


State Electricity Storage Policies

ESTAP Webinar

Hosted by Clean Energy States Alliance

July 12, 2012

Clean Energy States Alliance

Housekeeping

- All participants will be in listen-only mode throughout the broadcast.
- You can connect to the audio portion of the webinar using your computer's speakers or a headset. You can also connect by telephone.
- You can enter your questions by typing them into the "Question Box" on the webinar console. We will ask your questions, as time allows, following the presentations.
- This webinar is being recorded and will be made available after the call on the CESA website at:

  www.cleanenergystates.org/projects/energy-storage-technology-advancement-partnership/

CleanEnergy States Alliance

DOE-CESA Energy Storage Technology Advancement Partnership (ESTAP)

Purpose: Create new DOE-state energy storage partnerships and advance energy storage

Focus: Distributed electrical energy storage technologies (batteries, flywheels, supercapacitors, site-anywhere compressed air, micro pumped hydro)

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

Activities:

- State and stakeholder listservs (ongoing)
- Surveys and interviews (ongoing)
- Webinars

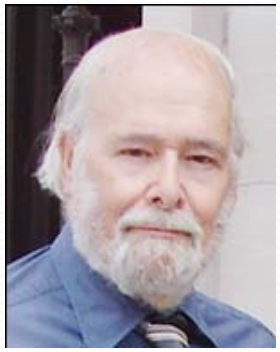
http://www.cleanenergystates.org/projects/energy-storage-technology-advancement-partnership/

Todd Olinsky-Paul, Project Director (Todd@cleanegroup.org)

CleanEnergy States Alliance

Today's Webinar:

Presenter: **DR. IMRE GYUK, Manager, DOE Energy Storage Systems Program, Office of Electricity Delivery and Energy Reliability**



Guest Speakers:

SHERIDAN J. PAUKER
Associate, Wilson Sonsini Goodrich & Rosati

DAVID M. NEMTZOW
Principal, Nemtzow & Associates
Senior Advisor, California Energy Storage Alliance (CESA)

JEANNE FOX
Commissioner, New Jersey Board of Public Utilities

CleanEnergy States Alliance

QUESTIONS?

Please enter your question in the Question Box on the webinar panel.

Contact Information

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Grid Energy Storage State Initiative

IMRE GYUK, PROGRAM MANAGER
ENERGY STORAGE RESEARCH, DOE

The Idea of a State Initiative Arose from the Success of ARRA

ARRA Projects and the new storage technologies becoming available, have created considerable interest among utilities, renewable developers and other potential Users.

DOE: $185M Cost Share: $585M

This Initiative intended to create Federal-State Partnerships to facilitate medium scale pioneering Field Tests of new Storage Technologies.

Projects were intended to allow potential users to become familiar with new technologies without the risks involved in large scale applications.

The aim was to create a close collaboration between project owners, the States, brokered by CESA, expertise in project management and storage testing by Sandia, and Federal Funding.

Unfortunately this model was not compatible with DOE procurement policy, as well as decreased FY13 funding,

We apologize deeply.

- Many good proposals have been received
- New technologies and new applications were proposed
- Sandia's 1MW test bed will evaluating some of these technologies
- We will be exploring new mechanisms for funding small projects.
-

Energy Storage is becoming a Reality!

Some Large Storage Projects

27MW / 7MWh	1995	Fairbanks, AL
34MW / 245MWh	2008	Rokkasho. Japan
20MW / 5MWh	2011	Stephentown, NY
32MW / 8MWh	2011	Laurel Mountain, WV
14MW / 63 MWh	2011	Hebei, China
8MW / 32MWh	2012	Tehachapi, CA
25MW / 75MWh	2013	Modesto, CA

Worldwide (CNESA)

2011 May	370MW
2011 Aug.	455MW
2011 Nov.	545MW
2012 Feb.	580MW
2012 Apr.	590MW
2012 June	605 MW

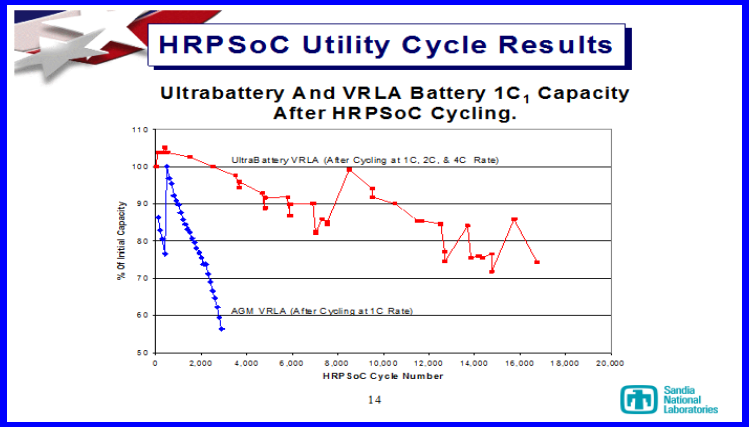
Beacon Flywheels

AES / A123 - Laurel Mountain

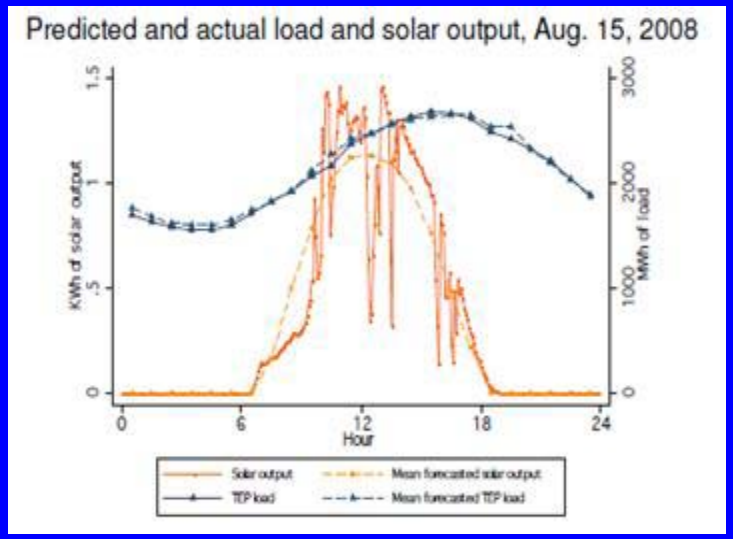
SoCal Edison / A123

ARRA – Public Service NM:

500kW, 2.5MWh for smoothing of 500kW PV installation; Using EastPenn Lead-Carbon Technology



PbC Testing at Sandia



Load & PV Output in Tucson, AZ

Commissioned Sep. 24, 2011 Integrator: Ecoult

ARRA – EastPenn, PA:

3MW Frequency Reg for PJM
1MW 1-4hrs Load Management
during Peak Periods

Commissioning June 15, 2012 Integrator: Ecoult

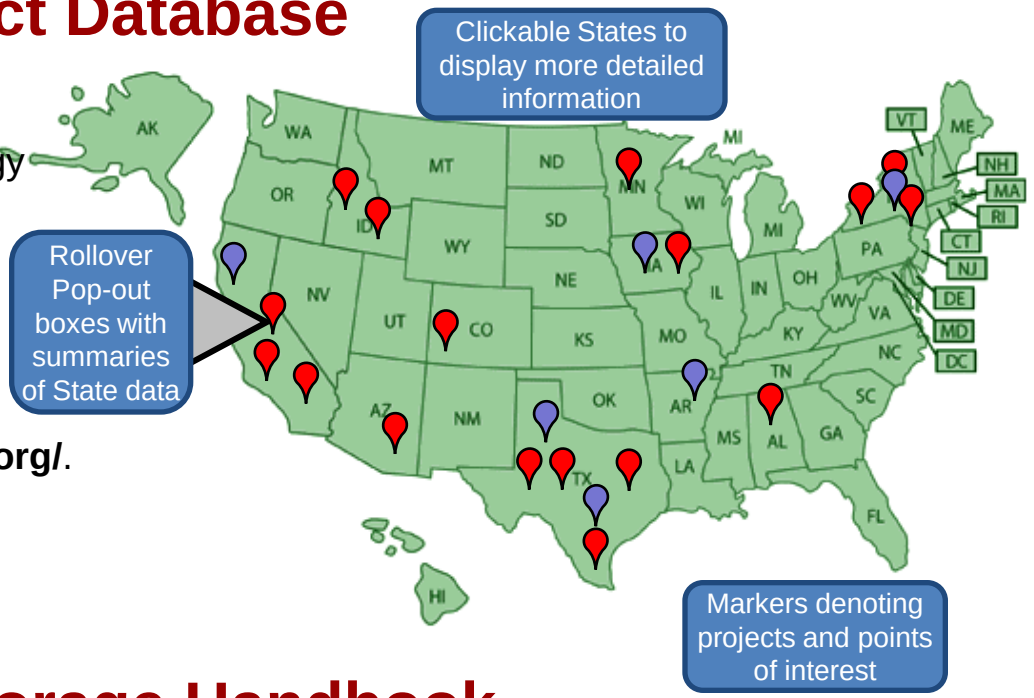
System is on line and drawing revenue!

S. Miksiewicz, CEO

Energy Storage Project Database

A publicly accessible database of energy storage projects world-wide, as well as state and federal legislation/policies

http://www.energystorageexchange.org/.



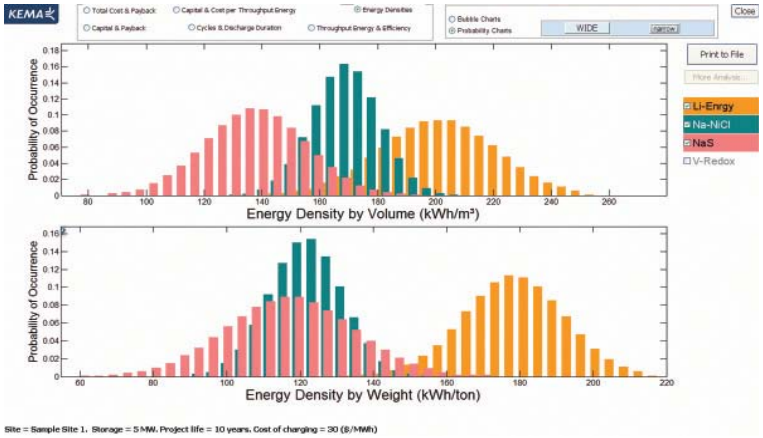
DOE/EPRI Energy Storage Handbook

Partnership with EPRI and NRECA to develop a definitive energy storage handbook:

- Details the current state of commercially available energy storage technologies.
- Matches applications to technologies
- Info on sizing, siting, interconnecting
- Includes a cost database

ES-Select: Energy Storage Selection Tool

- A tool for high-level decision makers to facilitate planning for ESS infrastructure:
  - High-level technical and economic review of storage technologies
  - Determine and size applicable energy storage resources
  - Develop a preliminary business case
- Educate potential owners, electric system stakeholders and the general public on energy storage technologies
- Developed by KEMA
- **http://www.sandia.gov/ess/esselect.html**



Storage Guidebook for Regulatory Officials

- Inform regulators about Storage benefits
- Provide information on technical aspects of Energy Storage Systems
- Identify regulatory challenges to increased Storage System deployment
- Suggest possible responses/solutions to challenges
- Develop model PUC submissions requesting approval of rate base addition
- Advisory Committee comprised of industry and government experts

Development of a Protocol to Measure and Report Performance of Energy Storage technology

- We need a common language for technology providers and prospective users
- No uniform acceptable criteria exist for comparable statements of performance
- This causes confusion in the market and adversely affects technology acceptance
- DOE is leading an effort to develop an initial protocol (pre-standard)
  - Formation of representative stakeholder group
  - Clarification of anticipated application and use of the protocol by industry
  - Develop a pre-standard with reasonable consensus
  - Ongoing support as technology evolves

Collaboration with Clean Energy States Alliance

- Webinar Series on Policy Issues related to Energy Storage
- Provide information on technical aspects of Energy Storage Systems
- Identify regulatory challenges to increased Storage System deployment
- Suggest possible responses/solutions to challenges
- Develop model PUC submissions requesting approval of rate base addition
- Advisory Committee comprised of industry and government experts

Sheridan Pauker

Associate, Wilson, Sonsini, Goodrich & Rosati

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New Jersey, Board of Public Utilities

Clean Energy States Alliance
Energy Storage Technology Advancement Partnership (ESTAP) Webinar:
State Electricity Storage Policies

July 12, 2012

Speaker:
Sheridan Pauker
Energy and Clean Technology Group

Wilson Sonsini Goodrich & Rosati
PROFESSIONAL CORPORATION

Wilson Sonsini Goodrich & Rosati

- Advise more than 300 public and 3,000 private enterprises
- Advise more U.S. companies on their **initial public offerings** than any other law firm (*IPO Vital Signs*), including:

Google TESLA MOTORS NETFLIX LinkedIn Sun microsystems Netscape

- Represent more companies that receive **venture financing** than any other law firm (*Dow Jones VentureSource*)
- Represent more technology companies in **M&A transactions** than any other U.S. law firm, including:

McAfee Genentech TOTAL ELECTRONIC ARTS Adobe Seagate

On the Forefront of Energy & Clean Technology

Energy & Clean Technology Practice

- Represent more than 400 energy and clean technology clients across a broad range of industries
- Built on our leadership in venture capital, project development, project finance, energy regulatory, government initiatives and intellectual property
- Focused on enterprises that create, commercialize and use emerging energy technologies and on the institutions that finance them.

Energy Storage Expertise

Select Energy Storage Clients:

Leyden energy

stem

valence

amprius

QuantumScape™

Nexant

eos
Powering the Dawn of Energy Storage

ACTIVEPOWER

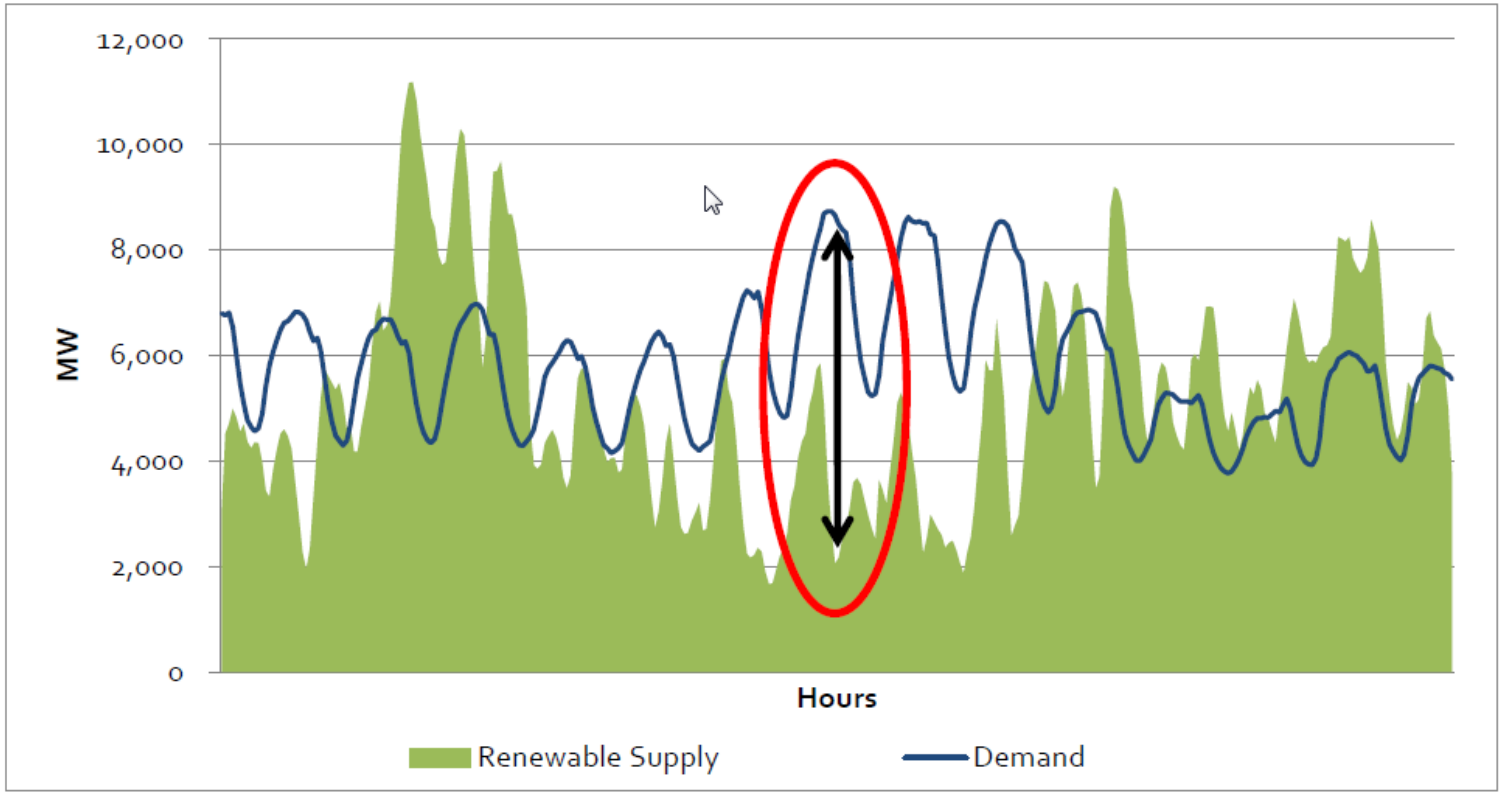
Select Energy Storage Transactions:

Leyden energy **Series B Financing** August 3, 2011	amprius **Series B Financing** March 4, 2011
stem Corporate finance, project development, licensing, and patent representation	AES Energy Storage Represented on two US Department of Energy smart-grid program applications
SEEO Corporate finance, project development, licensing, and patent representation	EIG Energy Innovation Group Represented in US Department of Energy loan application.

Outline

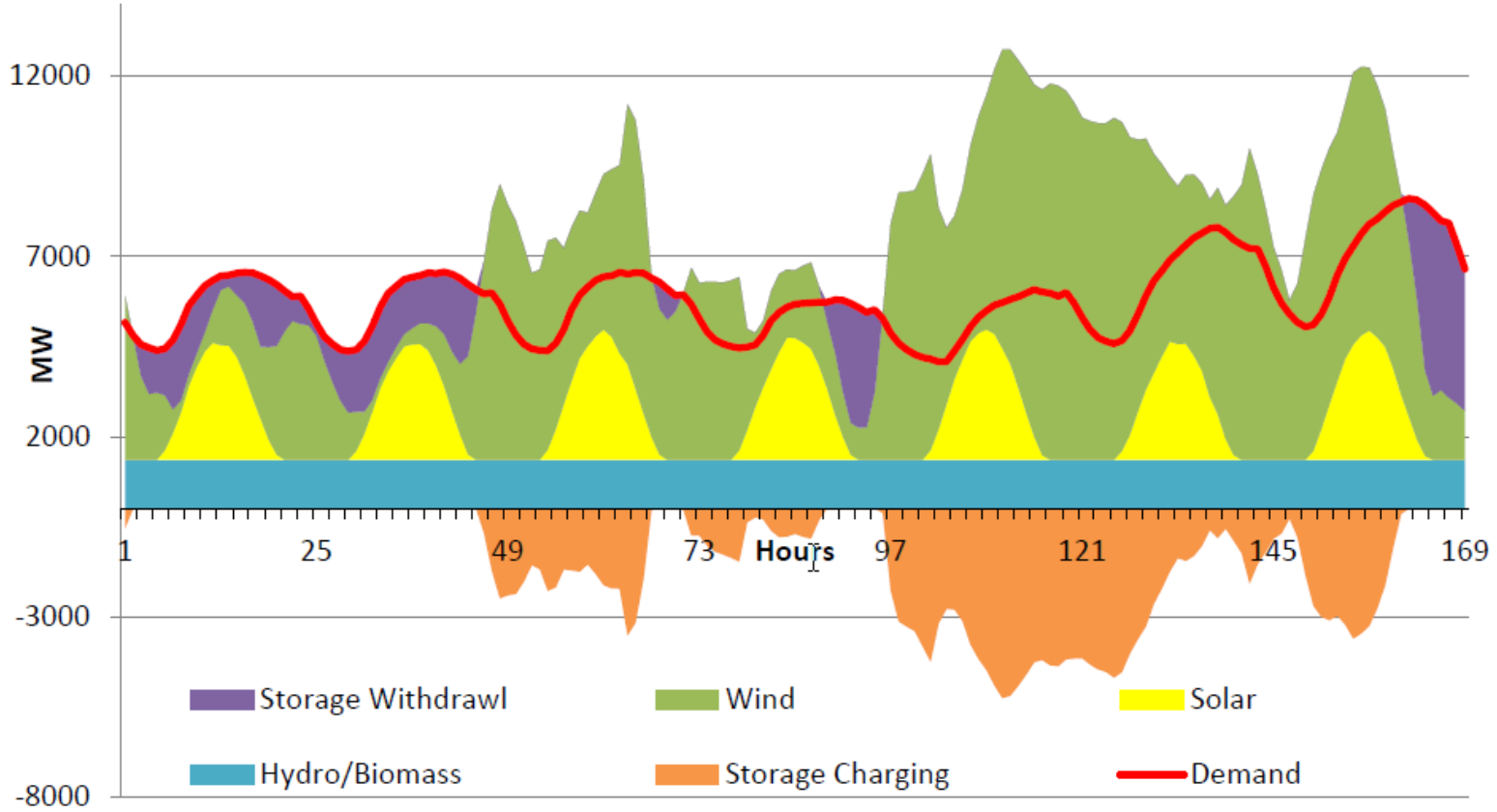
- Why Storage
- Technologies
- Applications
- Project Development
- Investments
- Constraints
- Energy Services Agreements
- FERC Developments
- California Regulatory Developments

Why Storage?



Source: Institute for Energy and Environmental Research, "Renewable Minnesota: A technical and economic analysis of a 100% renewable energy-based electricity system for Minnesota" (March 13, 2012) p. 33, Figure 111-1 (citing FERC, NREL, DOE data).

Why Storage?



Source: Institute for Energy and Environmental Research, "Renewable Minnesota: A technical and economic analysis of a 100% renewable energy-based electricity system for Minnesota" (March 13, 2012) p. 40, Figure 111-7.

Storage Technologies

- Batteries
- Pumped hydro
- Thermal (ice, molten salt, ceramic bricks)
- Mechanical (flywheels, compressed air)
- Magnetic
- Capacitors
- Energy analytics

Energy Storage Applications

Category	Storage 'End Use'
ISO/Market	1. Ancillary services frequency regulation 2. Ancillary services: spin/non-spin/replacement reserves 3. Ancillary services ramp 4. Black start 5. Real time energy balancing 6. Energy price arbitrage 7. Resource Adequacy
Generation	8. Intermittent resource integration: wind (ramp/voltage support) 9. Intermittent resource integration: photovoltaic (time shift, voltage sag, rapid demand support) 10. Supply firming
Transmission/Distribution	11. Peak shaving 12. Transmission peak capacity support (upgrade deferral) 13. Transmission operation (short duration performance, inertia, system reliability) 14. Transmission congestion relief 15. Distribution peak capacity support (upgrade deferral) 16. Distribution operation (voltage/VAR support)
Customer	17. Outage mitigation: micro-grid 18. Time-of-use (TOU) energy cost management 19. Power quality 20. Back-up power

Source: Proposed Decision Adopting Proposed Framework for Analyzing Energy Storage Needs (mailed July 2, 2012, available at: http://docs.cpuc.ca.gov/efile/PD/169946.pdf)

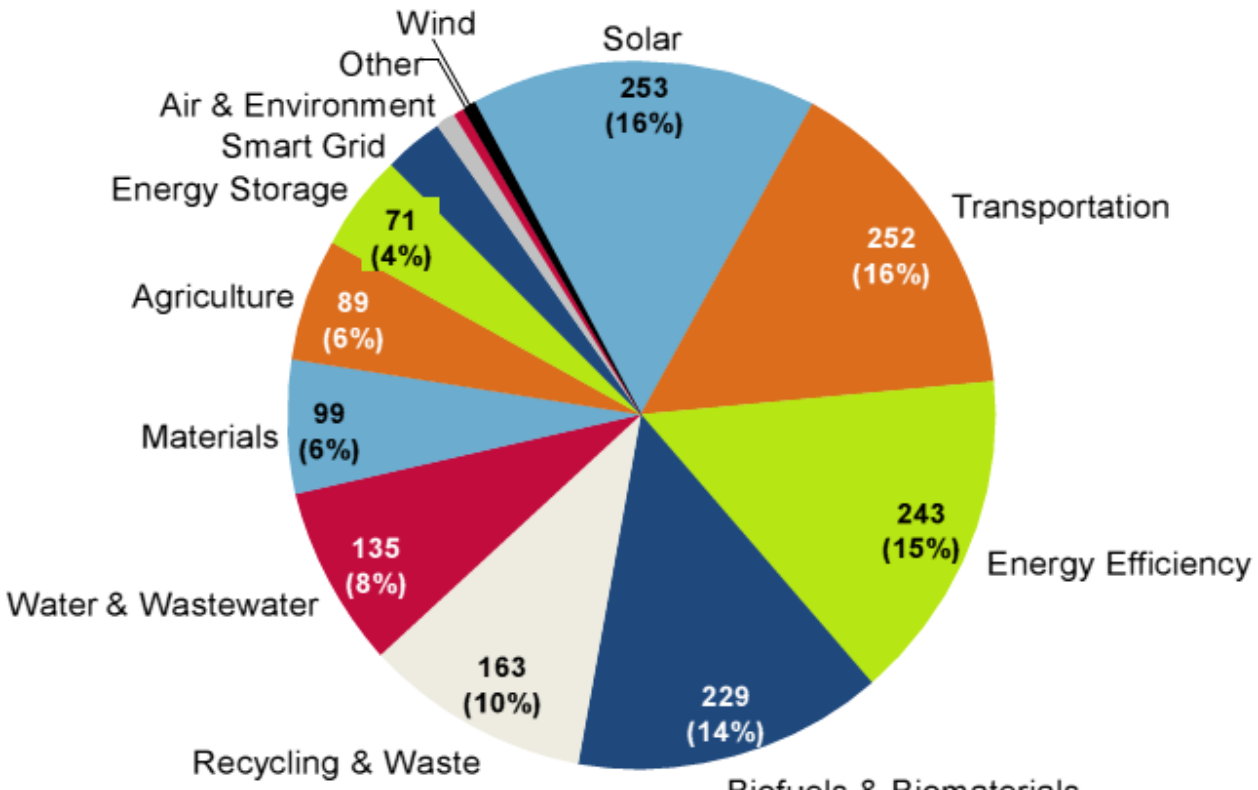
Storage Project Development: Progress to Date

- Approximately 128 GW worldwide (99% of which is pumped hydro)
  (source: CleanEdge, Clean Energy Trends 2012 (citing EPRI)).
- Approximately 25 GW installed in the U.S. (including 22 GW pumped hydro)
  (source: Arthur O'Donnell, "Energy Storage at the CPUC" presentation to Infocast Storage Week Summit (June 26, 2012) (citing Pike Research)).
- Trend: combined renewable storage projects (e.g. CSP/molten salt (BrightSource), wind/batteries (AES/A123))

Investments in Energy Storage

Global Cleantech Venture Investment by Sector, 2Q12

$ Millions and percentage

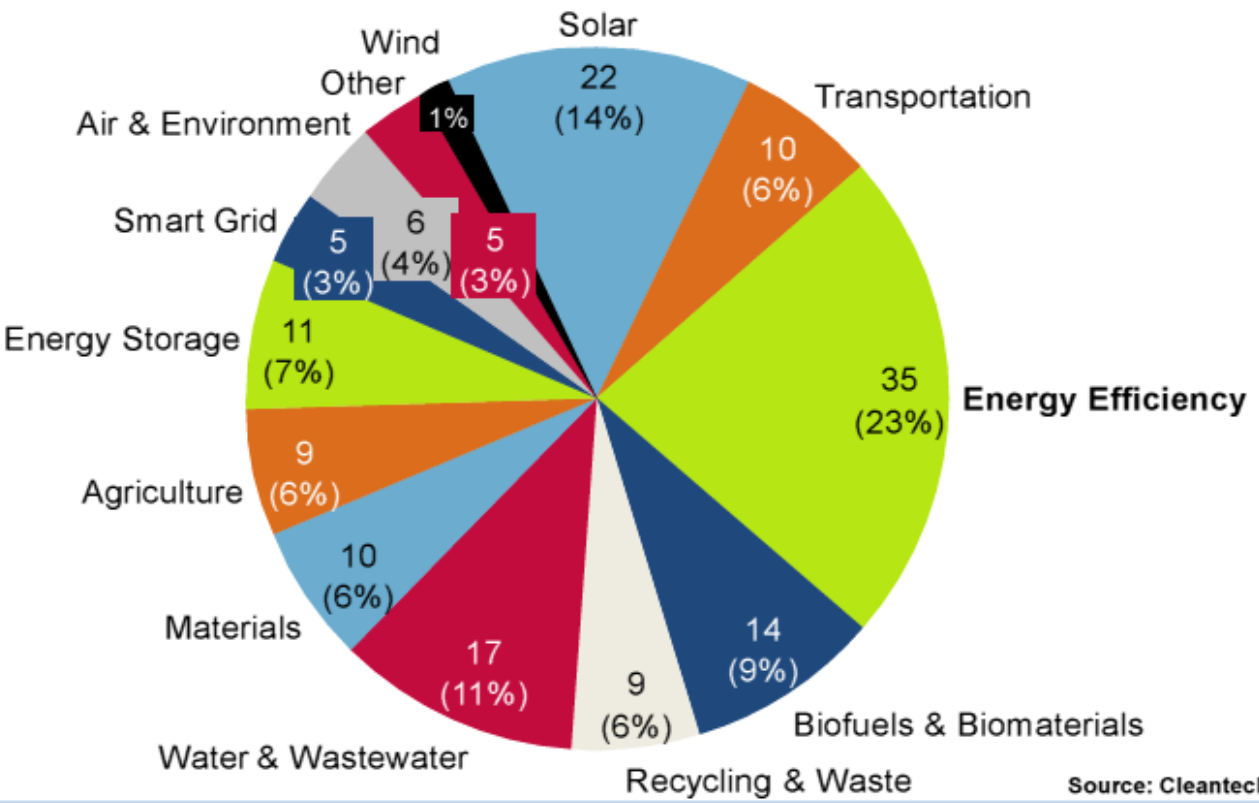


Source: Cleantech Group's i3 Platform

Investments in Energy Storage

Global Cleantech Venture Deals by Sector

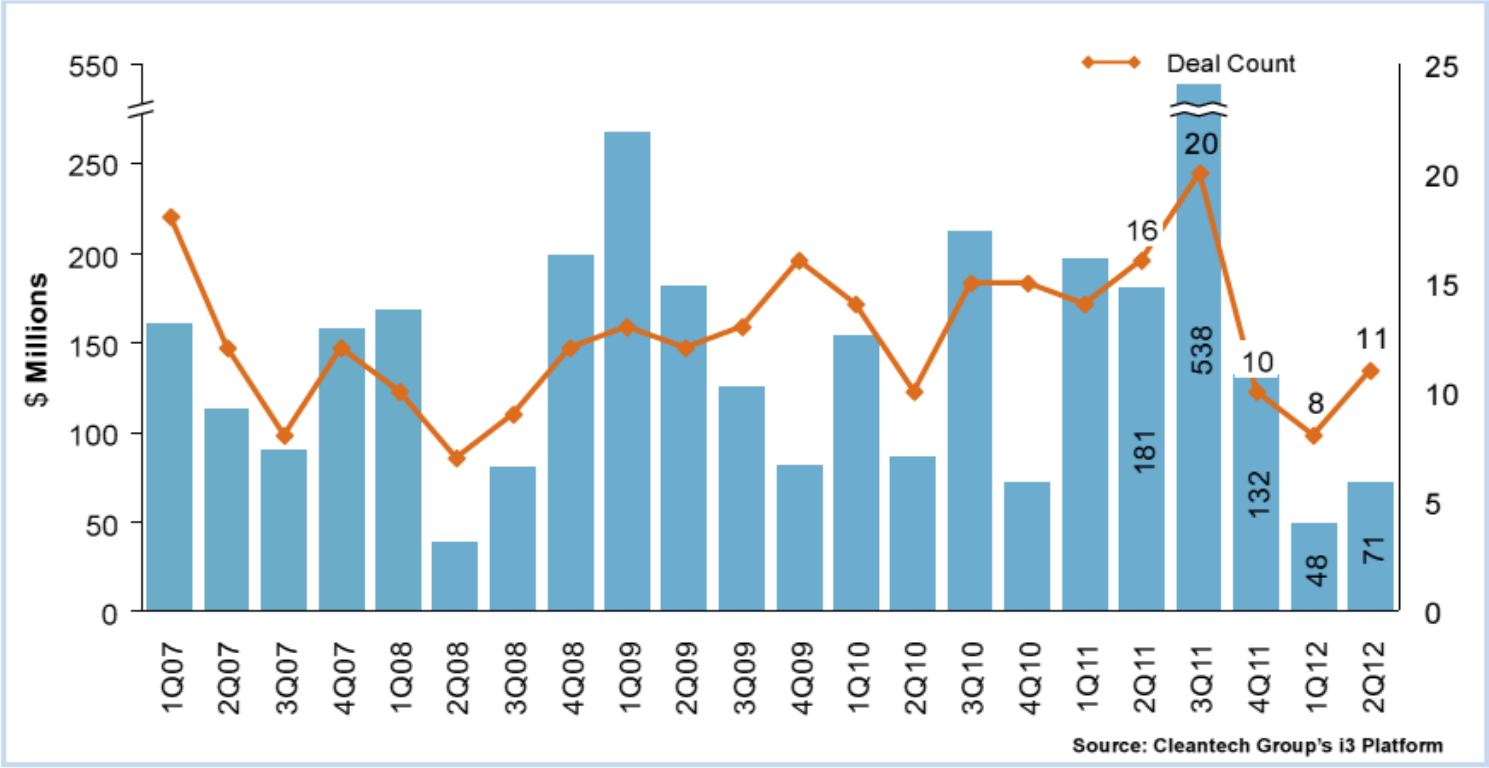
# of deals and percentage



Investments in Energy Storage

Global VC Investment in Energy Storage by Quarter

$ Millions, # of deals



Investments in Energy Storage

- $71 million in venture financing in Q2 2012; up 35% from Q1 2012 and down 60% from Q2 2011
- Over 46 M&A deals in storage since 2007 (includes fuel cells)
- Approximately 17 IPOs for storage companies (primarily NASDAQ and Shenzen exchanges, includes fuel cells)

Source: Cleantech Group; *Cleantech Group Quarterly Cleantech Investment Monitor, Vol. 11, issue 1 (data includes fuel cells).*

Constraints on the Deployment of Storage

- Emerging technologies
- Unclear ownership structure and cost responsibility
- Lack of clear product definition
- Incohesive regulatory treatment

Energy Services Agreements

- Commercial, customer size of the meter
- Services provided: avoided electricity costs, peak shaving, energy management, rate optimization
- Payment: flat fees, percentage of electricity savings, combination thereof
- Third-party ownership structures emerging
- Third-party maintenance

Regulatory Developments: Federal

FERC Order 755 (October 20, 2011)

- "Frequency Regulation" = "the injection or withdrawal of real power by facilities capable of responding appropriately to a transmission system operator's automatic generator control (AGC) signal."
- Requires RTOs/ISOs to develop tariffs to compensate adequately providers of frequency regulation through:
  - Capacity payments; and
  - Performance payments

CAISO Implementation: Pay for Performance

- CAISO filed tariff amendment on April 27, 2012
  - Proposal: separate bidding and market clearing prices for regulation capacity and mileage
  - Seeks extension with new effective date of April 9, 2013
- FERC issued Deficiency Notice on June 8, 2012 seeking additional detail
- CAISO responded on July 6, 2012.

Regulatory Developments: California

AB 2514 (Skinner, 2010)

- Required CPUC to open a proceeding by March 1, 2012 "to determine appropriate targets, *if any*, for each load-serving entity to procure viable and cost-effective energy storage systems to be achieved by December 31, 2015, and December 31, 2020."
  - Procurement targets to be adopted by October 1, 2013, *if determined by CPUC to be appropriate*.
  - Governing boards of publicly-owned utilities also required to evaluate whether procurement targets are appropriate.
- Energy storage systems can be used to meet Resource Adequacy requirements, if applicable standards are met
- Procurement of energy storage must be "cost-effective"

Regulatory Developments: California

CPUC Rulemaking 10-12-007

Phase I: policies to encourage storage, integration with IOUs' portfolios and loading order, analysis of barriers, applications, ownership models

Proposed Decision (mailed July 2, 2012)

- Adopts Staff Proposal
  - "end use" framework
  - Assign RA value to storage within R.11-10-023
  - Coordination with other proceedings (LTPP, RA, cost-effectiveness, Permanent Load Shifting, CAISO Pay for Performance, FERC ancillary services NOI, Rule 21 process)
- comments due July 23

Regulatory Developments: California

Self-Generation Incentive Program (SGIP)

- $2/W incentive for Advanced Energy Storage
  - Projects > 30 kW: 50% up front, 50% performance-based incentive
  - Paid out over 5 years
  - Tiered structure: declines based on rated capacity and annually
  - Incentives paid on first 3 MW
- Additional 20% incentive for California suppliers
- Manufacturer concentration limit: 40% of annual statewide budget

For More Information

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Clean Energy States Alliance Webinar on
State Energy Storage Policies

June 12, 2012

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CESA
CALIFORNIA ENERGY STORAGE ALLIANCE

CESA – Strength Through Diversity & Collaboration

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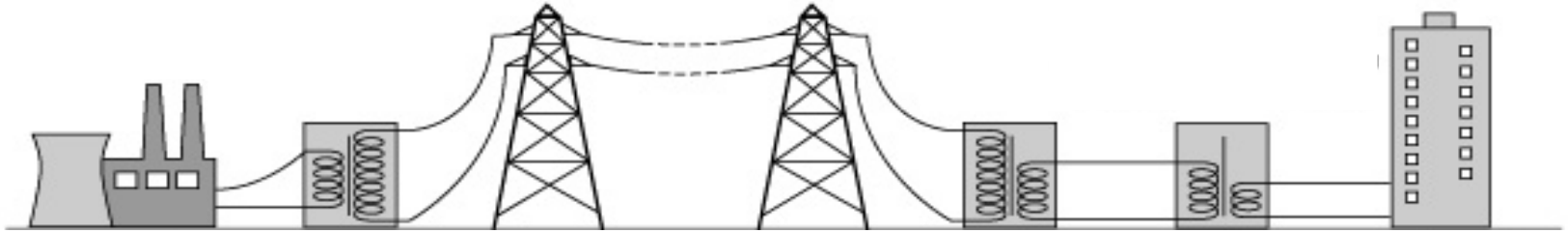
CESA CALIFORNIA ENERGY STORAGE ALLIANCE

Role for All Storage Technologies on the Grid

Technology Classes	Energy Storage Examples
Chemical Storage	**Advanced Lead Acid Battery** •Electrical energy is stored for later use in chemical form. Existing battery technologies are being improved, and new battery technologies are becoming available. •Example: 1.5MW Advanced Lead Acid Battey – Kaheawa, Hawaii Wind Farm 
Thermal Storage	**Chilled Water Storage** •Combustion turbines' efficiency is dependent upon the temperature of the air taken into the turbine. Water chilled during off-peak hours can greatly increase their efficiency by pre-cooling the air before intake. •Example: 23,700 tons of chilled water for a 1300MW Warren County, Virginia CCCT 
Mechanical Storage	**High Speed Flywheel** •Flywheels convert electrical energy to kinetic energy, then back again very rapidly. Flywheels are ideal for power conditioning and short-term storage. •Example: 3 MW Mechanical Storage for Ancillary Services — NE ISO (Beacon Power) 
Bulk Mechanical Storage	**Below Ground Compressed Air** •Electricity is used to compress air into small or large modular storage tanks or a large underground cavern. The compressed air is used to spin turbines when electricity is needed. •Example: 115 MW Compressed Air Energy Storage — McIntosh, Alabama 
Bulk Gravitational Storage	**Pumped Hydro** •Excess electricity is used to pump water uphill into a reservoir. When power is needed, the water can run down through turbines, much like a traditional hydroelectric dam. •Example: 1,532 MW Pumped Hydro — TVA's Raccoon Mountain 

Where does Energy Storage belong?



Central generation | Transmission | Distribution | Customer

Bulk storage

Substation storage

Distributed/demand-Side storage

32 Storage Benefits

Benefit	Central Storage	Distributed[1] Storage	Location-specific Storage[2]
Electric Supply			
1. Time-shift	x	x	
2. Supply Capacity	x	x	
Grid Operations (a.k.a. Ancillary Services)			
3. Energy Balancing	x	x	
4. Load Following	x	x	
5. Area Regulation	x	x	
6. Fast Area Regulation	x	x	
7. Frequency Response	x	x	
8. Ramping	x	x	
9. Reserve Capacity	x	x	
10. Voltage Support	x	x	x[3]
11. Black Start	x	x	
Grid Infrastructure			
12. Transmission Support			x
13. Transmission Congestion Management			x[4,5]
14. T&D Upgrade Deferral			x[4,5]
15. Substation On-site Power			x
End User			
16. Time-of-use Energy Cost Management			x
17. Demand Charge Management			x
18. Electric Service Reliability			x
19. Electric Service Power Quality			x

32 Storage Benefits

Benefit	Central Storage	Distributed[1] Storage	Location-specific Storage[2]
Renewable Integration			
20. Renewable Energy Time-shift	x	x	x
21. Renewable Generation Capacity Firming	x	x	x
22. Variable Renewables Grid Integration			x
Incidental Benefits			
23. Generation Dynamic Operating Benefits	x	x	x
24. Reduced Generation Fossil Fuel Use	x	x	
25. Reduced Generation Air Emissions	x	x	
26. Increased GT&D Asset Utilization	x	x	x[4]
27. Reduced T&D I^2R Energy Losses		x	x[4,5]
28. Avoided Transmission Access Charges		x	x
29. Reduce T&D Investment Risk			x[4]
30. Power Factor Correction		x	x[5]
31. Flexibility	x	x	x[5]
32. Real Options	x	x	x[5]

1. Deployment at a specific location is not necessary.
2. Location matters.
3. Best if located near the most troublesome loads during voltage emergencies.
4. Must be located (elecrically) downstream from "hot spots."
5. Value is somewhat to very situation-specific.

Avoided Utility Costs

Avoided Capital Facilities	• Future generating units • Transmission facilities • Distribution facilities
Reduced Energy Costs	• Swap high cost generation for low cost generation • Reduced emissions and costs • Improved resource utilization and operation
Reduced Costs of Market Transactions	• Avoided capacity purchases / demand charges • Swap high on-peak market prices for low off-peak prices
Avoided System Losses	• Reduced system losses • Improved system power factor • Improved voltage support
Reduced O&M Costs	• Avoided O&M costs (avoided facilities) • Reduced O&M costs on existing facilities
Reduced Costs for Ancillary Services	• Reduced ancillary services responsibilities / purchases • Ice Bear provides regulation service

Other Utility Benefits

Enhanced integration of renewable resources	• Addition of more renewable resource capacity • Augment operation / dependability of renewable resources
Improved system efficiency and reliability	• Reduced average system heat rate • Improved system reliability
Increased potential for market sales	• *Frees-up* generation that can be sold during peak periods • Surplus capacity sale • Surplus energy sale
Natural hedge against power prices	• Swap high on-peak prices for low off-peak prices • Swap high on-peak volatility for low off-peak volatility
Reduced costs for fuel procurement	• Higher utilization of base / intermediate resources • Less reliance on peaking resources (higher cost fuel) • Better utilization of fuel reservations

Barriers to adoption of cost-effective (especially distributed) Energy Storage

Valuation

- No universally recognized cost-effectiveness methodology (nevermind variances among storage technologies/applications)
- Costs of peak-period *in*efficiencies are not fully recognized
- Inadequate attention to system energy efficiency, not just end use
- Incomplete internalization of environment and other externalities
- Challenges of optimally and cheaply integrating renewables only now being fully recognized

Regulatory

- Regulators have not yet fully considered storage benefits and costs
- Some regulatory regimes do not adequately allow utilities to invest in demand-side resources
- Lack of familiarity with recent technological progress

CESA/Storage's Top 2012 Policy Priorities (1)

- Comprehensive Storage Rulemaking *(CPUC)*: ensure the AB 2514-authorized comprehensive Rulemaking (OIR) progresses and concludes rapidly, robustly considers all of storage's value, considers the views of the storage industry, and adopts appropriate storage procurement mechanisms and/or goals for IOUs
- Self-Generation Incentive Program *(CPUC)*: ensure that incentives of up to $2,000/kW and appropriate rules that facilitate grid storage development are adopted for energy storage's participation in SGIP program (per AB 1150 and SB 412)
- Permanent Load Shifting *(CPUC)*: $32M (over 3 years) incentives for PLS* resources, incl. energy storage, are adopted by IOUs in their DR programs
- California Loading Order *(CPUC and CEC)*: add energy storage to the state's energy resource loading order at the same level as DR
- Long-Term Procurement Planning and Resource Adequacy *(CPUC)*: ensure the full consideration and fair inclusion of energy storage in IOU long-term procurement plans, and in RA valuation

* "…PLS involves [on a recurring basis] storing electricity produced during off peak hours and using the stored energy during peak hours to support loads."

CESA/Storage's Top 2012 Policy Priorities (2)

- Pay for Performance *(CAISO)*: develop performance-based tariff for energy storage; robust implementation of FERC Order 755 by CAISO
- Behind-the-Meter Ancillary Services *(CAISO and CPUC)*: adopt rules for accessing ancillary services markets from behind-the-meter
- Energy Storage as a Mainstream Energy Resource *(multi)*: educate policymakers and stake-holders, and promote the consideration/inclusion of storage as a commercially available, cost-effective, mainstream energy resource in all salient proceedings, legislation, incl.:
  - Long-term procurement plans
  - Resource adequacy
  - AB32 GHG rules
  - Federal ITC
  - EPIC
  - 33% RPS implementation
  - FERC proceedings
  - Ramping, firming rules
  - Loading order
  - Interconnection, other Distributed Generation

Summary of Recent Developments in Texas

» Texas Legislature
  – SB 943 passed in 2011 to clarify rights of storage resources providing wholesale service(s) in competitive areas

» Public Utility Commission of Texas
  – Multiple projects and rulemakings to explore issues and remove barriers for storage, including establishing settlement rules and granting authority for ERCOT to establish pilot projects for emerging technologies

» ERCOT
  – Emerging Technologies Working Group (ETWG)
  – Fast Response Regulation Service (FRRS) pilot
  – Settlement protocols being drafted to allow storage participation in the market

Source: Xtreme Power

Regulatory proceedings typically divided into asset classes

…but storage spans across all asset classes