

# DOE-OE FY15 Industry Acceptance

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Sandia National Laboratories

DOE –OE

Peer Review

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# Industry Acceptance

## Presentation Outline

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- **Path Forward - Next Steps**
  - Demonstration and Analysis
  - Commissioning
  - Safety & Reliability

# Industry Acceptance Team

## ■ Sandia Team

- Jaci Hernandez
- Ben Schenkman
- Summer Ferreira
- Ray Byrne
- Georgianne Huff
- Ana-Marie Beare
- David Rosewater
- David Schoenwald
- Don Bender
- Lee Rashkin
- Cesar Silva-Munroy
- Lana Kimmel

## ■ Partners:

- Todd Olinsky-Paul (CESA)
- Elizabeth Endler (Shell)
- Ben Gully (DNV-GL)
- Rick Fioravanti (ICF)
- Bill Torre (UCSD)
- PNNL Team
- Jeff Hires (Pursuit Engr.)
- Mark Harral (Group Nire)
- HECO Team
- Laurence Sombardier (NELHA)
- Jeremy Lewis (EMNRD)
- Diane Broad (Oregon DOE)
- Josh Castonguay (GMP)
- Marc Mueller-Stoffels (UoA)
- Los Alamos County DPU

# Industry Acceptance Program Overview



## Mission Statement:

Encourage investment in Energy Storage by insuring systems are:

- Safe
- Reliable
- Cost effective
- Functional
- Understood by the public

# Industry Acceptance Program Overview

## Approach

- Work with National and International entities including DOD, State Energy offices, Utilities, ES Industry, Universities and Consumers to:
  - Provide **third party independent analysis and evaluation** for cells and systems
  - Support **grid-tied field demonstration** projects to monitor and analyze new and existing ES technologies in differing applications
  - Support State and International renewable/resiliency/ES initiatives
  - Develop public information programs

# Industry Acceptance Program Overview



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## Approach (continued)

### ■ **Third party independent analysis and evaluation**

1. Analyze and evaluate cells and systems for performance, safety and reliability
  - Innovative technologies – Aquion, Primus, UET, Transpower, EPC, Altairnano, Ceramatec, Gridtential
    - Testing protocol and specification development
    - Technical readiness level evaluation
    - System operational performance and **optimization**
    - **Safety** analysis and evaluation

# Industry Acceptance Program Overview



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## Approach (continued)

### ■ **Grid Tied Field Demonstrations**

#### 1. Analyze and evaluate systems

- Technical **consulting**, design support, **cost** and **optimization modeling**
  - Hawaiian Electric Company (HECO)
  - CEC ES 1.3 GW Initiative
  - University of California San Diego ES projects
  - Green Mountain Power
- Support the development of testing **protocols** and procedures
  - Measuring and evaluating the Performance of Energy Storage Systems
- Provide commissioning **support**
  - Primus Power, UniEnergy Technology, Green Mountain Power, UCSD
- **Monitor operational data, analyze, evaluate** and **disseminate** significant findings
  - UniEnergy, GMP/Dynapower, Enervault, DUKE Energy, Aquion

# Industry Acceptance Program Overview

## Approach (continued)

### ■ **State initiatives and Public education**

1. Through our Clean Energy States Alliance (CESA) partnership:
  - Provide Technical consulting to Various State Agencies
    - Connecticut DEEP; Innovate Massachusetts, New York, California, Hawaii, New Mexico
    - Market rules, Policy and system monetization
  - Develop projects, provide technical consulting and provide limited cost share to innovative technologies
    - Oregon Department of Energy
    - Hawaii Energy Office
    - Innovative technologies – Helix, Aquion, Ceramatech
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



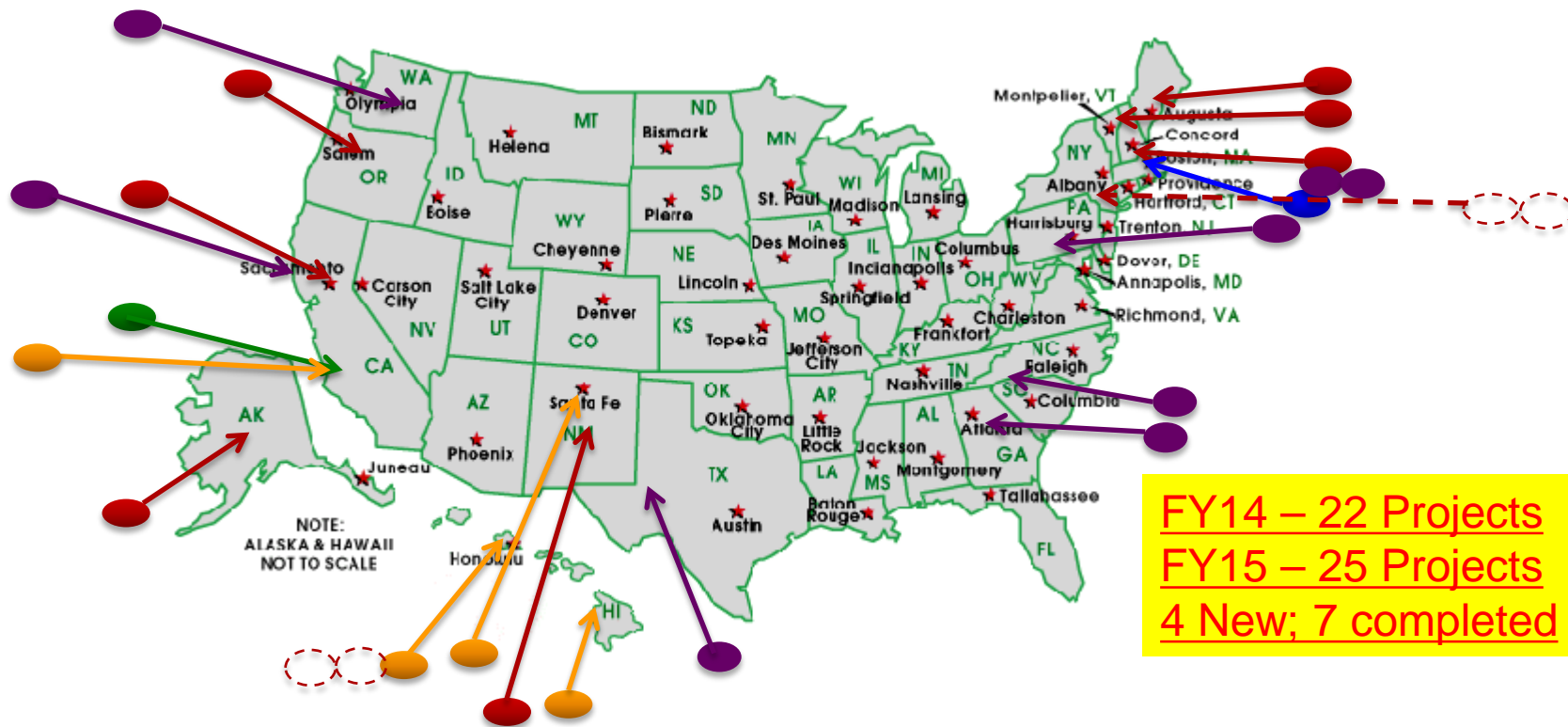
# Map of DOE-OE EES Projects 2015



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Legend:



State -6 (4)



DOD-1 (2)



Academia-1 (2)



Commercial End User- 4 (2)



Industry-8 (7)



New or Proposed-2 (2)

# IA - Summary of EES Projects

## FIELD DEMONSTRATIONS

<u>Location</u>	<u>Name</u>	<u>Technology</u>	<u>Environment/Application</u>	<u>Principal Investigators</u>
<b>Massachusetts</b>  <b>Completed</b>	Fort Devens Base Camp Integration Lab (BCIL)	30-75kW 0.5-1hr Lead Acid	Military Nanogrid – Forward Operating Base	Ben Schenkman David Rose
<b>California</b>  <b>Completed</b>	SunPower ES Installation	125kW 4hr Zinc Bromide	Commercial PV energy shifting Microgrid support	Matt Galland Ben Schenkman
<b>California</b>	University of California San Diego (UCSD) Energy Storage Initiative	2.5 MW 2hr	University campus microgrid with renewables	Ben Schenkman Bill Torre
<b>Hawaii</b>	NELHA	Aqueous sodium	PV support	Dan Borneo

# IA - Summary of EES Projects

## STATE INITIATIVES

<u>Location</u>	<u>Name</u>	<u>Technology</u>	<u>Environment/Application</u>	<u>Principal Investigator</u>
<b>Vermont</b>	Green Mountain Power	4MW with 1MWh Li-ion, and 2.4MWh LA	Utility/renewables	Jaci Hernandez
<b>Alaska</b>	Cordova Electric Co-op	Energy Storage	Utility/Grid	Ben Schenkman
<b>Connecticut</b>	Connecticut Deep	Multiple	Microgrid resiliency	Dan Borneo
<b>Massachusetts</b>	Clean Energy Center. Division of Energy Resources	various	DOER \$40M Grid Resiliency	Dan Borneo
<b>Oregon</b>	Oregon Dept. of Energy	TBD	Utility resiliency and upgrade deferral	Dan Borneo
<b>Washington</b>	Puget Sound Energy	1 MW 2 hr Zinc Bromine Flow	Utility grid Support	Ben Schenkman
<b>California</b>	CEC/CPUC		1.3 GW initiative	Ray Byrne
<b>New Mexico</b>	NM Department of Energy,	TBD	Renewable integration	Dan Borneo

# IA Summary of EES Projects



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## OPTIMIZATION, TESTING AND INDUSTRY SUPPORT

<u>Location</u>	<u>Name</u>	<u>Technology/Set-up</u>	<u>Environment/Application</u>	<u>Principal Investigators</u>
<b>South Carolina</b>	Duke Rankin site	FIAMM Sodium Nickel Chloride	Utility	David Schoenwald
<b>California</b>	Enervault	Iron Chrome Flow	Renewable support	Dan Borneo
<b>New Hampshire</b>	SustainX	ICAES	Industrial manufacturing facility grid	Summer Ferreira
<b>Pennsylvania</b>	Aquion Energy	Aqueous Sodium Ion	Industrial manufacturing	Summer Ferreira
<b>Massachusetts</b>	Helix	Flywheel	Frequency Response	Jaci Hernandez
<b>Georgia</b>	GS Yuasa	LA/Ruggedized ES mobile unit	Microgrid/Commercial Safety Testing	Ben Schenkman David Rose
<b>Texas</b>	Group Nire	1 MW 1hr Li-ion	Grid/Stabilization and arbitrage	Ben Schenkman
<b>Hawaii</b>	Hawaiian Electric Company	60-200 MW ES	Utility Renewable Support	Dan Borneo Ray Byrne
<b>New Mexico</b>	Los Alamos County	1.8 MW/8.3 MWh ES	Utility Grid optimization with PV	Lee Rashkin

Completed — SAND Report Issued

Completed

Completed

Cell Test Completed — System demonstration at HELCO

Completed — GS Rescu Unit commercially available

# Industry Acceptance New Projects



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## OPTIMIZATION, TESTING AND INDUSTRY SUPPORT

<u>Location</u>	<u>Name</u>	<u>Technology/Set-up</u>	<u>Environment/Application</u>	<u>Principal Investigators</u>
Hawaii	Ikehu Molokai Energy Storage Project	TBD	Renewable support	TBD
Hawaii	Kaimuki Middle School Microgrid Project	TBD	Microgrid	TBD
New York	NYSERDA	TBD	\$40M New York Prize - Grid Resiliency	TBD
New Jersey	Board of Public Utilities	TBD	\$10M ES for critical infrastructure \$200M NG Energy Resilient Bank	TBD



# Dan takes up fishing



# IA Team - FY15 Accomplishments



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- In-house cell to system testing
  - Analysis of three ES systems at ESTP
  - Testing of cells for three battery vendors
- Deployment - Construction/Commissioning
  - Construction of 2MW 2.5hr Li-ion ESS at UCSD
  - Commissioning of GMP's 4 MW 3.4 MWh ESS
  - Installation and commissioning of Aquion 10 KW system at NELHA
- Industry and Project Collaborations
  - Technical support to HECO on their 150MW ES initiative
  - RFP for an ES project with Oregon Dept. of Energy
  - Wind Energy Institution of Canada (WEIC)
  - Developed and delivered ES workshop for the Energy Market Authority of Singapore
  - Initiated projects with the Hawaii Department of Energy
- System Analysis
  - First phase testing of 1M - 1MWh Li-ion system at Reese test facility at TTU.
  - Third part witness testing of UET's 1MW - 4hrVanadium redox flow battery
  - Evaluation of Flywheel mishap in Poway, Ca.
  - Analysis using ES to defer diesel generator in military app.
  - Analysis of Flow battery operation at UCSD
  - Modeling for Ca. grid optimization
  - Los Alamos County Dept. of public service ES optimization
- Community Outreach
  - In partnership with CESA18 ES related webinars with 3280 attendees
  - Initiated update to ES Handbook
- Papers
  - SAND "Third Party Witness Test of UniEnergy 1MW / 3.2MWh Uni System"
  - Four Journal articles in review

**NOTE:**  
**Details in**  
**various team**  
**presentations**

## *Lessons Learned*

- A better understanding of optimization and how to use one ES System for multiple applications.
- Still not certain of capacity fade and lifetime reliability
- ES as a UPS+ other apps may justify capital expenditure
- Possibilities exist to decrease generator run-time using ES
- When depth of discharge and rate varies, ESS round trip efficiency decreases, e.g., frequency regulation vs. arbitrage



# IA Team *Path Forward*

- **Provide support to Nation in the development, design, installation, commissioning,** and operation of ES systems:
  - Cell and system testing
    - Cell and system performance and safety analysis
    - Increase awareness of SNL's onsite testing capabilities
    - Advertise SNL's at location testing capabilities
  - Analysis
    - Optimization modeling
    - Project operational analysis and evaluation support
  - Deployment - Construction/Commissioning
    - Commissioning documentation and Increase field Commissioning endeavours
    - Support the development of codes, standards, regulations, and safety roadmap
    - Initiate another ES project with a State energy department.
    - Increase exposure to the international community
    - Continue support of ongoing projects – CEC, HECO, VT, OR, etc.
    - Continue partnership efforts with the industry - Innovative technologies, DNV-GL, etc.
    - Continue ES education efforts and webinar series



For more information, visit the website at:  
[www.sandia.gov/batterytesting](http://www.sandia.gov/batterytesting)

### The 2016 Winter Call for proposals Will open end of September.

Application Deadline: January 15, 2016.  
Notifications will be sent out February 2015.

The 5<sup>th</sup> Proposal Call is for testing:  
January 16, 2016 - July 15, 2016.

The database is always open for [FAST-Track Proposals](#).

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Questions?

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**Thank You!**