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**BEFORE THE PUBLIC UTILITIES COMMISSION
OF THE STATE OF CALIFORNIA**

Order Instituting Rulemaking to Integrate and Refine Procurement Policies and Consider Long-Term Procurement Plans.	Rulemaking 10-05-006 Filed May 6, 2010

COMMENTS OF THE CALIFORNIA ENERGY STORAGE ALLIANCE ON RESOURCE PLANNING ASSUMPTIONS - Part 2 (Long Term Renewable Resource Planning Assumptions) – Track 1

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July 9, 2010

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ON RESOURCE PLANNING ASSUMPTIONS – Part 2
(Long Term Renewable Resource Planning Assumptions) – Track 1

Pursuant to the California Public Utilities Commission's ("Commission's") Rules of Practice and Procedure and the *Administrative Law Judge's Ruling Revising the Schedule for the Proceeding and Regarding Staff's Proposals for Resource Planning Assumptions – Part 2 (Long Term Renewable Resource Planning Standards)* issued by Administrative Law Judge Victoria S. Kolakowski on June 22, 2010 ("ALJ's Ruling"), the California Energy Storage Alliance ("CESA")[1] provides the following comments.

I. INTRODUCTION.

CESA is extremely appreciative of the White Paper published by the Commission earlier today, and looks forward to working very collaboratively with the Commission, Commission staff, and industry stakeholders over the coming weeks and months to further all of the demonstrably laudable analysis, conclusions, and recommendations it contains.[2] The same can also be said of the Discussion Paper issued by the California Independent System Operator ("CAISO") yesterday.[3] These Comments, written in the main before publication of both papers,

[1] The California Energy Storage Alliance consists of A123 Systems, Altairnano, Applied Intellectual Capital, Beacon Power Corporation, Chevron Energy Solutions, Debenham Energy, Deeya Energy, EAST PENN Manufacturing Co., Inc., Enersys, Enervault, Fluidic Energy, Ice Energy, International Battery, Inc., Powergetic, Prudent Energy, PVT Solar, Samsung SDI, SEEO, Suntech, SustainX Energy Storage Solutions, and Xtreme Power. The views expressed in these Comments are those of CESA, and do not necessarily reflect the views of all of the individual CESA member companies. http://www.storagealliance.org.
[2] *Electric Energy Storage: An Assessment of Potential Barriers and Opportunities*, Commission Policy and Planning Division White Paper, July 9, 2010.
[3] Discussion Paper, *Renewable Integration: Market and Product Review*, July 8, 2009.

should therefore be read in that light. CESA will address the detail contained in both of the excellent papers in its Reply Comments that are due next week.

As the Commission is well aware, energy storage is a mission-critical class of assets in the long-term procurement planning process, which encompasses numerous applications that affect any analysis of smart grid-related economic, environmental, and temporal analysis.[4] Likewise, a very recent California Energy Commission ("CEC") report modeled the impacts of wind generation, solar generation and energy storage on the grid, and evaluated the relative benefits of deploying energy storage versus conventional generation. Specifically, the salient conclusions reached by KEMA, the authors of the report, can be distilled as follows:

- **System degradation became "extreme" under a 33% Renewables Portfolio Standard ("RPS") scenario.**
- **Large-scale storage can improve system performance through regulation and ramping services, without emissions penalties and limited energy cost penalties.**
- **Existing storage technologies are capable of managing renewables integration.**
- **For regulation, storage can be 2-3 times as cost-effective as a combustion turbine.**
- **Without storage, equipment maintenance costs and greenhouse gas ("GHG") emissions may increase.**[5]

Cost-effective energy storage, as both a demand and supply-side resource, should be clearly and specifically incorporated into any set of RPS resource class-related scenarios that the Commission adopts for planning purposes. Although it is not called out directly in the Staff Proposal,[6] it can safely be presumed that past work preceding the Staff Proposal by several years presently informs the Commission's thinking.[7] Energy storage is very likely to affect the total amount of renewable generation necessary to achieve RPS goals by storing renewable generation

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[4] *See, Decision Adopting Requirements for Smart Grid Deployment Plans Pursuant to SB 17 (Padilla), Chapter 327, Statutes of 2009* (D.10-06-047, issued June 24, 2010).

[5] *See, Research Evaluation of Wind Generation, Solar Generation and Storage Impact on the California Grid* California Energy Commission, June 2010 (referred to herein as the "KEMA Report").

[6] ALJ's Ruling, Attachment 1. *Planning Standards for System Resource Plans – Part II Long-Term Renewable Resource Planning Standards* (referred to here in as the "Staff Proposal").

[7] *See, Draft 33% Renewables Portfolio Standard for California by 2020 Implementation Analysis Workplan*, November 21, 2008: "Achieving a 33% RPS will require an unprecedented amount of new renewable energy procurement in California and a new paradigm for conventional energy procurement. For example, a 33% RPS may require utilities to build several new transmission lines and procure storage, flexible fossil resources, or dispatchable demand response that provide sufficient ramp and regulation instead of baseload fossil resources.[Emphasis added]" (Workplan, pp. 2-3).

produced during off-peak times to be used to meet peak demand. Thus failure to maximize integrate energy storage as a "load modifier" (as the term is used in the Staff Report) into RPS scenarios developed in this proceeding would represent an unnecessary gap in the Commission's planning processes in this proceeding, as well as those taking place in smart grid and resource adequacy-related proceedings and elsewhere.

CESA strongly recommends robust analysis of the impacts of including energy storage in all of the Commission's proceedings, as well as its internal planning processes. Without considering an increase in storage capacity, the current analysis could fail to accurately capture the costs of each scenario on the system, from both an economic and environmental perspective. As previously noted by the Energy Division staff,[8] with a "time score" as a key variable in procurement planning, storage's ability to be quickly deployed should be integrated into the scoring system.

II. THE COMMISSION SHOULD ADOPT THE GUIDING PRINCIPLES FOR DEVELOPMENT OF RPS SCENARIOS THAT ARE PROVIDED IN THE ALJ's RULING.

The ALJ's Ruling correctly observes that: "Having detailed information about plausible renewable generation portfolios and associated transmission infrastructure requirements is desirable for identifying the need for new system or local resources, as well as any operational needs to integrate intermittent renewables. It is recognized that renewable development strategies may vary in terms of cost, time to implement, and development risk, and that the regulatory framework for renewables is under regular administrative and legislative review [footnotes deleted]" (ALJ's Ruling, pp. 2-3). Accordingly the ALJ's Ruling identified the following guiding principles for this key element of the proceeding:

"1. RPS scenarios should be reasonably feasible and reflect plausible procurement strategies with associated (conceptual) transmission.

[8] *See, 33 % Renewables Portfolio Standard Implementation Analysis Preliminary Results, June 2009*: ". . . if the RPS portfolio is likely to result in substantial penetration of new solar thermal resources with storage, the resulting capacity surplus would reduce the need for demand response. Alternatively, if the RPS portfolio is heavy in wind resources that produce mostly at night, efficiency programs that target night time energy use such as outdoor lighting programs would be substantially less valuable. These interactions also depend strongly on the timing of new resource development; implementing California's aggressive energy policy goals over a longer period of time would reduce the likelihood of negative interactions among the various programs because programs could be adjusted along the way more easily." (Interim Report, p. 31).

2. RPS scenarios should represent substantially unique procurement strategies resulting in material changes to corresponding (fossil) procurement needs and/or required (conceptual) transmission.

3. The number of RPS scenarios should be limited to 3-5." (ALJ' Ruling, p. 5)".[9]

In order to avoid duplicating the substantial effort that went into developing and vetting the methodology used in the Staff Proposal, and the KEMA Report, CESA simply refers the Commission to both of them as unimpeachable supporting documentation for these Comments.

III. CESA PROVIDES THE FOLLOWING RESPONSES TO THE SPECIFIC QUESTIONS POSED IN THE ALJ'S RULING FOR CONSIDERATION.

1. ***Do the proposed inputs and assumptions regarding the cost, value, and estimated Megawatt availability of renewable resources in California and throughout the West accurately reflect the best-available industry knowledge?***

Response: By not explicitly taking cost-effective energy storage into account, the proposed inputs and assumptions in the Staff Proposal likely fail to provide an accurate assessment of the cost and value of renewable resources in California; specifically this notable omission likely overstates the cost and understates the value of renewables, particularly related to reduction of emissions.[10] For example, the levelized cost of energy for each resource is calculated based on a generic set of cost assumptions, available incentives, financing and performance, and these costs are then applied to each scenario in order to calculate the levelized cost of electricity. However, the continued growth in energy storage capacity in California has the potential to fundamentally enhance the performance (and thus feasibility, cost and pace of deployment) of many renewable resources. In addition, cost-effective energy storage could substantially further improve the energy value for resources that generate during off-peak periods, such as wind.[11] Unfortunately, the Staff Proposal presently states that the size and cost of new generic transmission depends predominantly on the Competitive Renewable Energy Zones ("CREZ"),

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[9] The ALJ's Ruling also reiterated guiding principles applicable to all of the Track 1 Inputs, Assumptions and Methodologies: in a ruling issued on May 28, 2010: "1. Assumptions should reflect the behavior of market participants, to the extent possible. 2. Methodology should be consistent with previous regulatory decisions, to the extent applicable. 3. Any proposal should explain the policy basis for the proposal. 4. Any proposal must include supporting documentation." (ALJ's Ruling, p. 4).

[10] See, e.g., *Air Emissions Due to Wind and Solar Power*, Carnegie Mellon Electricity Center, October 23, 2008.

[11] *See*, KEMA Report, p. 76.

and therefore does not account for any increase in energy storage capacity that may result in avoided transmission construction and replacement costs.

The economic score specifically includes integration costs, such as the procurement of ancillary services in order to reliably integrate intermittent resources into the grid, yet does not discuss the potential of energy storage to meet this critical and growing challenge. For example, the KEMA Report estimates that the CAISO's control area will require 3,000 to 4,000 MW of regulation/ramping services under a 33% RPS scenario.[12] It concludes that: "Fast storage" (capable of 5 MW/second in aggregate) is more effective than conventional generation in meeting this need and carries no emissions penalties and limited energy cost penalties."[13] Specifically, as noted by KEMA, "a 30 to 50 MW storage device is as effective as a 100 MW CT [combustion turbine] used for regulation and ramping purposes."[14] Ancillary services such as frequency regulation are provided by regulation focused energy storage applications, and must significantly alter resource integration cost assumptions.[15] CESA accordingly strongly agrees with the CAISO's sense of the Discussion Paper referred to at the beginning of these Comments that the Staff Report should explicitly and fully incorporate energy storage into its models.[16]

2. ***Do you agree that concerns about environmental impacts may significantly affect the development of renewable generation between now and 2020, and should thus be considered in long-term planning, to the extent possible? If the Staff-proposed methodology appropriate for providing a high-level screening of the environmental concerns associated with renewable generation, by type and location?***

Response: CESA fully supports the consideration of environmental impacts of energy decisions to the extent possible. Energy storage can clearly lead to reduced use of fossil generating plants (whether for peaking or backing-up purposes) to significant ambient air quality improvements (especially smog-forming nitrogen oxides) and GHG emissions reductions Furthermore, energy storage can mitigate land use and aesthetic degradation resulting from transmission lines and peaking powerplants. The KEMA Report found that without storage, ramping of combustion turbine generators and hydroelectric generators is likely to increase, which could have significant environmental consequences. For example, increasing ramping of

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[12] *See also, California Independent System Operator Renewable Integration Study*, September 2007.
[13] *ibid*, p.75.
[14] *ibid.* p.78.
[15] *See, Western Wind and Solar Integration Study,* National Renewable Energy Laboratory, May 2010.
[16] Footnote 3, *Supra,*

hydroelectric generators will affect downstream water levels. In one of the "no storage" by 2020 scenarios versus an "infinite storage" scenario, the model forecasts a 3% increase in GHGs over a 24-hour time horizon in the former.

CESA recently produced a white paper analyzing the benefits of storage as a cheaper, cleaner substitute for natural gas-fired peaker plants.[17] Using a commercially available energy storage technology and assumptions taken from a CEC model[18], CESA demonstrated that energy storage usage results in significant air quality benefits. Assuming Pacific Gas and Electric's base load electric mix as the off-peak source of electricity, the model showed storage providing 55% CO_2 savings, 85% NOx savings, and up to 96% savings of CO per MWh of on-peak electricity delivered.[19]

Energy storage can also remove some of the delays of large projects – as well as the risk of cancellation – due to emissions, siting and/or other environmental concerns, as it can enable an increase in renewables in urban areas. This can also be cost-effective, as reported by Black and Veatch last year.[20] In their analysis, the Energy Division staff[21] also considered a number of potential "cases," including High Distributed Generation ("High DG"). Black and Veatch found that as PV costs come down – which they have substantially in the last year – the High DG Case is similar in cost to the 33% Reference Case.

3. *Do the proposed methodology and automated timeline tool provide realistic estimates for the timing of generation and transmission development?*

[**Response:** Without taking into account energy storage, the proposed methodology would not accurately estimate timing of generation and transmission development. Energy storage provides less timing risk, which was explicitly cited as a justification for considering alternative procurement strategies. The finding in the Staff Report that "it would be very difficult to build 24,000 MW of new generation and 11 major new transmission lines by 2020, given existing permitting and planning processes, risks around deployment of new technology,

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[17] Attached as Appendix A to these Comments (referred to herein as the "CESA Whitepaper") and available at http://www.storagealliance.org/presentations/CESA_Peaker_vs_Storage_2010-06-16.pdf.

[18] *Comparative Cost of California Central Station Electricity Generation Technologies,* California Energy Commission, August 2009.

[19] CESA White Paper, p. 4.

[20] *See*, Black and Veatch, power point slides prepared for and presented as a group at the Re-DEC Working Group Meeting *Summary of PV Potential Assessment in RETI and the 33% Implementation Analysis*, December 9, 2009.

[21] *See,* footnote 6*, infra.*

concerns about environmental impacts, and other factors," is in fact probably an understatement and supports the value of incorporating energy storage into procurement scenarios.[22] Energy storage can be deployed relatively quicker than other alternatives, and assist in integrating into the grid, and should therefore be taken into account in the "timing score."

4. ***Are the proposed assumptions about the availability and cost of transmission appropriate, considering the margin of error that must be accepted when performing a statewide study of this sort?***

Response: Due to the challenges of accurately assessing transmission availability and costs, the basic assumptions seem very appropriate candidates for workshop topics. The Energy Division Staff have also noted that without taking into account cost-effective energy storage, assumptions regarding the amount and cost of future transmission that will be necessary may lead to overestimation.[23]

5. ***Do you agree with the concept of holding constant through all scenarios a "discounted core" of the generation resources that appear most likely to develop by 2020? Do the proposed criteria and resulting projects comprising the "discounted core" represent a reasonable forecast of viable RPS generation in 2020, not necessarily by specific project, but by technology and location? If not, what other objective, publicly-available criteria might be more appropriate for building a "discounted core"?***

Response: In general, the concept of a "discounted core" strengthens the analysis by painting a more accurate picture of the likelihood of projects to eventually become operational, but this topic is best taken up in workshops. Interestingly and importantly, if storage is taken into account, many projects may become viable or enter this "discounted core."

6. ***The June 2009 33% RPS Implementation Analysis Preliminary Results report found that different 33% RPS scenarios help to achieve different policy goals, with no one scenario performing well across all policy metrics. Therefore, does the proposed set of scenarios strike an appropriate balance, presenting "reasonably feasible" and "plausible" 33% generation futures that still represent "substantially unique procurement strategies resulting in material changes to corresponding (fossil) procurement needs and/or required (conceptual) transmission", as envisioned in the guiding principles above?***

[22] Staff Report, p. 17.
[23] *See,* power point slides titled *Long-term Renewable Planning, Inputs and Assumptions, for the 2010 Long-Term Procurement Plan Proceeding,* presented at a Commission Workshop held on December 10-11 2009.

Response: The analysis is generally thorough, but fails to clearly incorporate storage or adequately take into account a number of the costs that would be associated with some of various scenarios. It is challenging to assess these metrics without including storage, especially since (as alluded to by the ALJ) pending legislation that would require consideration of accelerated deployment of energy storage by California's electric utilities has passed the Assembly and Senate Energy, Utilities and Communications Committee, and is currently advancing in the California Senate (AB 2514). The previously cited Black and Veatch analysis, for example, found that the High DG scenario may soon be cost-competitive with the 33% Reference Case. Incorporation of storage into the model could further decrease these costs, making the High DG scenario preferable from cost, timing, and environmental perspectives. Finally, it should also be recognized that cost accounting, among other aspects of energy storage regulation, is also the subject of active study at the federal level by the Federal Energy Regulatory Commission ("FERC").[24]

IV. CONCLUSION.

CESA appreciates this opportunity to help bring energy storage into the mainstream of the Commission's resource planning process and looks forward to working with parties and stakeholders going forward.

Respectfully submitted,

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July 9, 2010

[24] *See, e.g., Request for Comments Regarding Rates, Accounting and Financial Reporting for New Electric Storage Technologies*, FERC Docket No. AD10-13-000, issued June 11, 2010.

APPENDIX A

Energy Storage - a Cheaper and Cleaner Alternative to Natural Gas-Fired Peakers

Storage is vital in all efficiently functioning commodity markets—storage smoothes the fluctuations in supply and demand and ensures availability during critical periods of high demand. Energy storage systems store energy for use at a later time, when electric power is most needed and most valuable, such as on hot summer afternoons. Energy storage helps integrate intermittent renewable sources, can supplant the most polluting power plants, and enhances grid reliability. There are many ways to store energy, including chemically (batteries), mechanically (flywheels) and thermally (ice).[1]

Due to insufficient energy storage for the electric power grid, utilities must size their generation and transmission systems to deliver the full amount of electricity that consumers demand (or might demand) at any given moment of the year. Owning and operating sufficient assets to serve peak demand - only 5% or less of the hours per year - results in increased emissions and costs to electricity customers.

Energy storage has the unique potential to transform the electric utility industry by improving existing asset utilization, avoiding the building of new power plants, and avoiding or deferring upgrades to existing transmission and distribution networks. Scientists, utility CEO's, and policy makers frequently refer to energy storage as the "Holy Grail" for the electric power industry.

More recently, energy storage has achieved recognition as a foundational element of the Smart Grid[2], and the technical community speaks of energy storage as a key enabling resource to facilitate the transition away from a fossil fuel dominated generation fleet to one that is cleaner, more reliant on renewables, "smarter," and able to accelerate the electrification of the transportation sector.

To help illustrate the cost effectiveness of energy storage as an alternative to natural gas-fired peakers, we compared the cost of a kilowatt-hour (kWh) of electricity generated on-peak by a gas-fired peaker, with the cost of a kWh of electricity provided on-peak by an energy storage system. For simplicity, this comparison selected a commercially available energy storage technology – lead-acid batteries – and used the cost and specifications similar to the large lead-acid energy storage peaking facility shown below. Located in Chino, California, this 10 megawatt (MW), 4 hour duration system successfully demonstrated energy storage's ability to manage peak load from 1988 through 1996.[3,4]

Energy Storage Technologies Today Can Deliver On-Peak Electricity at a Lower Cost than Gas-Fired Peakers

Gas-Fired Turbine Peaker Plant

Energy Storage Peaker Substitution

[1] Pumped hydro energy storage, which has been in wide use for many years, is another form of mechanical, or kinetic, energy storage
[2] Title XIII of the Energy Independence and Security Act of 2007 described the Smart Grid as including "deployment and integration of advanced electricity storage and peak-shaving technologies, including plug-in electric and hybrid electric vehicles, and thermal-storage air conditioning"
[3] Energy storage performance specifications based on commercially deployed lead-acid grid storage projects, including the EPRI–funded grid level energy storage demonstration project in Chino, California
[4] EPRI Chino Study TR-101787, *Chino Battery Energy Storage Power Plant: Engineer-of-Record Report* (December 1992)

Assumptions for the gas-fired peaker were taken directly from the CEC's *Comparative Cost of California Central Station Electricity Generation Technologies* model. To calculate the cost per kWh of electricity discharged by an energy storage system, the same 20-year project time horizon and 5% capacity factor were used. Below is a detailed overview of the analysis methodology:

Gas-Fired Peaker Plant[5]

General Assumptions	
Technology:	Simple Cycle Combustion Turbine
Plant Size	49.9MW
Efficiency	37% (9,266 Btu/kWh Heat Rate)
Ownership	POU Owned/Financed
Project Life	20 years
Capacity Factor	5%
Plant, T&D Losses	6% (Centralized Plant)

Costs	Assumptions	LCOG ($/MWh)	LCOG ($/kW-yr)
Fixed O&M	$24/kW/yr	$69	$29
Corp. Taxes	0%	$0	$0
Insurance	0.6% of CAPEX	$23	$10
Property Tax	1.1% of CAPEX	$29	$12
Natural Gas Fuel	$61/MWh	$100	$41
Variable O&M	$0.04/kWh	$5	$2
Subtotal		$227	$93

Costs	Assumptions	LCOG ($/MWh)	LCOG ($/kW-yr)
Installed Cost	$1,394/kW	$265	$109
Grand Total		$492	$203

Energy Storage Peaker Substitution[6]

General Assumptions	
Technology:	Lead-Acid Battery
Plant Size	49.9MW (4h duration)
Efficiency	84% (AC to AC Roundtrip)
Ownership	POU Owned/Financed
Project Life	20 years
Capacity Factor	5%
Plant, T&D Losses	6% (Centralized Plant)

Costs	Assumptions	LCOG ($/MWh)	LCOG ($/kW-yr)
Fixed O&M	$6/kW/yr	$17	$7
Corp. Taxes	0%	$0	$0
Insurance	0.6% of CAPEX	$22	$9
Property Tax	1.1% of CAPEX	$28	$12
Off-Peak Grid Charging	$24/MWh[7]	$48	$20
Variable O&M	$0.04/kWh	$5	$2
Subtotal		$121	$50

Costs	Assumptions	LCOG ($/MWh)	LCOG ($/kW-yr)
Installed Cost	$1,351/kW[8] ($338/kWh)	$256	$105
Grand Total		$377	$155

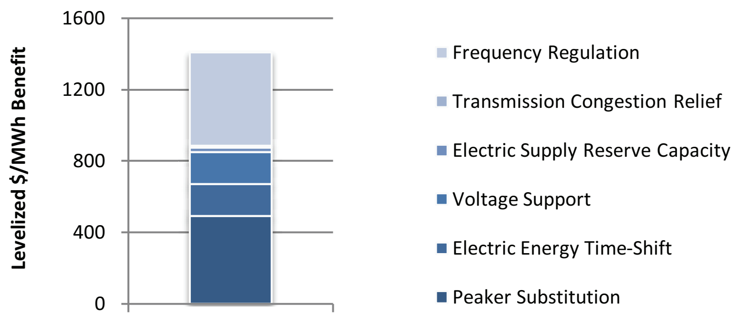
Levelized Cost of Generation for Energy Storage is Less Than a Simple Cycle Gas-Fired Peaker

Energy Storage Has the Ability to Deliver More than Peaker Substitution Value to the Grid

In addition to cost savings for electricity consumers, energy storage provides multiple value streams above and beyond peaker substitution, making the economic case for energy storage even stronger. For example, by their nature, gas-fired peaker plants cannot be economically sized below 50 MW and therefore are not easily installed in a distributed footprint. Energy storage systems do not have this limitation, opening up the potential for many technical and economical benefits available to distributed energy resources such as reduction of transmission and distribution losses. Additional benefits include electric energy time-shift, voltage support, electric supply reserve capacity, transmission congestion relief, and frequency regulation. Ranges for each of these value streams have recently been quantified by Sandia National Laboratories, and are presented in the chart below in terms of additional benefits per MWh delivered on-peak.

[5] Source: *CEC 2009 Comparative Cost of California Central Station Electricity Generation Technologies* (CEC_COG_Model_Version_2.02-4-5-10)
[6] Source: StrateGen Consulting, Levelized Cost of Generation Model
[7] Assumes most recent sample of average summer off-peak wholesale price from CAISO OASIS database
[8] EPRI Chino Study TR-101787, *Chino Battery Energy Storage Power Plant: Engineer-of-Record Report* (December 1992)

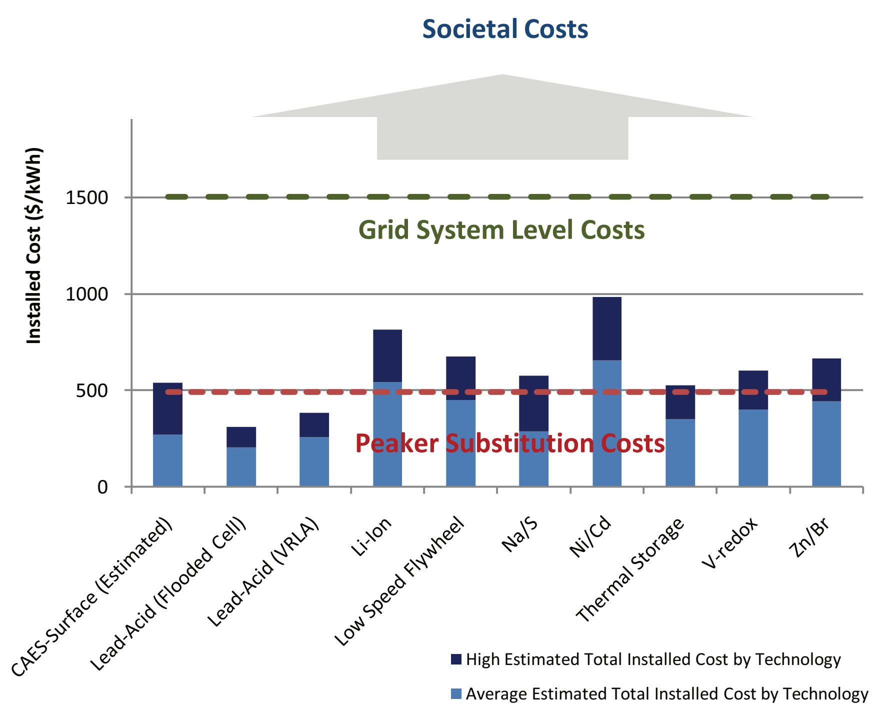
Additional System Benefits of Energy Storage[9]



Energy Storage is the Most Cost-Effective Resource

When these benefits are factored in and compared to the total installed cost for a range of energy storage technologies, energy storage emerges as a comprehensive, cost-effective system resource.

Fossil Fuel Societal, Grid, and Peaking Costs vs. Energy Storage Costs[10,11]



Avoided Costs Realized

Societal Level:
- GHG & Air Quality
- Renewables Integration
- Smart Grid Implementation
- Streamlined Permitting

Grid System Level:
- Electric Energy Time-Shift
- Voltage Support
- Electric Supply Reserve Capacity
- Transmission Congestion Relief
- Frequency Regulation

Peaker Level:
- Peaker Plant Substitution

The bars in the chart above represent the total installed cost per kWh of energy storage capacity by major storage technology, assuming four hours of capacity for each. The red dashed line indicates where storage costs

[9] Source: SANDIA Report SAND2010-0815, *Energy Storage for the Electricity Grid: Benefits and Market Potential Assessment Guide*, Jim Eyer & Garth Corey (February 2010)

[10] Assumptions: All energy storage technology costs shown are normalized for a four-hour duration; Technology comparison is for modern energy storage systems only, but does not include pumped hydro or high-speed flywheels which are not designed for long-duration peaking applications

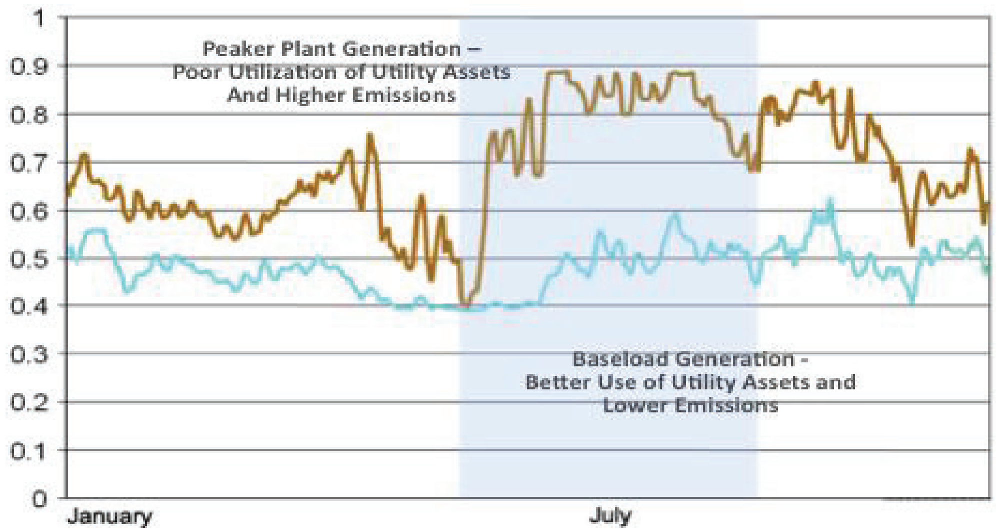
[11] Source: Average estimated total installed cost estimate from: Sandia Report SAND2008-0978, Susan M. Schoenung and Jim Eyer, *Benefit/Cost Framework for Evaluating* (February 2008)

are at cost parity with a natural gas-fired peaker. The green dashed line indicates the grid system level costs avoided with energy storage – in other words, this line is representative of other real system costs that are borne by electricity customers. Finally, the blue arrow represents the total societal cost avoided by energy storage, including its ability to help achieve a smart grid, accelerate and facilitate renewables integration, and avoid GHG emissions.

Energy Storage is a Cleaner Alternative to Natural Gas-Fired Peakers

Grid storage displaces less efficient, dirtier peaker generation by time-shifting more efficient, cleaner base-load generation to peak periods. This results in substantial system-wide air quality benefits. The chart below compares actual carbon dioxide (CO_2) emissions of peak vs. off peak generation in Southern California Edison's service territory. Peaker plant generation produces far more CO_2 emissions per MWh than base load generation, especially during the summer months. This is true of California's other utilities as well.

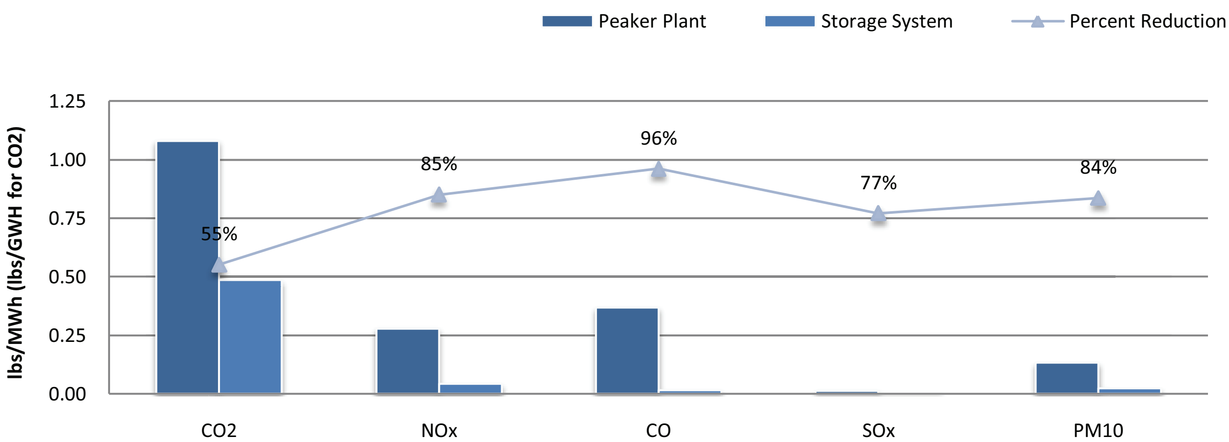
Peak vs. Off-Peak CO_2 Emission Rate (Tons/MWh)[12]



Energy storage usage results in significant air quality benefits. Assuming Pacific Gas and Electric's base load electric mix as the off-peak source of electricity, energy storage would provide 55% CO_2 savings, 85% NOx savings, and up to 96% savings of CO per MWh of on-peak electricity delivered (shown in the chart below). These emissions benefits increase as more off-peak renewable generation comes on-line. Energy storage will also help optimize the use of existing transmission and distribution capacity, enabling the deployment of more renewable energy. Finally, because of its ability to store locally generated power and be remotely dispatched, energy storage is an indispensable component of a more affordable, secure and reliable smart grid.

[12] Source: 2006 CPUC Update for Energy Efficiency Proceeding (Brian Horii, E3)

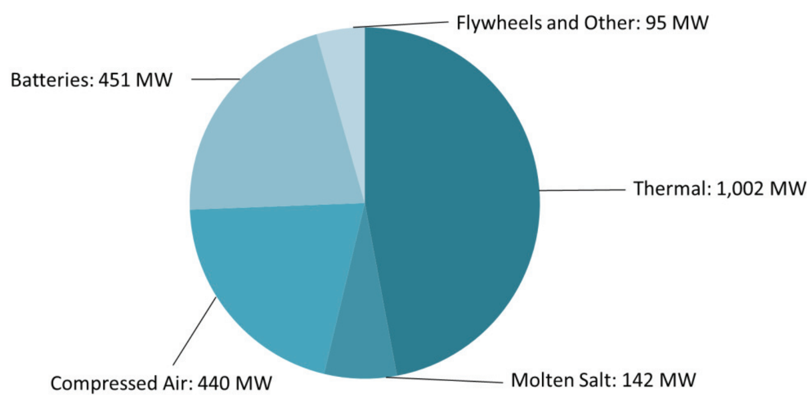
Energy Storage is a Cleaner Alternative to Gas Peakers[13]



Smart, Clean, Cost-Effective Energy Storage: Ready for Deployment

Modern energy storage technologies, some of which have been in existence for decades, cover a wide range of sizes, power (measured in MW), and discharge durations (measured in hours). An energy storage system can be either centralized or distributed and can be utility-owned, customer-owned or third-party owned. Today, there are more than 2,000 MW of installed grid connected energy storage technologies deployed worldwide with a comparable amount under development.[14]

Current Estimated Worldwide Installed Advanced Energy Storage Capacity (2128 MW as of 2010)



Why Isn't Energy Storage Being Widely Used in California?

Current California policy has not kept pace with advances in energy storage, yet energy storage can cost-effectively help address California's many energy policy challenges, such as green house gas emissions reduction, renewables integration, transmission and distribution constraints, increasing peak demand and enabling electric vehicles. Energy storage is particularly relevant, as many of these complex challenges need to be addressed in the near term, and storage technology is currently available and deployable on a large scale.

[13] Assumptions from CEC Cost of Generation Model for simple cycle peaker and standard combined cycle for off-peak base load; generation mix based on annual report of actual electricity purchases for Pacific Gas and Electric in 2008

[14] Source: StrateGen and CESA research. Excludes pumped hydro capacity, estimated at ~123 GW

Energy storage technologies are well established in other industries and market applications, such as the transportation and consumer electronic industries. Grid storage, a key component of the electric power industry, represents a large new market application for both existing and emerging energy storage technologies. Unfortunately, the electric power industry is a highly regulated industry that has historically overlooked using storage for grid optimization. As a result, current market structure does not allow for the buyer of the storage equipment to easily capture all the value streams provided by storage across the entire electric power system.

The barrier is neither the availability of a reliable energy storage technology nor its cost; the barrier is the current accounting of disaggregated benefits in a deregulated utility industry and lack of clear policy direction to utilities that energy storage is a superior alternative to gas-fired peakers. Thus, while energy storage presents compelling social and economic benefits, California's current market structure has led to underinvestment.

Key State and Federal Policy Recommendations to Realize the Benefits of Energy Storage:
Energy storage can cost-effectively help address California's many near term, complex and inter-related energy policy challenges, such as green house gas emissions reduction, renewables integration, transmission and distribution constraints, increasing peak demand and enabling electric vehicles.

State Recommendations

1) Require utilities to evaluate procurement targets for cost-effective storage deployment (e.g., AB 2514)
2) Encourage diversity in energy storage technology deployment, including market application and ownership options to foster utility, third party, and customer-owned applications
3) Fully implement SB 412 to provide Self Generation Incentive Program (SGIP) incentives for energy storage coupled with solar and used standalone on the customer side of the meter
4) Implement energy-storage focused rulemaking, require consideration of energy storage as a valued system resource in all regulatory proceedings (e.g. distributed generation, smart grid, renewables, and demand response/permanent load shifting)
5) Include energy storage in a standardized cost-effectiveness methodology applicable to all resources
6) Require utilities to include energy storage as a bidding option in peaking capacity Requests for Offers (RFOs)
7) Require storage as part of long term procurement process, including pursuing standard offers for permanent load shifting
8) Explore tariff design that encourages load shifting
9) Increase Feed-in-Tariff price for renewables firmed/shifted with energy storage
10) Accelerate the CAISO's stakeholder processes to achieve comparability of energy storage (implementation of FERC Orders 890 and 719)
11) Consider peak reduction standard for state agency power purchases
12) Clarify net metering rules for renewable energy projects with storage

Federal Recommendations

1) Support extension of the existing federal investment tax credit to energy storage systems (e.g., S.1091)
2) Add energy storage as its own category in the FERC's Uniform System of Accounts

APPENDIX

GLOSSARY[15,16]

Levelized Cost of Generation: According to the CEC, levelized cost of generation of a resource represents a constant cost per unit of generation computed to compare one unit's generation costs with other resources over similar periods. This is necessary because both the costs and generation capabilities differ dramatically from year to year between generation technologies, making spot comparisons using any year problematic. The levelized cost formula used in this model first sums the net present value of the individual cost components and then computes the annual payment with interest (or discount rate) required to pay off that present value over the specified period. These results are presented as a cost per unit of generation over the period under investigation. This is done by dividing the costs by the sum of all the expected generation over the time horizon being analyzed. The most common presentation of levelized costs is in dollars per megawatt-hour ($/MWh) or cents per kilowatt-hour (¢/kWh).

Capacity Factor: The capacity factor is specified as a percentage and is a measure of how much the power plant operates. More precisely, it is equal to the energy generated by the power plant during the year divided by the energy it could have generated if it had run at its full capacity throughout the entire year (Gross MW x 8,760 hours). For the purposes of this analysis, specifically for energy storage, the capacity factor is measured using the number of hours discharged only and does not include the number of hours used to charge the storage system.

Electric Energy Time-Shift: Electric energy time-shift involves purchasing inexpensive electric energy, available during periods when the price is low, to charge the energy storage plant so that the stored energy can be used or sold at a later time when the price is high. This is also sometimes referred to as "arbitrage."

Voltage Support: An important technical challenge for electric grid system operators is to maintain necessary voltage levels with the required stability. In most cases, meeting that challenge requires management of a phenomenon called "reactance." Reactance occurs because equipment that generates, transmits, or uses electricity often has or exhibits characteristics like those of inductors and capacitors in an electric circuit. To manage reactance at the grid system level, grid system operators rely on an ancillary service called "voltage support." The purpose of voltage support is to offset reactive effects so that grid system voltage can be restored or maintained.

Electric Supply Reserve Capacity: Prudent operation of an electric grid includes use of electric supply reserve capacity ("reserve capacity") that can be called upon when some portion of the normal electric supply resources become unavailable unexpectedly. In the electric utility realm, this reserve capacity is classified as an ancillary service.

Transmission Congestion Relief: In many areas, transmission capacity additions are not keeping pace with the growth in peak electric demand. Consequently, transmission systems are becoming congested during periods of peak demand, driving the need and cost for more transmission capacity and increased transmission access

[15] Source: CEC 2009 Comparative Cost of California Central Station Electricity Generation Technologies Report
[16] Source: SANDIA Report SAND2010-0815, Energy Storage for the Electricity Grid: Benefits and Market Potential Assessment Guide, Jim Eyer & Garth Corey (February 2010)

charges. Additionally, transmission congestion may lead to increased use of congestion charges or locational marginal pricing for electric energy.

Frequency Regulation: regulation is used to reconcile momentary differences between supply and demand. That is, at any given moment, the amount of electric supply capacity that is operating may exceed or may be less than load. Regulation is used for damping of that difference.

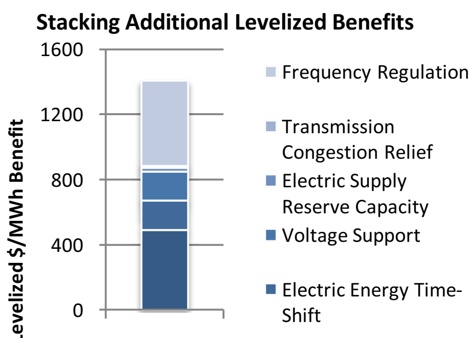
ANALYSIS METHODOLOGY: PEAKER VS. ENERGY STORAGE

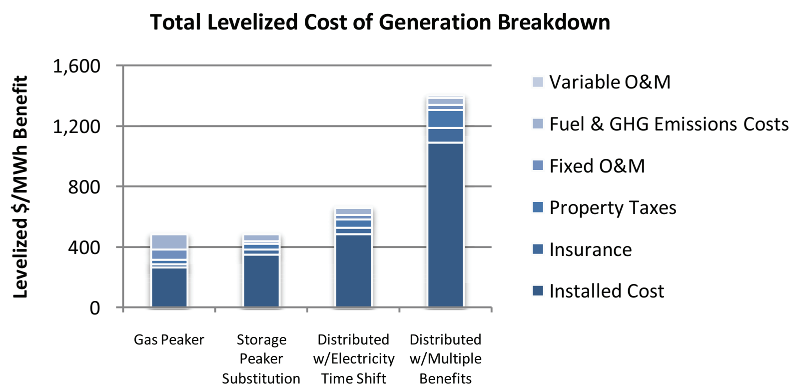
For further examination of the analysis above and access to the spreadsheet model used for the above analysis, see the following website: http://storagealliance.org/work-presentations.html

ANALYSIS METHODOLOGY: ADDITIONAL BENEFITS

Unlike a single-use centralized peaker plant, energy storage can be used for a multitude of applications beyond those of simple peaker plant substitution. When reasonable and “stackable” additional benefits are factored into the maximum allowable installed cost, energy storages’ ‘cost effective’ price point increases. This means that energy storage technologies that are technically capable of capturing these additional benefits should be cost effective even at higher installed costs.

To help illustrate the impact of additional value streams to the maximum allowed installed cost of grid-integrated storage, we utilized the midpoint of the Sandia report benefit estimate for each value stream[17], and utilized the same 20 year time horizon and targeted return for investors and solved for the maximum *increase* in installed cost of the storage system resulting from these added benefits. The incremental allowable installed cost for energy storage was then added to the maximum allowable installed cost per kWh of energy storage capacity calculated for the peaker substitution. To be conservative, we further adjusted operating assumptions for each benefit to allow for increased transaction and maintenance costs for distributed systems to arrive at the final installed cost/kWh capacity of the energy storage system, as indicated in the chart below.





[17] Source: SANDIA Report SAND2010-0815, Energy Storage for the Electricity Grid: Benefits and Market Potential Assessment Guide, Jim Eyer & Garth Corey (February 2010)

CERTIFICATE OF SERVICE

I hereby certify that I have this day served a copy of ***Comments of the California Energy Storage Alliance on Resource Planning Assumptions - Part 2 (Long Term Renewable Resource Planning Assumptions) – Track 1*** on all parties of record in proceeding ***R.10-05-006*** by serving an electronic copy on their email addresses of record and by mailing a properly addressed copy by first-class mail with postage prepaid to each party for whom an email address is not available.

Executed on July 9, 2010, at Woodland Hills, California.

Michelle Dangott

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