State & Federal Energy Storage Technology Advancement Partnership (ESTAP)

Todd Olinsky-Paul

Clean Energy States Alliance

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Sandia National Laboratories

U.S. DEPARTMENT OF ENERGY

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Thank You:

Dr. Imre Gyuk
U.S. Department of Energy,
Office of Electricity Delivery and
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Dan Borneo
Sandia National Laboratories

CleanEnergy States Alliance

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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.

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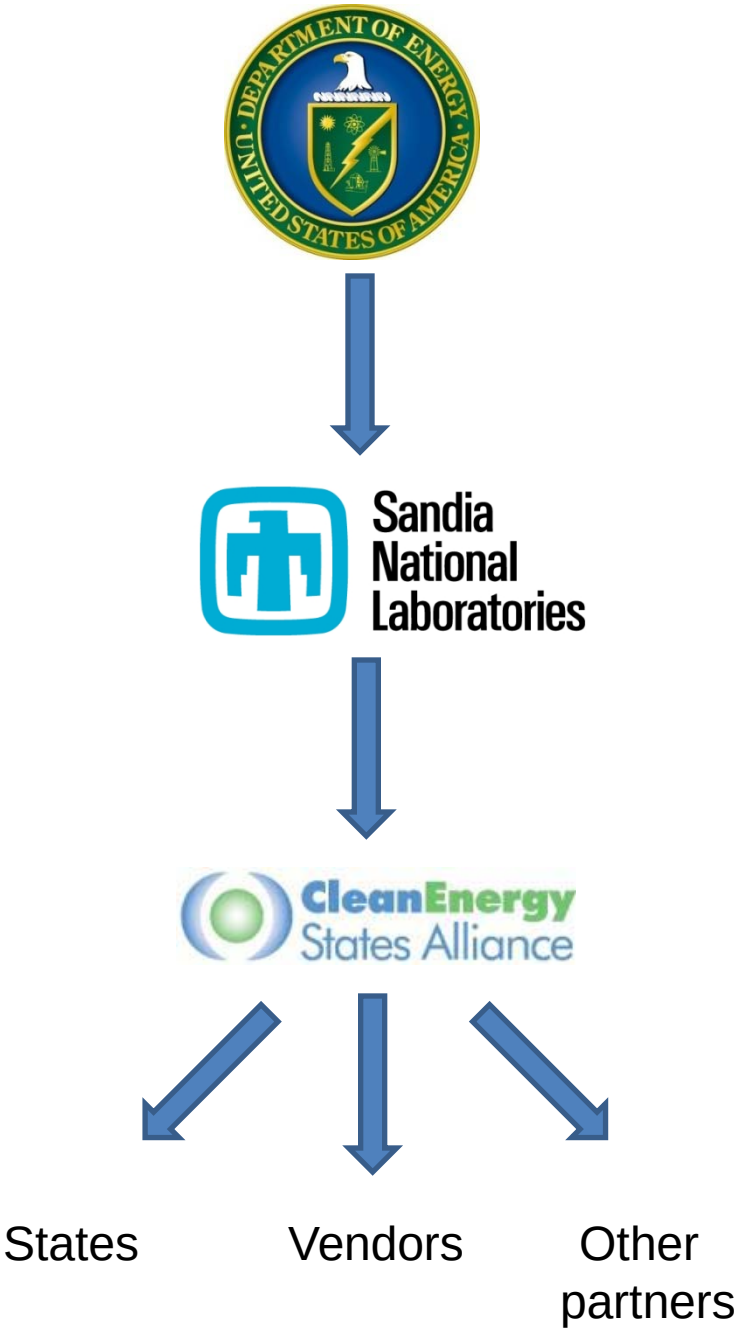
ESTAP* Overview

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

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

www.cleanenergystates.org/events

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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

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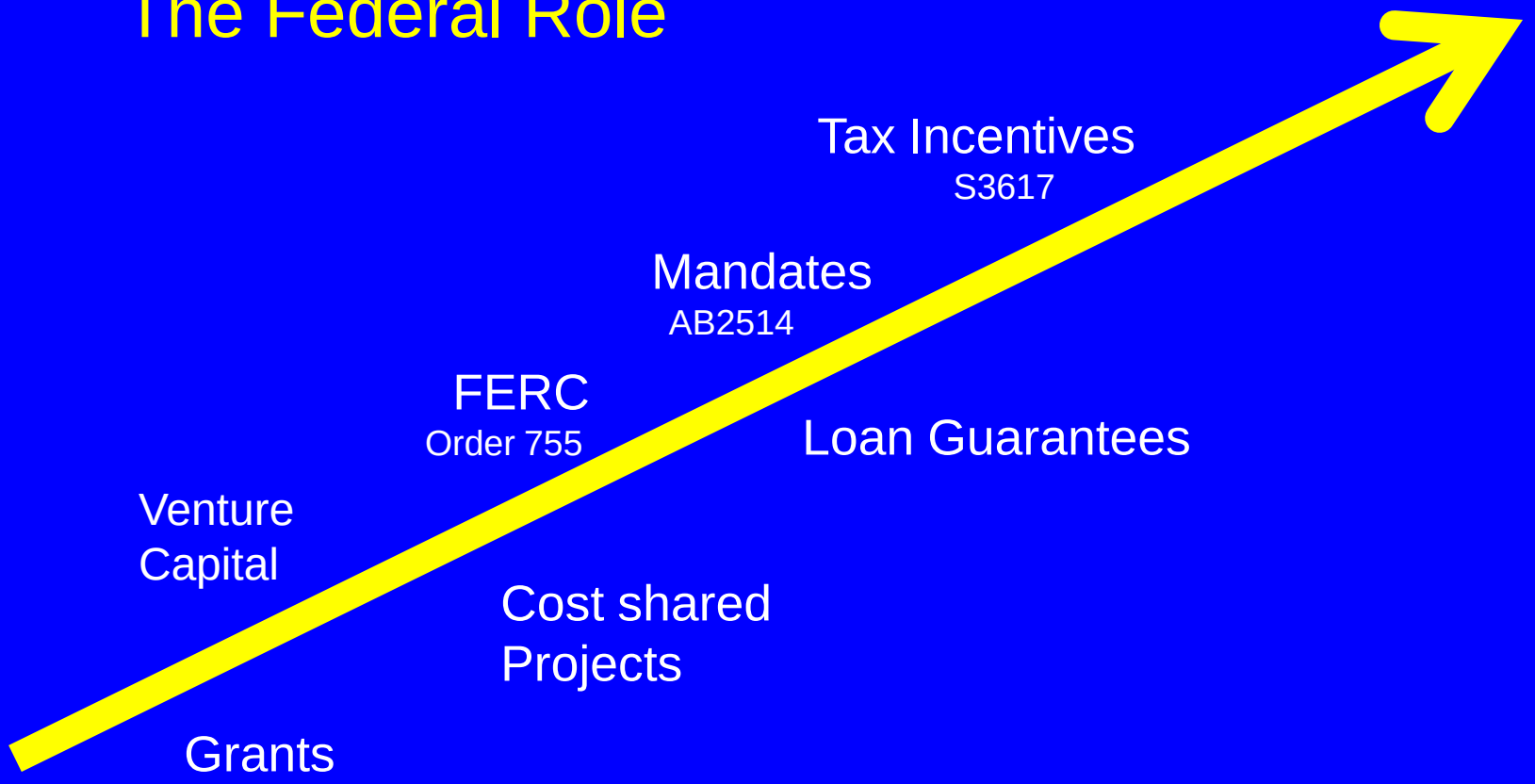
The Co-Evolution of Research, Deployment, and Regulatory Structure

IMRE GYUK, PROGRAM MANAGER
ENERGY STORAGE RESEARCH, DOE

ESTAP 04– 24- 2013

The Federal Role



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 ?

Exceptional service in the national interest

Sandia National Laboratories



Evaluating Utility Procured Electric Energy Storage Systems: A Perspective for State Electric Utility Regulators

Clean Energy States Alliance| ESTAP | April 24, 2013

Electric Power Systems Research Group

Dhruv Bhatnagar

Verne Loose

U.S. DEPARTMENT OF ENERGY

NNSA National Nuclear Security Administration

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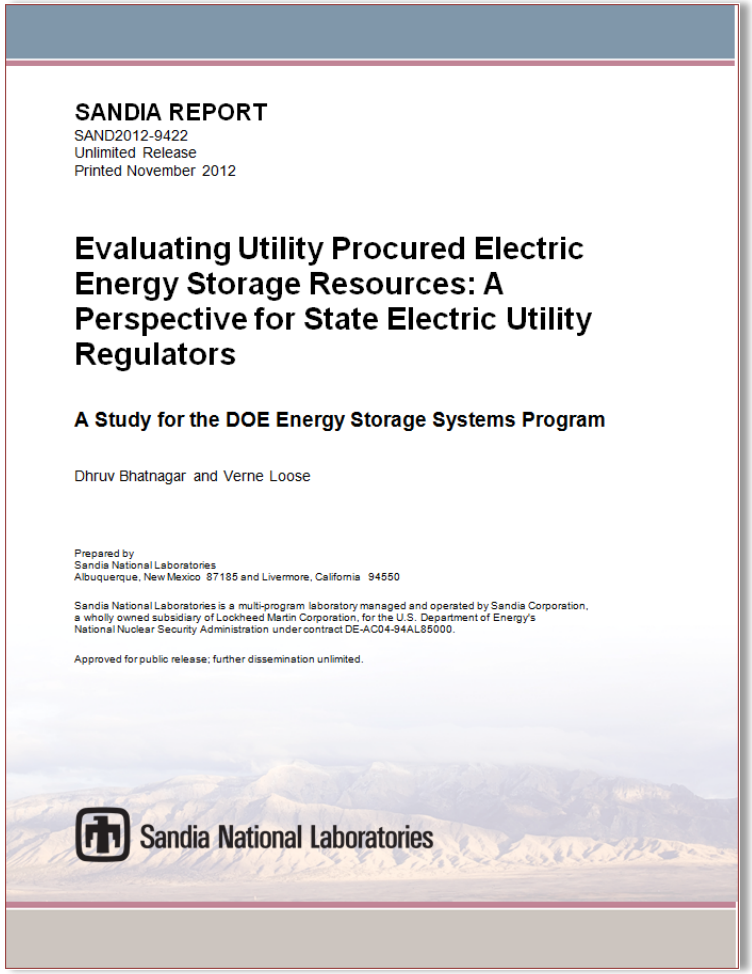
Purpose

- 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



SANDIA REPORT
SAND2012-9422
Unlimited Release
Printed November 2012

Evaluating Utility Procured Electric Energy Storage Resources: A Perspective for State Electric Utility Regulators

A Study for the DOE Energy Storage Systems Program

Dhruv Bhatnagar and Verne Loose

Prepared by
Sandia National Laboratories
Albuquerque, New Mexico 87185 and Livermore, California 94550

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Approved for public release; further dissemination unlimited.

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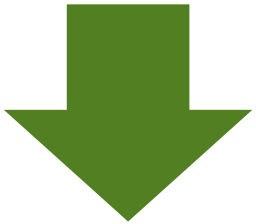
Promoting informed and impartial analysis of competing technologies is the mechanism to develop a robust and efficient future U.S. electric system.

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

Sandia National Laboratories

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*

Evaluated Proceedings

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*

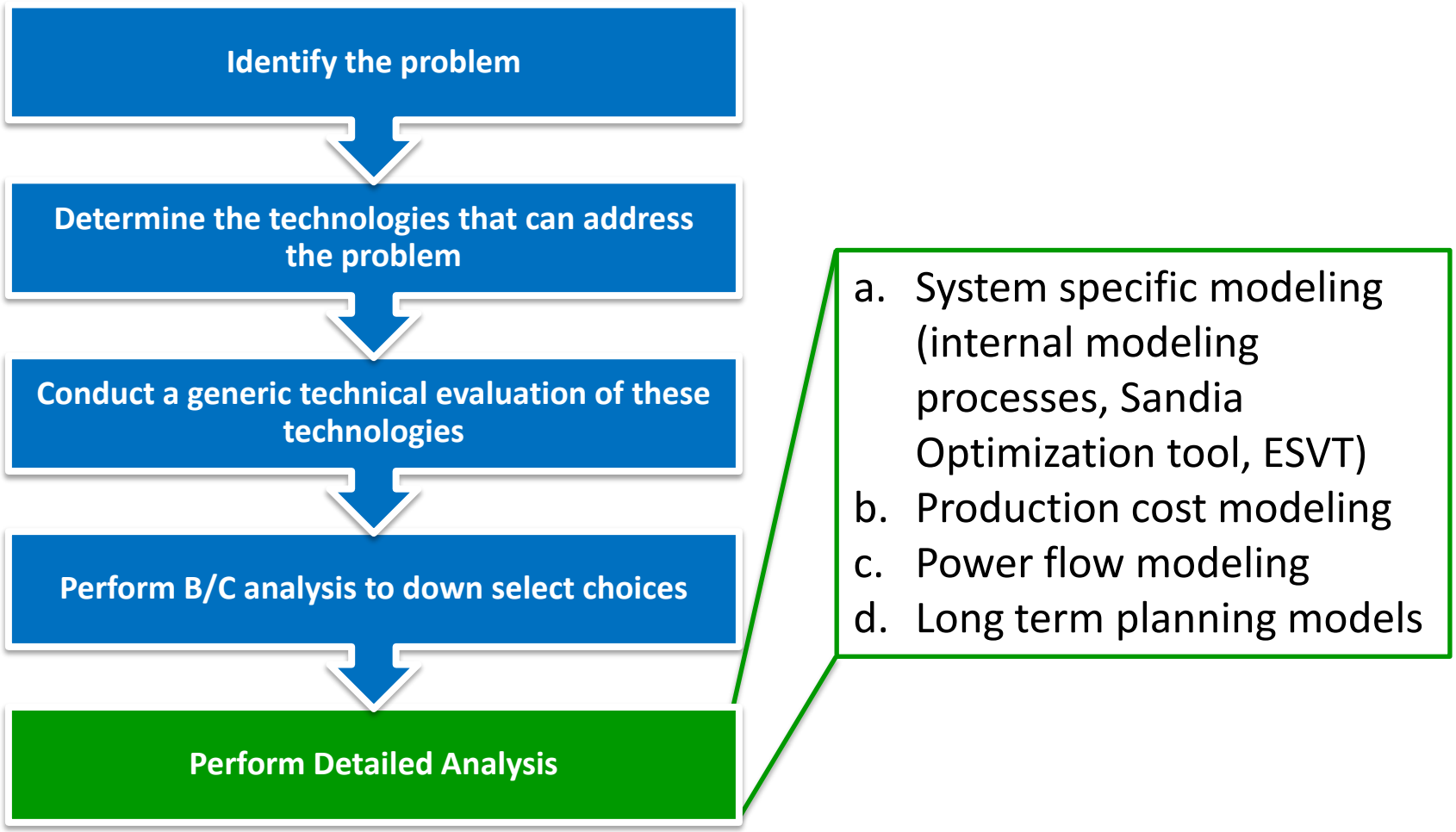
Evaluated Proceedings

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:



Functional Uses & their Evaluation

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

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