State & Federal Energy Storage Technology Advancement Partnership (ESTAP)

Todd Olinsky-Paul
Clean Energy States Alliance
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● This webinar is being recorded and will be made available after the event on the CESA website at

www.cleanenergystates.org/events/
Thank You:

Dr. Imre Gyuk
U.S. Department of Energy,
Office of Electricity Delivery and
Energy Reliability

Dan Borneo
Sandia National Laboratories
ESTAP is a project of CESA

Clean Energy States Alliance (CESA) is a non-profit organization providing a forum for states to work together to implement effective clean energy policies & programs:

- Information Exchange
- Partnership Development
- Joint Projects (National RPS Collaborative, Interstate Turbine Advisory Council)
- Clean Energy Program Design & Evaluations
- Analysis and Reports

CESA is supported by a coalition of states and public utilities representing the leading U.S. public clean energy programs.
ESTAP* Overview

**Purpose:** Create new DOE-state energy storage partnerships and advance energy storage, with technical assistance from Sandia National Laboratories

**Focus:** Distributed electrical energy storage technologies

**Outcome:** Near-term and ongoing project deployments across the U.S. with co-funding from states, project partners, and DOE

* (Energy Storage Technology Advancement Partnership)
ESTAP Key Activities

• Disseminate information to stakeholders
  • ESTAP listserv >500 members
  • Webinars, conferences, information updates, surveys

• Facilitate public/private partnerships at state level to support energy storage demonstration project development
  • Match bench-tested energy storage technologies with state hosts for demonstration project deployment
  • DOE/Sandia provide $ for generic engineering, monitoring and assessment
  • Cost share $ from states, utilities, foundations, other stakeholders
Contact Information

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Report is available on the DOE Energy Storage Program Website at sandia.gov/ess

www.cleanenergystates.org/events
Today’s Speakers

Dan Borneo, Sandia National Laboratories

Imre Gyuk, U.S. Department of Energy, Office of Electricity Delivery and Energy Reliability

Verne Loose, Sandia National Laboratories

Dhruv Bhatnagar, Sandia National Laboratories

www.cleanenergystates.org/events/
The Co-Evolution of Research, Deployment, and Regulatory Structure

IMRE GYUK, PROGRAM MANAGER
ENERGY STORAGE RESEARCH, DOE

ESTAP 04-24-2013
The Federal Role

- Grants
- Cost shared Projects
- Loan Guarantees
- Mandates (FERC Order 755, AB2514)
- Tax Incentives (S3617)
- Venture Capital
- Research
- Development
- Demonstration
- Niche Market
- Mass Market
Policy Decisions are as important as Technological Progress!

FERC 755: Pay for Performance
California AB2514: PUC to Develop Targets
PUC Order: Deploy 50MW Storage!

Regulatory Policy is evolving along with Technology and Deployment
Concept: Frequency Regulation by fast Storage

- CEC/DOE: 100kW Beacon Flywheel Demo
- DOE ARRA: 20MW Beacon Installation
- AES: 32 MW Commercial
- FERC 890: Pay for Performance
DOE ARRA: 36MW / 40 min battery plant 
Notrees, TX, Duke Energy / Xtreme Power 

Ribbon Cutting 
March 28, 2013 

► ERCOT: Pay for Performance?

Clean Energy States Alliance| ESTAP | April 24, 2013
Electric Power Systems Research Group
Dhruv Bhatnagar
Verne Loose
Purpose

- Developing a guidebook:
  - Inform regulators about the system benefits of energy storage
  - Identify regulatory challenges to increased deployment
  - Suggest responses & solutions to challenges
  - Identify energy storage valuation principles
  - Provide sample economic evaluations for regulatory commission submissions

Promoting informed and impartial analysis of competing technologies is the mechanism to develop a robust and efficient future U.S. electric system.
Process

- Advisory Committee
  - Mr. Joseph Desmond, BrightSource Energy
  - Ms. Eva Gardow, FirstEnergy
  - Dr. Ali Nourai, DNV-KEMA
  - Dr. J. Arnold Quinn, FERC
  - Mr. Benjamin Rogers, Grid Storage Technologies
  - Mr. Carl Weinberg, Weinberg Associates

- Extensive literature searches
  - 48 State Utility Commission Dockets
Process, Continued

- Discussions with regulatory commissioners and their staff
  - Illinois, New Jersey, Arizona, California (CAPUC & CEC), New Mexico, Texas
- Discussions with utilities
  - SCE, PNM, FirstEnergy, Duke Energy
- Discussions with industry experts, consultants, academics, DOE, EPRI, NRRI
- Participated in NRRI and CESA webinars

Draft guidebook
The Guidebook

1. Energy Storage Defined
   - Sources, technologies, functional uses, factors affecting demand & the future grid

2. Review of PUC Hearings
   - Challenges, regulatory responses to these challenges

3. A Framework for Evaluating the Services of Energy Storage

4. Evaluation Case Studies
   - Renewable energy time-shifting and firming
   - Distributed generation smoothing and integration
Evaluated Proceedings

California

- **Case:** California Rule Making for Energy Storage *AB2514*
- **Summary:** A rulemaking in response to the enactment of legislation *AB2514*. The legislation directs the CA PUC to open a proceeding to determine appropriate targets to procure viable and cost-effective energy storage systems and, by October 1, 2013, to adopt an energy storage system procurement target, if determined to be appropriate.
- **Case Status:** *In Progress*
Evaluated Proceedings

California

- **Case:** Southern California Edison Tehachapi Wind Storage Project *as part of California’s Smart Grid Rule Making Process*
  - **Applicant:** Southern California Edison (SCE)
  - **Case Status:** Approved: July 2010
  - **Project Status:** *Projected to be in operation by late 2013*

- **Case:** Compressed Air Energy Storage Proposal
  - **Applicant:** Pacific Gas & Electric (PG&E)
  - **Case Status:** Approved: January 2010
  - **Project Status:** *In the planning and design phase*
Texas

- **Case:** Presidio, TX Sodium Sulfur Battery
- **Applicant:** Electric Transmission Texas (ETT)
- **Summary:** A case filed for regulatory approval and transmission cost of service recovery for the installation of a Sodium Sulfur Battery System (4.8 MW) in Presidio, TX.
- **Case Status:** Approved April 2009
- **Project Status:** *In Operation as of April 2010*
Evaluated Proceedings

New Jersey

- **Case:** Proposal for Four Small Scale/Pilot Demand Response Programs: Energy Storage Program
- **Applicant:** Jersey Central Power & Light Company
- **Summary:** JCP&L seeks Commission approval to obtain 3 MW of demand response through an electricity storage program consisting of the deployment of three large battery systems at substations as well as customer-located electricity storage systems.
- **Case Status:** Withdrawn
The Analysis Process

For a specific deployment:

1. Identify the problem
2. Determine the technologies that can address the problem
3. Conduct a generic technical evaluation of these technologies
4. Perform B/C analysis to down select choices

- a. System specific modeling (internal modeling processes, Sandia Optimization tool, ESVT)
- b. Production cost modeling
- c. Power flow modeling
- d. Long term planning models

Perform Detailed Analysis
## Functional Uses & their Evaluation

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<th>Functional Use</th>
<th>Value Metric</th>
<th>Possible Analysis Approaches</th>
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<td><strong>Energy</strong></td>
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<tr>
<td>1 Electric Energy Time-Shift</td>
<td>The price differential between off-peak and on-peak prices minus any</td>
<td>Production cost modeling; Sandia optimization tool; ESVT</td>
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<td></td>
<td>efficiency losses associated with the charging process.</td>
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<tr>
<td>2 Electric Supply Capacity</td>
<td>The avoided cost of new generation capacity (procurement or build capital</td>
<td>Long term planning models</td>
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<tr>
<td></td>
<td>cost) to meet requirements.</td>
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<tr>
<td>3 Transmission Upgrade Deferral</td>
<td>The avoided cost of deferred infrastructure to address the issue.</td>
<td>Long term planning models</td>
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<tr>
<td>4 Distribution Upgrade Deferral</td>
<td>The avoided cost of deferred infrastructure to address the issue.</td>
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<td>5 Transmission Voltage Support</td>
<td>The avoided cost of procuring voltage support services through other</td>
<td>Power flow modeling</td>
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<td>Power flow modeling</td>
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<tr>
<td>7 Synchronous Reserve</td>
<td>Regulated Env: the avoided cost of procuring reserve service through other</td>
<td>Production cost modeling</td>
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<td>means. Market Env: the market price for synchronous reserve.</td>
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<td>8 Non-Synchronous Reserve</td>
<td>Regulated En: the avoided cost of procuring reserve service through other</td>
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<td>means. Market Env: the market price for non-synchronous reserve.</td>
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<tr>
<td>9 Frequency Regulation</td>
<td>Regulated env: the avoided cost of procuring service through other means.</td>
<td>Production cost modeling</td>
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<td>Market env: the market price for frequency regulation service.</td>
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<td>10 Power Reliability</td>
<td>The avoided cost of new resources to meet reliability requirements.</td>
<td>Distribution modeling: power flow</td>
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<tr>
<td>11 Power Quality</td>
<td>The avoided cost of new resources to meet power quality requirements,</td>
<td>Distribution modeling: power flow</td>
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<td></td>
<td>or avoided penalties if requirements not being met.</td>
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<tr>
<td>12 Retail TOU Energy Time Shift</td>
<td>The price differential between low TOU and high TOU prices.</td>
<td>Simple internal models; Sandia optimization tool; ESVT</td>
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<tr>
<td>13 Demand Charge Management</td>
<td>The avoided cost of demand charges.</td>
<td>Simple internal models; Sandia optimization tool; ESVT</td>
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*Functional uses and value metrics jointly developed with EPRI & ESA*
Results of this Work: Lessons Learned and Conclusions

- Limited operational experience leads to uncertainty regarding the ability of energy storage to provide service economically
  - Deployments and performance standard development are often issues cited that would increase regulator (and utility) comfort

- Challenges to quantifying value leads to difficulty in proving cost-effectiveness
  - The value of an energy storage system is governed by the cost of the next best alternative means of providing the regulated service(s)
  - In market areas, opening market access for energy storage to deliver market and regulated service may be key to proving cost-effectiveness
Results of this Work: Lessons Learned and Conclusions

- Operational, definition and classification issues: energy storage defies classification as a generation, transmission or distribution asset
  - These can be clarified by viewing EES systems from the view of the services they perform rather than their inherent engineering characteristics

- The regulatory environment may make it difficult for utilities to propose energy storage systems
  - Regulatory commissions may need to work with utilities to facilitate deployment
  - Third party developer owned energy storage may be a mechanism towards addressing this difficulty

- Mandates and incentives might encourage more deployment but interrupt the process of market valuation of the technologies.
  - Phase-in tariffs or other incentives might provide the necessary financial boost to induce utilities to invest in EES in the absence of carbon pricing.
Q&A

- Questions?
Contact Information

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- Report is available on the DOE Energy Storage Program Website at sandia.gov/ess