Bulk Storage Update
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Coalition to Advance Renewable Energy through Bulk Storage (CAREBS)

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CAREB's Mission

- Promote the benefits of bulk energy storage to enhance electricity grid operations, including integration of renewable energy, improved reliability and security, advanced market development, and cost efficiencies throughout the production and delivery value chain
- Shape and support federal policies affecting bulk energy storage, work with key state-level and storage organizations to advance energy storage generally, and **act as a conduit between federal, state, and regional policy**
- Distinguish bulk energy storage from distributed storage options - CAES, Pumped Storage Hydroelectric, large-scale batteries and flywheels

When vision…

- California pursues the most ambitious clean energy strategy in the country, and arguably the world
  - Aggressive RPS goals
  - State-wide carbon cap and trade
  - California Clean Energy Future
  - Clean Energy Jobs Plan
  - California Solar Initiative
  - ARB Climate Change Scoping Plant
  - CPUC Long Term Energy Efficiency Strategic Plan

…bumps economic reality

- Slow to modest economic growth forecasts
- Historically high unemployment
- Low natural gas prices baked into planning
- Consumer resentment of subsidies
- Business backlash against high energy costs
- Regionalization of electricity infrastructure (economies of scale, renewable integration)
- Electricity service reliability issues

Bulk Energy Storage

- CAREBS believes that bulk energy storage facilities rest at the convergence of California's clean energy vision and the economic realities that confront the state and the country
- According to EPRI's latest economic evaluations, bulk storage is the most cost effective of the storage options

CAES Technology Status

- 50 plant years of commercial operation – 270 MW facility, Huntorf, Germany (1977), 110 MW facility, McIntosh, Alabama (1994) operated by Power South
- System Improvements for 20% performance gain over McIntosh available from the marketplace today with full warranties
- Advanced systems teed up - Adiabatic CAES and Next-Generation CAES systems slated for demonstration through ARRA Stimulus funding
- U.S. based supplier (Dresser Rand) with U.S. manufacturing base! Others could bid as well. Performance guarantees available
- More than a dozen commercial and demonstration projects currently being considered
- Above-ground (power plant) piece – today's commercial offerings pose little to no technology risk
- Below-ground (storage medium) piece – cavern storage proven, aquifer storage needs demonstration but natural gas storage in similar geologies operating for decades

Pumped Storage Technology Status

- Represents 21,000 + MW of storage currently serving the U.S. electricity grid and 127,000 MW worldwide.
- 2.5% of U.S. generation capacity, 5% of Europe's, and 10% of Japan's.
- New variable speed machine designs substantially add operating flexibility and shorten response times.
- More than three dozen projects in development around the country, many in the Western U.S., with preliminary FERC permits issued
- Environmentally manageable closed-loop water system
- No aquatic habitat issues, e.g., no fish

An Emerging Policy Framework

Layers of Legislation/Policy Supporting Storage

Federal Layer	FERC	DOE	EPA	CONGRESS
	NOPR Frequency Regulation Compensation in the Organized Wholesale Power Markets; (February 17, 2011) NOI Promoting Transmission Investment through Pricing Reforms (May 19, 2011) - Electric Storage Technologies Request for Comments (June 11, 2010) - FERC Order 1000 - Variable Energy Resources Notice of Proposed Rule Making; NOI Third Party Provisions of Ancillary Services (June 16, 2011)	- ARRA Demo Funds ~ $200 M ARPA - E Funding (12% devoted to storage or $49 M)	- Carbon Reduction laws - Emissions Rules on Peaking GTs?	- Storage Investment Tax Credit (ITC) being re-introduced -Potential Clean Energy Standard Legislation - Clean Energy Development Bank (under discussion)

National Layer	NERC	EIPC, ISO/RTO COUNCIL
	- Issued Report from Variable Generation Task Force - Annual Long-term Reliability Assessment	- Modeling Studies Include Bulk Storage - Briefing Paper on Variable Energy Resources

ISO/RTO Layer	NY-ISO	PJM	MISO	CAISO	ERCOT	WECC	SPP	
	FERC Approved Energy Storage Tariffs for Day-ahead and Real-Time Regulation Service Markets (15 min. intervals)	- Ancillary Service - Frequency Regulation	- Ancillary Services Tariffs - Developing Ramping Product	- Approved Tariffs for Ancillary Services from Non-generators Developing Ramping Product - Modeling Storage in Production & Forecasts	- Day-ahead Ancillary Services Tariffs and Market - Texas Nodal Market Beginning 2011	- Modeling Storage	Variable Energy Generation Policy Initiatives	

State Layer	NEW YORK	OHIO	CALIFORNIA	TEXAS	UTAH	KANSAS	OTHERS
	- Storage R&D Program	- Storage Included in the PUCs Alternative Energy Portfolio Standard	- AB2514 Possible Storage Procurement Mandates - Storage Included in Integrated Resource Plan - SDGE Storage Rate Case	- Bill 1421 Utilities Code Amendment Energy Storage Equipment - Proposed PUC Rulemaking on Legislative Target of 500 MW of Non-wind Renewable Energy - S.B. 943 on Energy Storage	- Storage RPS - Proposed Renewable Energy Zones Include Storage	- Regulations to implement legislation supporting CAES	-24 states currently have RPS policies --Colorado PUC public hearing on CAES

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FEDERAL

Federal Layer	FERC		DOE	EPA	CONGRESS
	NOPR Frequency Regulation Compensation in the Organized Wholesale Power Markets; (February 17, 2011) NOI Promoting Transmission Investment through Pricing Reforms (May 19, 2011)		ARRA Demo Funds ~ $200 M ARPA - E Funding (12% devoted to storage or $49M- expires at the end of this year)	Carbon Reduction laws Emissions Rules on Peaking GTs?	Storage Investment Tax Credit (ITC) being re-introduced Potential Clean Energy Standard Legislation Clean Energy Development Bank (reintroduced by the Senate Energy & Natural Resources Committee)
	Electric Storage Technologies Request for Comments (June 11, 2010)	**Variable Energy Resources Notice of Proposed Rule Making; NOI Third Party Provisions of Ancillary Services; Accounting and Financial Reporting for New Electric Storage Technologies (June 16, 2011)**			

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ISO/RTO Layer

NY-ISO	PJM	MISO	CAISO	ERCOT	WECC	SPP
FERC Approved Energy Storage Tariffs for Day-ahead and Real-Time Regulation Service Markets (15 min. intervals)	Ancillary Services rates Frequency Regulation	Ancillary Services Tariffs Developing Ramping Product	Approved Tariffs for Ancillary Services from Non-generators Developing Ramping Product Modeling Storage in Production & Forecasts	Day-ahead Ancillary Services Tariffs and Market Texas Nodal Market Beginning 2011	Modeling Storage	Variable Energy Policy Initiatives

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State Layers

NEW YORK	OHIO	CALIFORNIA	TEXAS	UTAH	KANSAS	OTHERS
Sustained storage R&D Program Large Flywheel (20-MW) demonstration facility CAES DOE demonstration project	Storage Included in the PUC's Alternative Energy Portfolio Standard Ground broke for huge CAES facility (Norton)	AB2514 Storage Legislation Storage Included in Integrated Resource Plan SDGE Storage Rate Case CAES DOE demonstration project Several PHS projects moving forward Robust Storage R&D program	Bill 1421 Utilities Code Amendment Energy Storage Equipment or Facilities Proposed PUC Rulemaking on Legislative Target of 500 MW of Non-wind Renewable Energy Several CAES projects under development	Storage RPS Proposed Renewable Energy Zones Include Storage	Regulations to implement legislation supporting CAES CAES projects under development	**30 states currently have RPS policies** Colorado PUC public hearing on CAES

Focus on California

- 33% RPS by 2020 is a "floor, not a ceiling."
- AB2514 – storage legislation – recommendation of storage capacity "targets" by October 2013
- PIER Strategic Analysis of Energy Storage in California – top suggested research and development priority: "bulk energy storage demonstrations for variable renewable energy integration (for example, pumped hydro, concentrating solar power, and solar thermal)
- Renewable energy contract failure rate – 40%: Could bulk storage provide a risk management strategy?
- Issue raised in the CA IEPR: Need for a goal that "significant fraction of renewable energy be dispatchable" - creates a role for bulk storage
- California Clean Energy Future – goal to add 1000 MW of energy storage by 2020

CAREBS encourages… federal

- Re-introduction of the storage investment tax credit (ITC) – Senate bill. Bingaman (NM), Wyden (OR), Congressman Thompson (CA), others
- Appropriate subsidies and incentives that recognize storage as a cost-effective multiplier of renewable energy delivered through the grid
- Inclusion in the proposed Clean Energy Credit program
- FERC incentives similar to transmission assets
- Classification by FERC as a separate asset class with its own benefits to the grid
- Inducements to electric utilities and ISO/RTOs to evaluate bulk storage on a equal basis with generation and transmission assets

CAREBS encourages… California

- Full consideration of bulk storage in subsequent editions of the Integrated Energy Policy Report (IEPR) for benefits as a grid management and optimization asset – *it's more than renewable energy integration*
- Allocations of renewable energy credits for bringing more renewable energy to California
- Recognition of its substantially more favorable economics compared to emerging distributed storage options
- Demonstration of evolutionary advances in bulk storage technologies
- Modeling studies to monetize the multiple benefits of strategically located bulk storage facilities serving the California grid
- Distinction between the commercial and large-scale nature of bulk storage technologies and emerging distributed storage technologies

Marketplace Realities

- **Legislative/policy framework still evolving**
- Value to monetize still may not be transparent
  - Carbon credits
  - Costs of cycling fossil units
  - Modeling capabilities still evolving
- Underground CAES and today's PHS consistently exhibit lowest cost/kWh compared to most other storage options
- CAES and PHS equipment come with WRAP and performance guarantees
- CAES and PHS equipment are majority sourced from US-based manufacturing facilities
- CAES and PHS satisfy response time and duration requirements of most ancillary services applications and grid integration services
- CAES and PHS pose the least technological risk for storage
- Severe fiscal constraints at all governmental levels, weak electricity demand forecasts and high reserve margins (ERCOT one exception), and the shale gas "revolution" challenges the marketplace

CAES and PHS can compete against today's prevailing options - gas turbine and combined-cycle solutions and deeper cycling of fossil assets – in select locations

Vision to reality… bulk storage

- Commercial, warranted systems available today from U.S. based suppliers – little technology risk
- More than renewable energy integration – electricity infrastructure optimization and management – *the Swiss Army Knife of the system*!
- Better fit with least cost planning goals
- Numerous pumped storage and CAES sites available in California (and neighboring states)
- Mitigates fuel risk – natural gas prices won't remain low forever!

To learn more, visit:

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