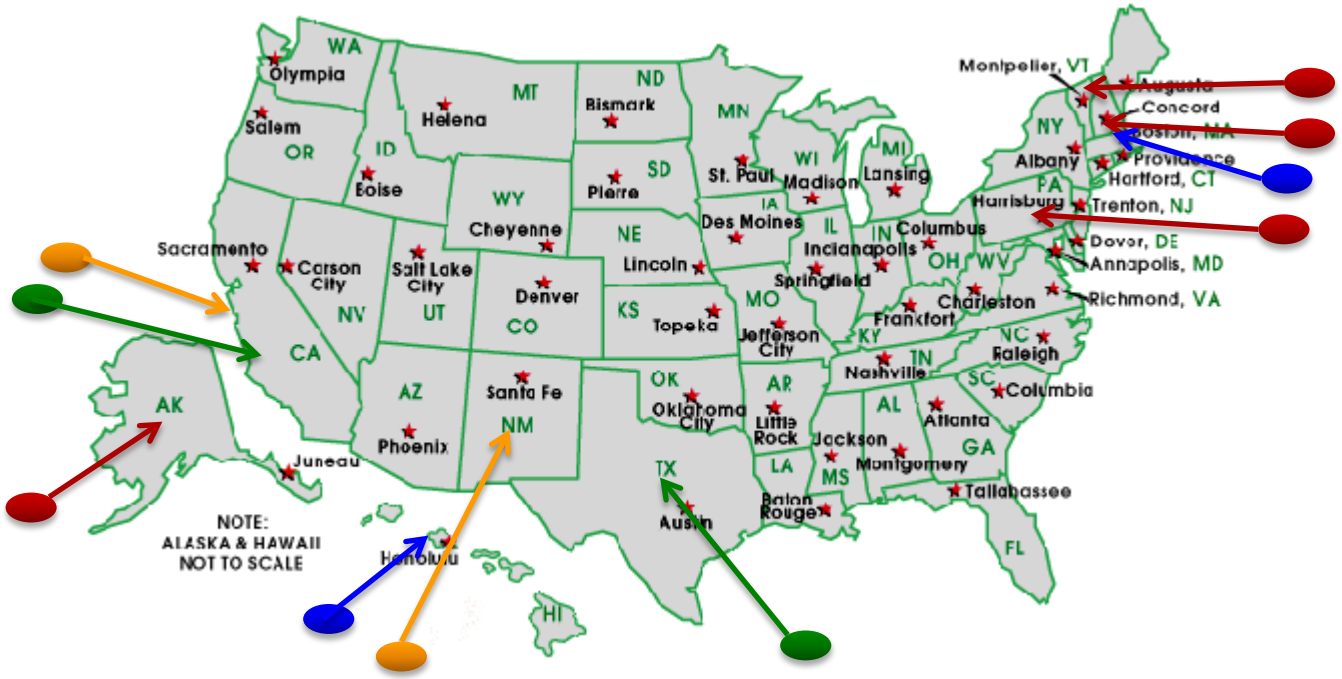
- Project Overview
- Problem Statement
  - Approach
  - Current Status
  - Path Forward - Next Steps
- Geographical Representation of Projects
- Summary Chart of Projects
- Brief Descriptions of Individual Projects
- Concluding Remarks

EES Demonstrations Project Overview

- Problem Statement
  - To **encourage investment** in electrical energy storage that impacts **services** critical for the next generation grid, it is important to develop the **proper test platforms**, collect meaningful **data**, and work with analysts and **engineers** trained in different **environments**, to understand how to satisfy requirements related to the variety of **emerging energy storage** technologies & applications.
- Approach = Deliverables
  - Use **grid-tied field demonstration** projects to test and evaluate new and existing ESS technologies in different settings
  - Provide **third party** independent **testing and analysis**
- Current Status (Provided later in Individual Reports)
- Path Forward
  - Work to **support vendor – utility understanding** of the role EES can play to be effective in various **grid services** and applications.
  - Continue to use **independent evaluations** of EES to **validate and encourage** commercialization of new technologies.

Locations of DOE-OE EES

Demonstration Projects in this Presentation



Legend: CESA DoD Academia Commercial End User

Stock Image source: http://www.devarticles.com/c/a/Web-Services/Cooking-With-Web-Services-PHP-and-GD/3/

Summary Snapshot of EES Demo Projects

Location	Name	Technology/Set-up	Environment/Application
Massachusetts	Fort Devens Systems Integration Lab (SIL)	2-4 Vendors & Varied Technologies/Military Nanogrid	Forward Operating Base
Hawaii	Fort Hickam	Zinc Bromide/Military Microgrid	Military Base
California	SunPower	Zinc Bromide & ICE Energy/ Renewable - PV	Commercial Application
California	University of California at San Diego	TBD/Microgrid and Renewables - PV	University Campus
Texas	Texas Tech University	TBD/Renewables - Wind	University & Industry Testbed
New Mexico	Mesa del Sol	Lead Acid – GS, EP; Fuel Cell/ Microgrid with local Generation; Renewables - PV	Commercial and residential
	Clean Energy States Alliance		
Vermont	TBD	TBD	TBD
Alaska	ZBB	Zinc Bromine/Microgrid	University Testbed Facility
Pennsylvania	Aquion Energy	Aqueous Sodium; Grid-Tied	Industrial Manufacturing Facility
New Hampshire	SustainX	ICAES; Grid-Tied	Industrial Manufacturing Facility
TBD	Enervault	Iron Chrome/TBD	TBD

Fort Devens: BCIL / Forward Operating Base (FOB)

Image source: http://www.army.mil/article/60473

Permission granted for images by Systems Acquisition Manager, US Army

Base Camp Integration Lab

- **Project Scope** – EES demonstration in Forward Operating Base (FOB) application. FOB consists of 6-60KW gen sets serving 150-man base camp.
- **Goal** – Provide technical consulting and third party evaluation to the Army to incorporate energy storage into FOB microgrid with objective of reducing the generator fuel usage.
- **Current Status – RFI issued and submittals received** to provide EES systems for evaluation.
  - Testing first at Sandia, and then at BCIL, Ft. Devens
- **Path Forward**
  - **Down select Review RFI submittals and invite vendors to test** their system at Sandia first and then Ft. Devens

Pearl Harbor – Ft Hickam: Joint Base SPIDERS Microgrid Demonstration Project

Permission granted for use of image by Project Lead, US Army Corps of Engineers, ERDC-CERL

View of Hickam Air Force Base Beach.
Photo by Fred Farrell

- **Project Scope** – As part of the SPIDERS program, Fort Hickam is receiving a ZBB, 400KWh Electrical Energy Storage system to include in their (SPIDERS) microgrid.
- **Goal** – Analyze system and the various components to develop optimization strategies.
- **Current Status** – Delivery of system scheduled for September/October 2012. Installation to be completed mid to late October. Commissioning estimate to start November timeframe.
- **Path Forward** – Installation, Startup/Commissioning, operation, system evaluation and analysis.

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http://www.google.com/search?num=10&hl=en&site=imghp&tbm=isch&source=hp&biw=1241&bih=806&q=SunPower&oq=SunPower&gs_l=img

Image source: http://www.yelp.com/biz_photos/siNxEpLbxqAuy0DsnHJa6A?select=O4SzLJ4BOqiJzKsiFMOEQ#NqSvan2J87osXss2XE4n8g

- **Project Scope** – The Project will install energy storage systems on existing PV systems at two separate locations in California.
  - Thermal energy storage: Ice Energy at Kohl's Department Store in Redding, coordinated with Redding Electric Utility.
  - Electric energy storage: ZBB flow-battery at to-be-announced Silicon Valley hi-tech manufacturing company.
- **Goals**
  - Identify and measure potential synergistic economic benefits of combined PV and ES installations in commercial applications (customer's side of the meter).
  - Provide technical consulting, data collection, analysis and issue report of findings in collaboration with DNV-KEMA..
- **Project Status** – Ice Energy: **Installation under way**; ZBB: Design and permitting under review.
- **Path Forward** – Engage Ice Energy and ZBB (with DNV-KEMA) for **baseline and operational testing.**

University of California at San Diego

Image source: http://www.borregosolar.com/solar-projects/education/university-of-california-san-diego/

- **Project Scope** – OE/Sandia will collaborate with UCSD as they procure 3.6 MW of electrical energy storage. The Project will install EES systems on existing PV systems and in a stand-alone application.
- **Goal** – Determine how EES can benefit a microgrid environment.
- **Current Status** – Project to start October 1, 2012.
- **Path Forward** – Engage with University facility team; develop specifications; review submittals for energy storage system.

Texas Tech University EES Project

- **Project Scope** – Sandia/DOE will evaluate electrical energy resources on a wind test site being developed with Sandia, TTU and industry.
- **Goal** – Establish site-specific EES benefits for this Wind installation.
- **Current Status** – Kickoff meeting held and work is expanding to specify energy storage system.
- **Path Forward** – Identify and procure energy storage system.

Image source: http://www.depts.ttu.edu/weweb/

TEXAS TECH UNIVERSITY

Mesa del Sol - A Planned Community

Image source - http://www.solarfeeds.com/microgrid-planned-at-mesa-del-sols-aperture-center/

- **Project Scope** – Conduct analysis of new and existing systems installed at Mesa del Sol to **minimize power while extending storage lifetime**. The proposed system includes PV, energy storage, gas generators, and fuel cells.
- **Goal** – Analyze the complete system under **different control strategies**; review MDS **with varying coordination levels to optimize control strategies**.
- **Current Status** – Preliminary modeling using a natural gas gen set to **optimize storage life and smooth PV output** completed.
- **Path Forward** – Complete modeling. Develop test plan to verify and validate modeling results.

CESA EES Demonstration Projects

Info from the CESA website

Core Membership Information

Eligible entities: States, cities, other sub-national entities that administer public dollars for clean energy, and publicly owned utilities - provided that the program makes funding available to the public for clean energy projects, market building, or related activities.

Services: Full members will receive the full complement of current CESA services, including Members-Only monthly webinars, biannual meetings, peer-to-peer listserv, cutting-edge analysis, direct consulting services, media support, priority project participation, and governance rights.

Image source -http://www.cleanenergystates.org/

CESA Projects Status

Name of Entity	Current Status	Path Forward
ZBB	Collaboration with ZBB and University of Alaska	*Work with ZBB to develop scope of services and schedule of activities*
Aquion	Aquion is planning a grid demonstration at their manufacturing site in Westmoreland, Pennsylvania	Develop relationship with PA. Energy office for their involvement
SustainX	SustainX is planning a grid demonstration at their manufacturing site in New Hampshire	Develop testing plan
Enervault	Working with Enervault to develop project with state entity	Find State energy entity that want to be involved in a energy storage demonstration.

- **Project Scope** – Develop **collaborations** with **State entities** to conduct energy Storage demonstrations. Sandia/DOE will provide technical consulting, data collection, analysis and issue report of findings.
- **Goal** – Increase **state** energy offices' **awareness** of EES.
- Secondary Goal – To support FOA 36 sect 2.5_Innovative technologies through their "Second Valley of Death."

EES Emerging Technology Demonstrations Presentation Schedule Milestones

Name of Project	FY13 Milestones
Fort Devens; Massachusetts	Q1 – RFI received & Vendors selected; Q2 – Testing commences.
SunPower; California	Q1 – Evaluation of ICE Energy system ; Q2 – commissioning of ZBB system
University of Cal/San Diego; California	Q1/Q2 – Specify and procure ESS; Q3 – Installation and commissioning of ESS; Q4 – Operation
Texas Tech University; Texas	Q1/Q2 – Specify and procure ESS; Q3 – Installation and commissioning of ESS; Q4 – Operation
Mesa del Sol; New Mexico	Q1/Q2 – Modeling of systems. Q2 – Begin testing
Fort Hickam; Hawaii	Q1 – Commissioning of system and commence testing and evaluation
CESA	These projects represent an inter-laboratory and multi-state arrangement. The day-to-day and periodic milestones are based on vendors – and state entity relationships and will report quarterly on their progress toward their individual energy storage demonstration goals that have been approved.
University of Alaska; Alaska	
Aquion; Pennsylvania	
SustainX; New Hampshire	
CESA; Vermont	

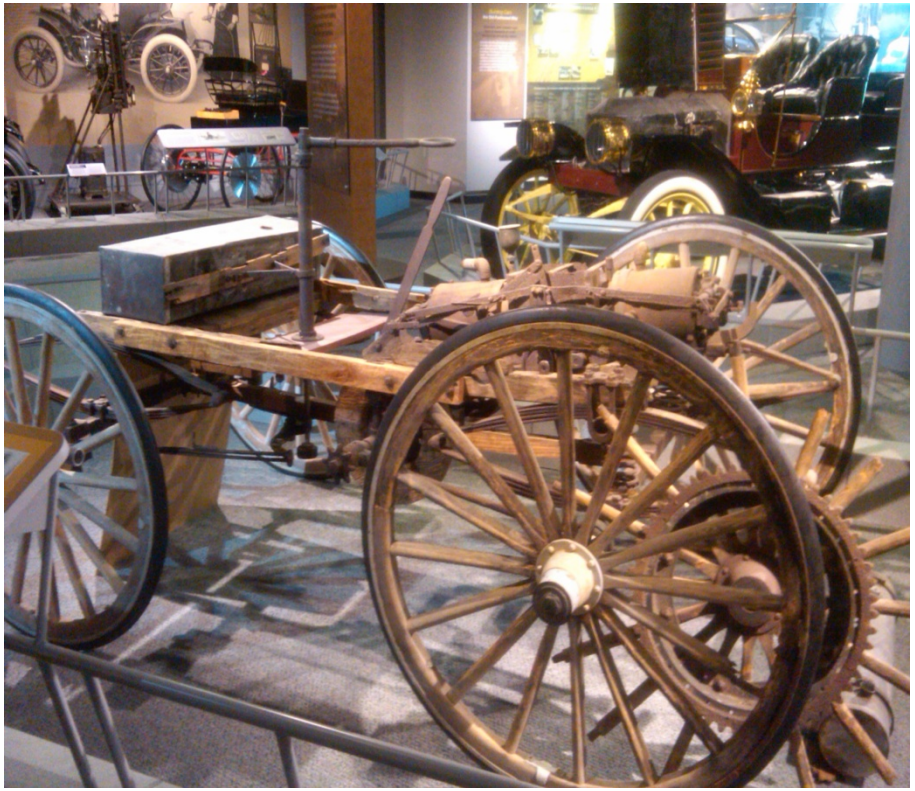
EES Emerging Technology Demonstrations Concluding Remarks

- There are different energy storage technologies that continue to advance. We continue to learn how to help those in the electric utility industry, academia, and research and development to **encourage investment**, overcome technical **challenges**, and provide the right skill mix in developing **energy storage** projects.
- Even after nearly two decades of demonstrations, the variety of projects in this overview are still needed to move new products to commercialization with important benefits such as:
  - **Independent third party**
    - Verification, testing and analysis
  - **Technology clearinghouse** for vendors, users, and industry of **emerging storage technologies**. An we **develop a confidence** in how to meet requirements for the new and **different services** that electrical energy **storage provides**.
- Demonstration projects require EES to **be forward thinking** and become engaged in establishing **industry standards and protocols** for new, innovative approaches to encourage the electric utility industry to improve, expand, and grow with changing customer needs.

Innovation

One of the first Gasoline power cars built ~1891 by Henry Nadig, Allentown, PA.

Courtesy of American Automobile Museum, Allentown, PA.



Courtesy of American Automobile Museum, Allentown, PA.

Quotes from the day in 1891*

- Blasted as a “dangerous device” – backfiring caused fires
- Car not allowed on the streets during the day as it “frightened” the horses
- Constable served notice and were liable for arrest for creating a “public nuisance”
- “Shouts of ‘get a horse’ were followed by ***Flying Cabbages*** thrown at the hapless Nadig”

* Whelan, Frank “Did Auto Age First Dawn in the Valley? Allentown Mechanic Built One of Country’s First Gas-powered Cars” Sept, 14, 1989 The Morning Call

Thank You and Once Again a Thank You to the OE and Especially Dr. Gyuk for his Dedication and Support to the ES Industry and Sandia's ES Program.

Questions?

Principal Investigator Contact Information:

Dan Borneo – drborne@sandia.gov