



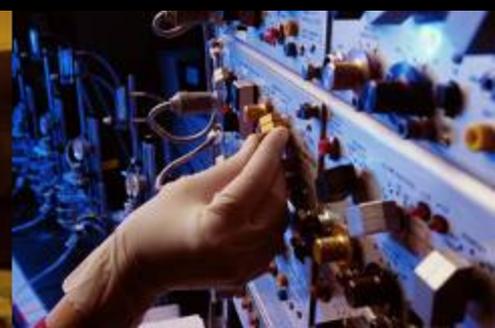
California Energy Commission Energy Storage Workshop

Comments submitted by:

Beacon Power Corporation

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Barriers and Obstacles to Scale



- *What barriers and/or obstacles have prevented large, utility scale electricity energy storage systems from being installed in California and the nation?*
 - Closed market for storage regulation; CAISO non-compliance with FERC Order 890 (see 4/1/9 Beacon Power Protest to FERC)
 - Lack of tariffs and EMS software that exploit system benefits of storage and pay for added system-wide grid performance
 - Lack of long-term take-or-pay contracts
 - Lack of large-scale project financing (limited or non-recourse)
 - Collapse of capital markets
 - Lack of clear and beneficial tax treatment at Fed. and State levels
 - Lack of subsidies for initial large scale commercial projects

Market Status for Frequency Regulation



Market	Average MW Market Size	Average Pricing*	Market Developments and Status
ISO NE	130	\$48	<ul style="list-style-type: none"> Pilot program unanimously approved August 5, 2008, Began on November 18, 2008
NYISO	220	\$62	<ul style="list-style-type: none"> Tailored market rules approved by stakeholders Approved by FERC March 2009 Market and software expected to be effective in May 2009
PJM	1000	\$61	<ul style="list-style-type: none"> Market open
MISO	Est. 1000 (new open market)	N/A (new open market)	<ul style="list-style-type: none"> FERC ordered new tariff for Energy Storage Resources MISO filed tailored tariff in May 2008, approved Dec08 Expect open market by June 2009
CAISO	360	\$37	<ul style="list-style-type: none"> California is market closed to fast-response storage Stakeholder process to develop market rules for Energy Storage Resources derailed by MRTU priorities Inability and/or unwillingness to comply with Order 890
ERCOT	Approx 100 and growing	N/A	<ul style="list-style-type: none"> Not FERC regulated – less transparent Highest wind penetration

* Average 12 month prices paid by ISO/RTO per MW service hour through July 08

- *How does energy storage affect the ramping and regulation of renewable energy sources?*
 - Storage can reduce system-wide regulation capacity needed
 - Fast-response storage can deliver twice the system regulation impact (on average) in California... can cut regulation procurement by 40%
 - Energy storage does not require base load generation; helps keep out-of-merit generation from being pulled up just to provide regulation
 - Zero direct emissions translate to fast permitting and construction
 - Storage can double as a ramping resource (to a degree)
 - Storage will significantly lower CO₂ due to regulation and ramping*

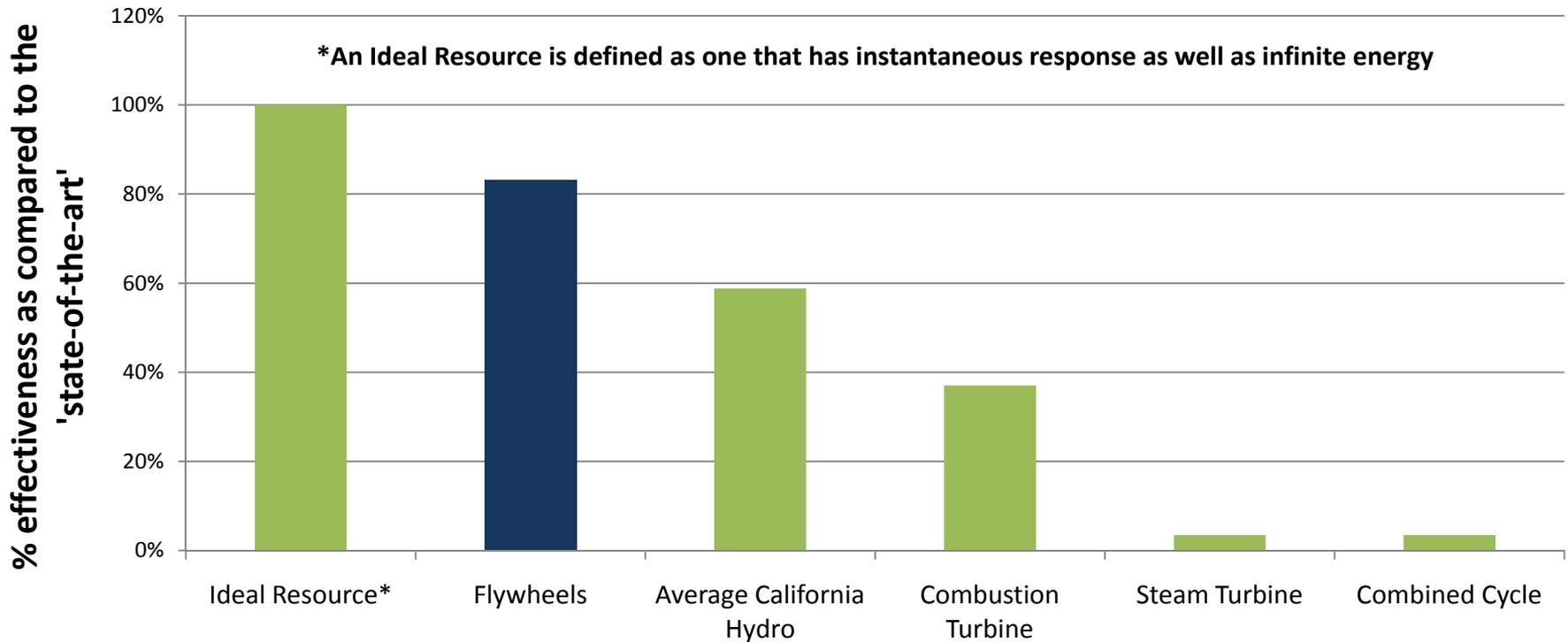
* Other unwanted emissions also decreased, e.g., SO₂, NO_x, Mercury

System Benefits of Fast Regulation



Regulation Effectiveness

As compared to an 'Ideal Resource'



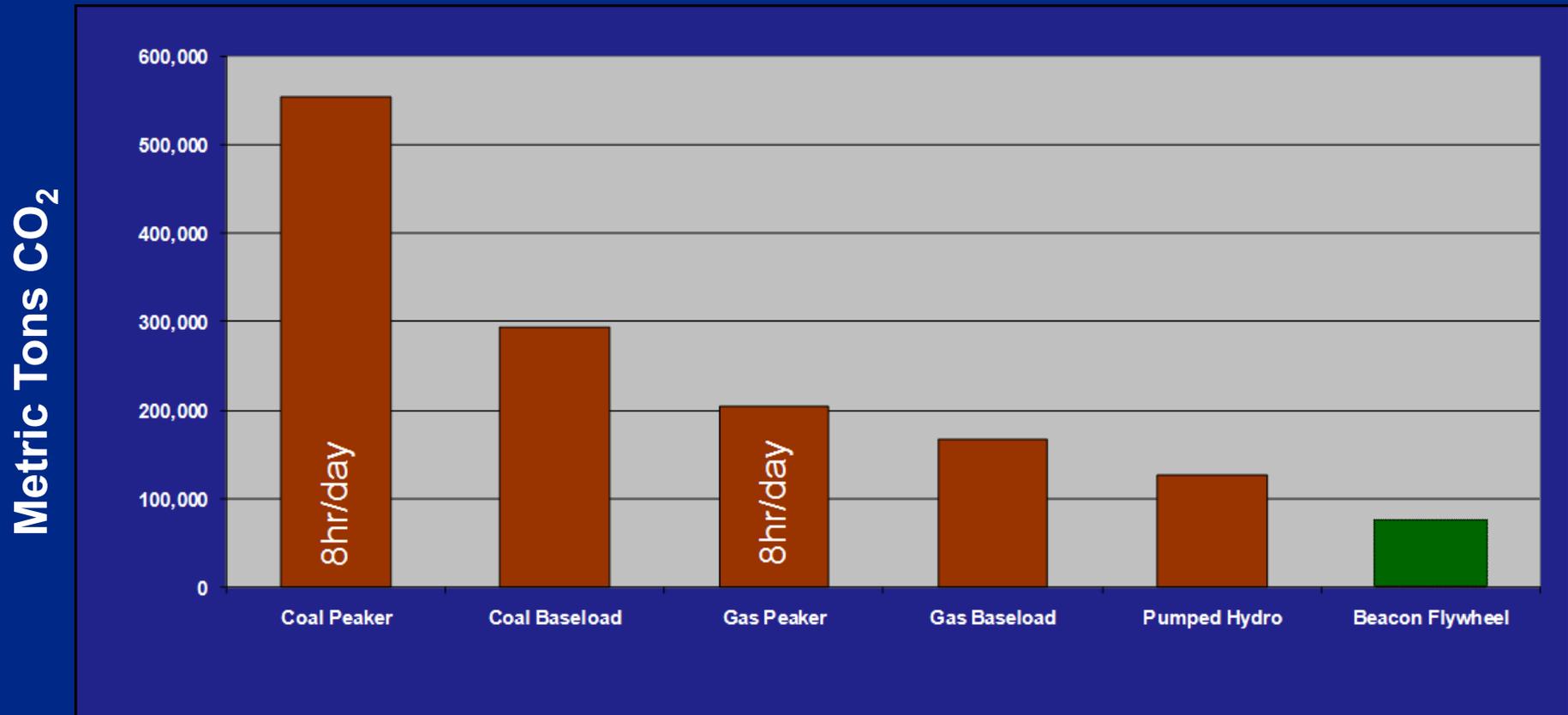
PNNL: Fast-response energy storage can reduce the amount of regulation procurement required by up to 40% in CAISO

- *What value does a large scale electric energy storage system provide the integration of large amounts of renewable resources as compared to other backup or intermittency support alternatives?*
 - Can provide **Frequency Response Reserve** and **VAR control**; and in future: **Angular Stability Control** (wide area oscillation dampening)
 - Lower system-wide regulation capacity requirement and cost
 - Doubles as a *fast-acting* ramping resource (good for wind, solar)
 - Saves energy across the grid system; reduces foreign energy imports
 - Zero direct emissions, smaller CO₂ footprint
 - Can be sited and built quickly

Fast Storage CO₂ Emission Advantage



From KEMA study: 20 MW of Regulation over 20-year operating life

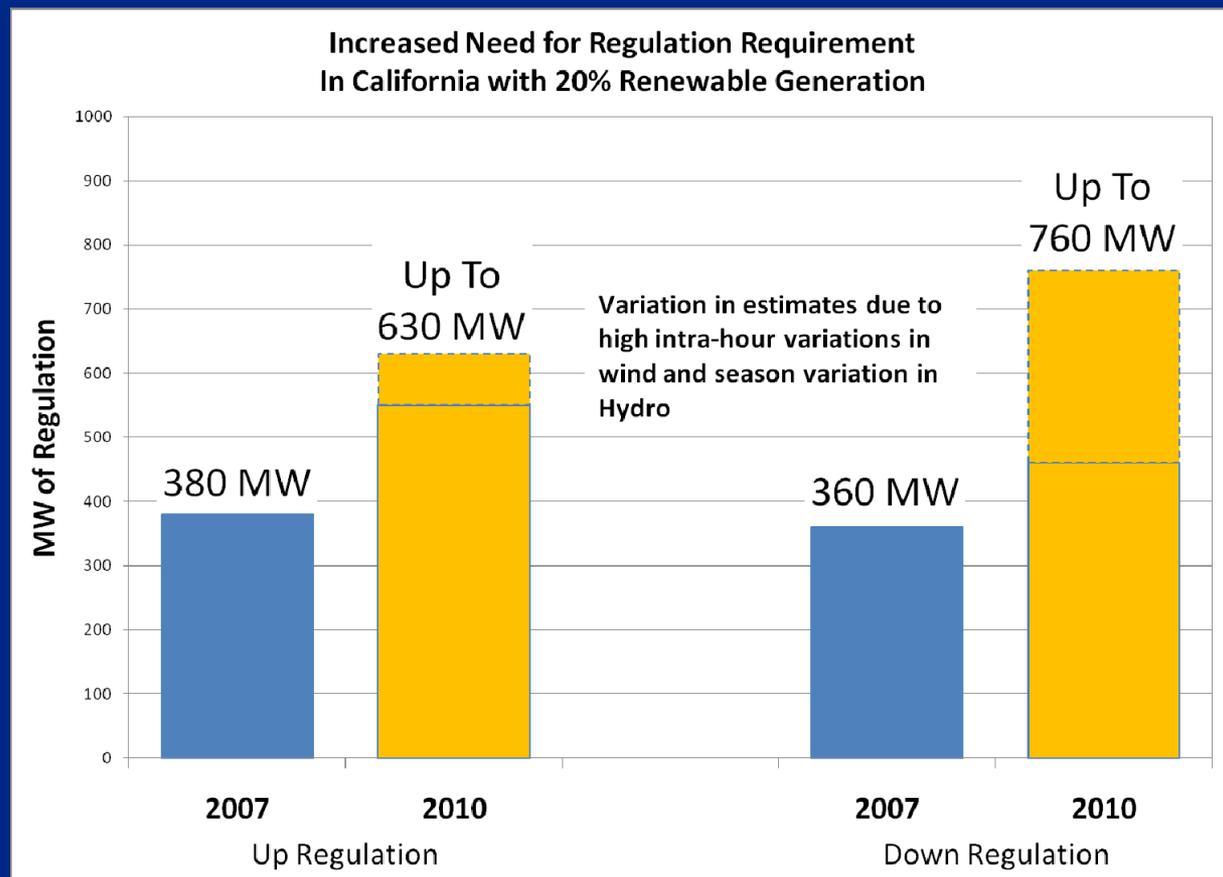


Up to 80% reduction in CO₂ emissions vs. fossil generation

Intermittent Resources Increase the Need for Regulation and Ramping



- Increased wind penetration creates the need for **greater regulation capacity and faster regulation ramping capability**
- Nov '07 CAISO report identifies significant additional regulation requirements with 20% renewables (about 10% wind penetration)



Source: "Integration of Renewable Resources" CAISO, Nov. 2007

Fast-response energy storage can help fill this growing gap

Best Location for Storage



- *Where should large, utility scale electric energy storage systems be deployed to have the greatest beneficial impact on meeting the RPS goals of 2020?*
 - Regulation resources located near wind resources may reduce transmission up-lift costs by mitigating some variability at the source
 - Regulation resources should be located primarily in-State in a dispersed fashion to decrease susceptibility to long-line transmission failures and make the grid more resistant to cascading blackouts

Other locational factors less important to meeting RPS goals:

- Fast-response storage can be located to reduce the susceptibility of the system to wide-area oscillations (Angular Stability Control)
- Storage can be located where VAR control is needed (provided such locational constraints do not undermine its regulation capability)

Storage Cost / Benefits of Ownership



- *What is the cost of ownership of electrical storage systems, what benefits will be accrued and how will they be distributed?*
 - \$2,500 - \$3,000 per KW capital cost (today, for regulation)
 - \$8 - \$10 million per year in revenues (per 20 MW resource)*
 - Operating costs 20 %- 25% of revenues (per 20 MW resource)
 - Regulation effect: ~ twice as effective, on average (in CA)
 - PNNL projects ability to reduce amount of regulation capacity up to 40%
 - CO₂ reduction: ~ 50% reduction vs. gas-fired, 80% for coal-fired

* Does not reflect added payment for superior “2 X” performance

Allocating Benefits and Costs



- *What are the challenges and solutions to having the costs associated with energy storage systems be recouped from those who benefit from the technology when the benefits are expected to be provided to multiple beneficiaries?*
 - Some benefits at macro system level cannot be directly or easily measured at reasonable cost, only inferred, e.g., CO₂ reduction, system-wide energy savings, reduction of foreign energy imports
 - Lack of precision in calculating system-wide benefits and costs leads to resistance in allocating costs to specific stakeholders
 - Setting up an administrative apparatus to measure and allocate macro level benefits and costs will lead to delay and failure

These conditions call for sound policy to socialize benefits and costs in simple, expedient, and justifiable ways

- *What incentive programs or other economic stimulus alternatives can be proposed that will encourage the deployment and fielding of more large, utility scale electric energy storage systems in California?*

State Level

- No sales tax on sale of components and assets used for projects
- 5 year MACRS depreciation
 - Based on total cost, inclusive of any other government financing
- 20% Investment Tax Credit (standard type)

Tax incentives for storage should be at parity with wind and solar since they enable both!

- *What incentive programs or other economic stimulus alternatives can be proposed that will encourage the deployment and fielding of more large, utility scale electric energy storage systems in California?*

Federal Level

- 30% Investment Tax Credit (convertible type)
 - Based on total cost, inclusive of any other government financing
 - Convertible to grant at owner's option, paid directly from Treasury
- 5 year MACRS depreciation

Tax incentives for storage should be at parity with wind and solar since they enable both!

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Federal Level

- National project financing facility
- Allow utilities to rate base storage investments, subject to appropriate cost / benefit calculations
- Make sure IRS tax code provides clear and unambiguous beneficial tax treatment
 - “Storage” should be identified in the tax code for applicable incentives (not just for V2G)

Tax incentives for storage should be at parity with wind and solar since they enable both!

- *What research is needed on energy storage in order for the California Grid to be capable of supporting the RPS goal of 33 percent renewables by 2020?*
 - Careful study and analysis of Federal and State tax treatments and identification of necessary legislative and regulatory language changes needed to insure proper treatment of storage assets
 - Summary of existing studies... or a new definitive study of the economic system level benefits from fast responding resources
 - Needed to justify a premium payment for regulation service
 - Commercial scale project (s) to help empirically quantify the economic system benefit from fast responding resources

Tax incentives for storage should be at parity with wind and solar since they enable both!



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