BEFORE THE PUBLIC UTILITIES COMMISSION
OF THE STATE OF CALIFORNIA

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OPENING COMMENTS OF THE CALIFORNIA ENERGY STORAGE ALLIANCE ON ADMINISTRATIVE LAW JUDGE'S RULING REQUESTING COMMENTS ON THE IMPLEMENTATION OF SENATE BILL 412 AND NOTICING WORKSHOP

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December 15, 2009

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Pursuant to the *Administrative Law Judge's Ruling Requesting Comments on the Implementation of Senate bill 412 and Noticing Workshop*, issued by Administrative Law Judge Dorothy J. Duda ("ALJ") November 13, 2009, ("ALJ's Ruling"), the California Energy Storage Alliance ("CESA")[1] hereby submits these comments on how the California Public Utilities Commission ("Commission") might consider implementing Senate Bill 412.

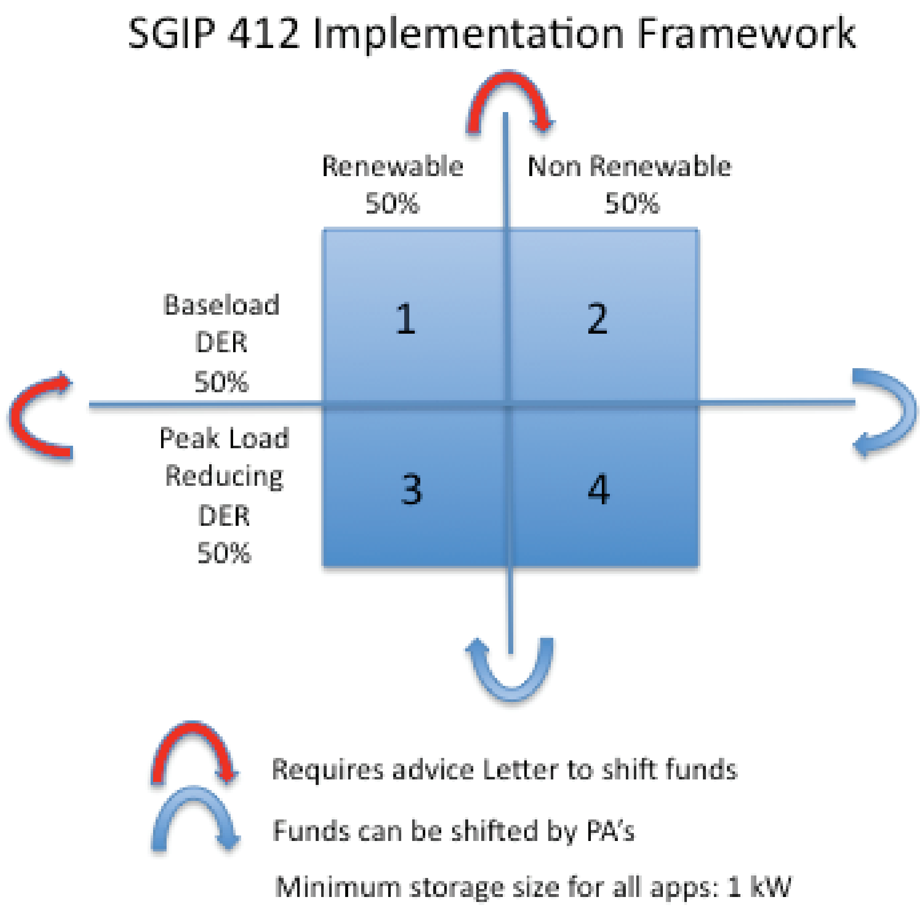
I. INTRODUCTION.

CESA is a technology-neutral, *ad hoc* advocacy group made up of renewable energy system integrators, energy storage system manufactures, renewable energy manufacturers and developers. CESA is committed to the rapid expansion of energy storage to promote growth of renewable energy and a more reliable and secure electric system. CESA's membership presently consists of A123 Systems, AltairNano, Beacon Power, Chevron Energy Solutions, EnerSys, Fluidic Energy, Ice Energy, Powergetics, Prudent Energy, PVT Solar, Suntech Power, Xtreme Power Solutions and ZBB Energy Corporation.

[1] The views expressed in these comments are those of CESA as a group, and do not necessarily reflect the views of any of CESA's individual member companies.

II. THE COMMISSION SHOULD CONSIDER IMPLEMENTING A FUNDING FRAMEWORK FOR THE SELF GENERATION INCENTIVE PROGRAM THAT EXPLICITLY ENCOURAGES PEAK LOAD REDUCTION.

In Decision 01-03-073, the Commission created the Self Generation Incentive Program ("SGIP") as a 'peak load reduction program' in response to enactment of AB 970. Consistent with this goal, CESA recommends that the SGIP's current funding framework be extended so that, in addition to renewable and non-renewable allocations, there are also allocations for peak load-reducing and baseload distributed energy resources ("DERs"), essentially creating four major funding categories as depicted below:



New eligible technologies applying for SGIP incentives would apply for one of these four funding categories. Energy storage would only apply to peak load reducing resources, and should be eligible for Category 3 and Category 4 incentives as follows:

Category 3: Energy storage coupled with any form of renewable distributed energy resource (*e. g.* wind, solar, and fuel cells operating on renewable fuel)

Category 4: Energy storage operating 'standalone' as well as energy storage technologies coupled with any form of distributed energy resource using non-renewable fuels (*e. g.* fuel cells operating on natural gas).

In each of the above categories, energy storage should be permitted to charge from the grid, and discharged during peak times. This will substantially improve California's load factor and help reduce the amount of peak demand. Energy storage should be permitted to charge directly from the renewable resource itself and/or use regenerative power *e.g*. otherwise wasted mechanical or heat energy that can be converted for use later.

Current SGIP rules require an advice letter be filed and approved to shift funds from renewable to non-renewable categories. CESA recommends that an approved advice letter should similarly be required if the SGIP Program Administrators wish to move funds from 'Peak Load reducing DERs' to 'Baseload DER' categories.

Energy storage technologies offer multiple benefits. CESA therefore proposes that energy storage systems that receive SGIP funding also be allowed to provide emergency backup power to end use customers, and/or provide ancillary services to load serving entities ("LSEs") and/or the California Independent System Operator ("CAISO"). These additional services for SGIP-funded energy storage systems should only be allowed if they are technically able to provide them reliably, and still meet onsite customers' peak demand reduction performance requirements.

III. <u>THE SELF GENERATION INCENTIVE PROGRAM SHOULD CONTINUE TO OFFER TECHNOLOGY DIFFERENTIATED INCENTIVES.</u>

The SGIP has nearly nine years of successful administration of technology differentiated incentives. CESA recommends maintaining this successful approach as it has resulted in substantial numbers of DER installations over the years, and the program has a well-established administrative process in place to ensure its continued success.

IV. GREENHOUSE GAS COMPLIANCE CAN BE TRACKED AT THE TECHNOLOGY CLASS LEVEL, BY ESTABLISHING MINIMUM EFFICIENCY AND OTHER PERFORMANCE REQUIREMENTS.

There are well-established procedures for determining minimum air quality standards for specific classes of technologies in the SGIP, such as combined heat and power. Energy storage, as a new class of technologies, does not have the same body of pre-existing third party reference studies, and efficiency and performance requirements to establish its compliance with the California Global Warming Solutions Act of 2006 (AB 32). However, taking account of the losses associated with generating and delivering power during peak load times, a net benefit in CO2 emissions reduction can be realized with the use of distributed energy storage systems. These systems effectively move more efficiently generated and transmitted off-peak energy forward in time when it can be utilized during peak hours - effectively becoming a demand-side peak load reduction mechanism. Assuming an average night-to-day ambient temperature swing of 25°F, and the associated losses avoided during off-peak generation, a distributed energy storage system must be capable of shifting on-peak energy needs to off-peak time periods with a round-trip efficiency of at least 56% in order to reduce greenhouse gases ("GHGs"). This means, anything above this minimum storage efficiency threshold would translate directly into a reduction in CO2 production thereby moving toward the GHG reduction goals set forth by AB 32.

Round trip efficiency of a distributed energy storage system is defined as the "AC-to-AC round trip efficiency"[2] of shifting on peak energy needs to off peak time periods; adjusted for avoided onsite energy needs such as offsetting energy used by an electric air conditioner unit or an electric water heater. The minimum distributed energy storage round trip efficiency requirement of 56% can be calculated by determining the minimum energy storage system efficiency required to be on-par with existing system-wide emissions resulting from the generation, distribution and transmission of electricity during the time period that an energy storage system displaces energy. The following example illustrates the calculation methodology

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[2] The AC-to-AC round trip efficiency should include inverter losses and other parasitic energy losses from the energy storage system itself, including losses resulting from the system's balance of system components. Minimum efficiency must be achieved across all ambient operating temperatures and humidity levels for the area in which the system is operating.

using Federal Energy Information Administration ("EIA") data for California peak and off-peak emissions per MWh.

Emissions Profiles using EIA 2007 data[3]:

Peak Hours Production

Natural Gas Peaker Plants:	644 kg CO2/MWh produced

Off-Peak Hours Production

Natural Gas Combined Cycle Plant:	398 kg CO2/MWh
PG&E Generation Portfolio:	247 kg CO2/MWh*
SDG&E Generation Portfolio:	396 kg CO2/MWh*

**Note: reference value only for comparison.*

The following losses were additionally modeled for the generation and distribution of energy associated with transmission and distribution losses, and reserve margin requirements:

Transformer Loss: Constant loss rate of 2.5% for the transformer occurring at all times of the day and year.

Line Loss: Losses associated to both increased ambient temperature (approx 0.2% per F of temp rise above ISO temperature (59ºF) = 5% for a 25°F swing)[4] as well as increased load at peak times as losses increase at peak times. (Applying the linear relationship between load and rate of loss equal to the average load loss divided by the regional load factor = 5% of the peak load on average[5] Line losses are proportional to the square current.)

Reserve Margin Requirements: 15% of the load served[6].

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[3] 2007 EIA Data available at: http://www.eia.doe.gov/cneaf/electricity/page/eia906_920.html. Accessed December 8th, 2009. Data analysis of this data was performed by CARB at CESA's request for purposes of preparing these comments.

[4] Grigsby, Leonard, 2007. *Electric Power Engineering Handbook: Electric Power Generation, Transmission, and Distribution*, 2nd Edition, CRC Press.

[5] *The Source-Equivalent Multiplier: The Relationship between Load Shifted On-Peak Hours and the Real Peak Generation Capacity Reduced, Ice* Energy 2009.

[6] Reserve Margin requirements established by the Commission in Decision 04-01-050 are 15-17%. *See*, the Commission's website: http://docs.cpuc.ca.gov/published/Final_decision/33625-03.htm#P237_36790 Accessed December 10th, 2009.

Case	Type	Generation		CO2 rate	Distribution Loss (%)			Reserve Loss	Storage Loss	Delivered to the Load		CO2 Produced
		MWh	When	Kg/MWh	Trans-former	Amb. Temp	Peak Load	%	%	MWh	When	kg
1	NG Peaker	1.34	Peak	644	2.5%	5.0%	5.0%	15.0%	-	1.00	Peak	850
2	CCNG	1.21	Off-Peak	398	2.5%	-	-	15.0%	-	1.00	Off-Peak	482
3	CCNG	2.14	Off-Peak	398	2.5%	-	-	15.0%	43.5%	1.00	Peak	850

Explanation of Results:

Case 1: A Natural Gas-Fired Peaker Plant would need to generate 1.34 MWh at peak time of day to deliver 1.0 MWh to the load at peak time. This 1.34 MWh of energy production would then generate approximately 850 kg of CO2.

Case 2: A more efficient combined cycle natural gas plant typically utilized for baseload power production would need to generate 1.21 MWh of off-peak power to deliver 1.0 MWh to the load during off-peak times (night). This 1.21 MWh of energy production would generate 482 kg of CO2.

Case 3: This scenario represents the delivery of off-peak-generated energy to a customer-sited energy storage system. It solves for the minimum efficiency required from a customer-sited energy storage device to achieve the same GHG profile as would be the case from a centralized natural gas peaker. The efficiency of the energy storage system translates directly into the amount of off-peak generation needed to fulfill the same 1.0 MWh of peak load. To achieve GHG neutrality (in this case, same CO2 production of 850 kg for 1MWh of energy delivered on peak), a combined cycle natural gas system would need to generate 2.14 MWh to charge a distributed energy storage system that has a minimum roundtrip AC-to-AC efficiency of approximately 56%. This is the same as a 43.5% system loss associated with an energy storage system. In sum, in order for an energy storage system to reduce GHG, it must be capable of shifting peak energy needs to off-peak time periods with a round-trip AC-toAC system efficiency of at least 56%. In addition, if the system can also be used to avoid existing energy needs (*e.g.* offsetting the energy consumed by an electric air conditioning unit or an electric water heater), the round trip efficiency calculation of the energy storage system should factor in any existing energy needs that are either reduced or avoided as a direct result of operating the system.

Due to the inefficiencies of the high demand during peak periods, standalone energy storage systems can reduce GHG emissions by storing and time shifting this energy. Therefore, CESA proposes that the Commission require a minimum of 56% AC-to-AC system efficiency for standalone energy storage systems. However, for energy storage systems coupled with renewable energy resources or regenerative mechanical/thermal power, CESA does not recommend a minimum efficiency requirement. If charged from renewable energy resources or regenerative mechanical/thermal power, an energy storage system will result in a decrease of GHG emissions regardless of efficiency. In this context, the main purpose of an energy storage system is to improve the cost-effectiveness and efficacy of the associated renewable energy resource.

V. 'STANDALONE' ENERGY STORAGE INSTALLED ON THE CUSTOMER SIDE OF THE METER, AS WELL AS ENERGY STORAGE 'COUPLED WITH OTHER DISTRIBUTED ENERGY RESOURCES', SHOULD BE ELIGIBLE FOR SELF GENERATION INCENTIVE PROGRAM INCENTIVES

Energy storage technologies, including technologies that store energy via 'electro-mechanical', 'electro thermal' and 'electro chemical' means should be eligible for SGIP incentives, as all of these technologies have the ability to store energy and displace on-peak electrical generation. CESA has provided its specific recommendations regarding the expansion of eligible energy storage technologies in the SGIP in its responses to the questions set forth in Appendix A of the Ruling, and attaches them as Appendix A - CESA's New Technology Proposal. Specific examples of eligible technologies are provided as attachments to Appendix A. These specific technology examples are provided as examples of energy storage technologies that should be included in the SGIP and are by no means exhaustive of the variety of electro mechanical, electro thermal or electro chemical storage systems that are commercialized today.[7]

Energy storage is already eligible in the SGIP when coupled with distributed wind and fuel cells, and the same rationale that led to its current inclusion in the SGIP[8] can be extended to other DER such as solar. While solar is not eligible for SGIP incentives (solar is separately

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[7] CESA plans to submit additional examples of eligible technologies prior to the planned January workshop.

[8] *See,* Decision. 08-11-044

funded through the California Solar Initiative), energy storage that is coupled with solar or other forms of eligible renewable energy resources under California's Renewables Portfolio Standard[9] should be eligible under the SGIP, even if those renewable energy sources themselves are not eligible for incentives under the SGIP. In addition to the peak load reduction benefits of energy storage, it is widely recognized that energy storage can help facilitate and accelerate the deployment of renewable energy resources. Energy storage is able to do this by increasing the value of renewable energy generated through helping to firm and deliver the renewable energy on peak and helping end users to capture demand charges. Energy storage also integrates renewable energy resources into the grid by smoothing voltage fluctuations inherent with intermittent sources of renewable energy.

SunEdison, (www.sunedison.com) North America's largest solar energy services provider, has developed a preliminary five-year forecast for photovoltaic ("PV") hybrid system usage in California starting in 2011. The forecast was developed by applying a conservative customer adoption rate limited to 50% market penetration to the anticipated and existing commercial PV systems in the state. Anticipated and existing PV systems were used with the expectation that energy storage systems will be retrofitted on PV systems already deployed. The customer adoption rate was developed by SunEdison using a combination of customer feedback, anticipated cost/benefit value for PV hybrids, and a rating system called the Pugh Decision Matrix which can be used to predict customer demand. Several of SunEdison's large government clients, including the California Department of General Services, and other large commercial retail clients with multi-megawatt PV installations in California have expressed interest in PV-storage hybrids, and initial cost/benefit analyses suggest a strong value proposition. However, it is important to note that no large scientific survey has been conducted to assess customer demand. A normal distribution with a conservative mean (5 years) and standard deviation (2.5 years) has been applied to predict the rate of dispersion of the technology starting in 2011.

California Forecast of Hybrid PV + Energy Storage Systems MW of PV -- source: Sunedison)

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[9] *See*, Renewable Portfolio Standard Eligibility Guidebook, published by the California Energy Commission.

Customer Type		2011	2012	2013	2014	2015	2016
PV+ESS Market Share		7.9%	20.9%	43.7%	72.6%	94.5%	91.0%
New MW (Retrofits and New Systems)		28.2	50.5	105.8	163.3	66.1	81.9
Cummulative		28.2	78.7	184.5	347.8	414.0	495.8

The forecast of anticipated energy storage capacity that would be installed with the PV ranges from 20-50% of the nameplate PV capacity, depending on the specific customer application/load shape.

Standalone energy storage systems should also be eligible for SGIP incentives as this application of distributed storage presents vast peak load reduction potential for millions of California ratepayers. The following information provides a 'floor' for the number of ratepayers who could benefit from standalone distributed energy storage. It is based on a Federal Energy Regulatory Commission ("FERC") study of customers with elastic demand who can participate in demand reduction without adversely affecting their operations[10]. This is the floor of the market as energy storage technology can be effectively utilized by additional commercial and industrial customers who have inelastic or elastic demand.

Commercial Customers who can provide Demand Response revenue through Load Shedding (ELASTIC).
This is a FLOOR estimate of customer demand that storage can serve by removing need to diminish operations while still reducing demand.

	2010	2011	2012	2013	2014
Primary market only					
20-200 kW CA only	310,598	315,165	319,799	324,501	329,272
20-200 kW U.S. penetration	2,254,164	2,284,855	2,315,982	2,347,552	2,379,570
Primary and secondary markets combined (including residential and very small commercial)					
0-200 kW CA only	1,942,881	1,971,447	2,000,433	2,029,845	2,059,690
0-200 kW U.S. penetration	18,661,887	18,900,937	19,143,242	19,388,849	19,637,805

10 FERC National Demand Response Potential Assessment Results, June 18, 2009 *See* http://search.ferc.gov/search/?sp_a=sp1002733d&sp_q=NADR+model&sp_k=&Go.x=0&Go.y=0&Go=Go&sp_p=all&sp_f=ISO-8859-1&sp_s=0&sp_s=1

End-use customers utilizing grid-connected energy storage for peak load reduction should be allowed to take advantage of the many benefits of energy storage for both standalone applications and applications of energy storage coupled with on-site DER funded by the SGIP. For example, end-use customers should be allowed to take advantage of the power quality enhancing benefits of energy storage. Customers should be allowed to utilize their on-site energy storage system for emergency backup purposes as well, provided that the systems are grid-connected and they are first and foremost installed for the purpose of peak load reduction or renewable resource integration (in other words, energy storage technologies whose sole purpose is emergency backup should not be eligible for SGIP funding). To the extent that such use reduces the need for on-site diesel generation for emergency backup, distributed energy storage will have additional significant local air quality benefits. Another application of energy storage that will soon be possible from a distributed footprint is the ability to sell services into the CAISO's wholesale ancillary services market. While this may be limited to larger (>500kW) installations of energy storage or distributed energy storage on an aggregated basis, this is a potential market that distributed energy storage customers should be able to participate in, even if their energy storage system received SGIP incentives.

VI. THE SELF GENERATION PROGRAM INCENTIVE STRUCTURE AND $/WATT AMOUNT CURRENTLY PROVIDED FOR ENERGY STORAGE SYSTEMS SHOULD REMAIN AT CURRENT LEVELS, BUT SHOULD BE INCREASED TO $2.50/WATT FOR APPLICATIONS OF ENERGY STORAGE COUPLED WITH DISTRIBUTED RENEWABLE ENERGY RESOURCES.

CESA generally supports the concept of performance based incentives – such incentives have demonstrated great success in renewable energy markets around the world as well as with the California Solar Initiative. However, for a performance based incentive to be successful, a robust third party financing market needs to be in place, and for the robust third party financing market to be in place, the technology class in question needs to have reached sufficient level of maturity to enable financiers/investors to appropriately price energy storage systems. Although a number of energy storage systems are commercially available today, there is not yet a sufficient body of installations in place to warrant third party investment to date. Therefore, a performance based incentive for storage at this stage in its commercialization would not accelerate deployment.

Similar to how the SGIP initially provided effective capacity-based incentives for solar PV in 2001, capacity-based incentives from the SGIP will be key to establishing greater commercial acceptance of energy storage technologies as a key tool for demand and peak load reduction. Hence, CESA recommends that the SGIP incentive for energy storage structurally remain the same at $2/Watt. However, consistent with the funding framework established for fuel cells whereby fuel cells receive a higher per watt incentive for renewable applications, CESA recommends that incentives for energy storage coupled with renewable-fueled DER also receive a higher incentive -- $2.50/Watt. This will encourage greater deployment of energy storage coupled with renewable energy resources and help facilitate the integration of intermittent renewable resources onto the grid.

Given recent activity in SGIP applications especially related to new fuel cell applications, CESA recommends that fuel cell incentives be reduced to comparable levels for energy storage to help preserve funding for a variety of technologies and to ensure that as many cost-effective new technologies as possible are enabled by the limited SGIP funds.

VII. DECLINING INCENTIVE STRUCTURES MAY BE APPROPRIATE AS MORE ENERGY STORAGE PROJECTS ARE DEPLOYED AND NEW LOWER COST TARGETS ARE ACHIEVED, BUT THERE IS NOT SUFFICIENT EXPERIENCE WITH ENERGY STORAGE TECHNOLOGIES TO DETERMINE THE RATE OF DECLINE AT THIS TIME.

Distributed grid-connected applications of energy storage for peak load reduction and integration with distributed renewable energy resources is a new market application for energy storage. Until many more megawatts are deployed and there are at least a few years of successful commercial implementation of energy storage technologies, it is premature to determine the exact rate of incentive decline at this time. The $/W amount of incentives may need to be revised in the future and it is unclear thus far as to which direction may be appropriate. SGIP incentives may need to be adjusted upwards if insufficient energy storage project applications are realized. More experience with actual projects in the field will help guide future program development.

VIII. LIFE-CYCLE COST DISCLOSURE SHOULD BE A REQUIREMENT FOR THE SELF GENERATION INCENTIVE PROGRAM IN ORDER TO ENSURE PROJECT DEVELOPER ACCOUNTABILITY.

Some SGIP stakeholders have raised concerns about ways to ensure that end-use customers achieve desired project objectives. Short of a performance based incentive, one way to ensure that end-use customers have considered the full lifecycle cost of a proposed system is to require a lifecycle cost *pro forma* at the time of their SGIP applications. This should not pose undue hardship on project developers, because this is an activity that all project developers will need to undertake in any case.

CESA has developed a ten year project *pro forma* template as an example of the cost and performance information that can be required by Program Administrators as part of SGIP incentive applications. It is attached as Appendix B. Similar project templates can be developed for other technology categories as well - such as fuel cells or combined heat and power. The objective of such a template is to ensure that the project developer is fully capturing a project's entire lifecycle cost, including the capital equipment, operations and maintenance, and the cost of replacement parts over the project's full 10 year life cycle. The Program Administrators can also check basic performance assumptions used in the *pro forma* analysis against the manufacturer's specification sheet to ensure that the technology being proposed is being appropriately applied in the market.

The Program Administrators' role should ensure that sufficient performance information has been disclosed, along with all necessary cost categories so that the end-user is properly informed. The Program Administrators' role is NOT to recommend specific vendors or to provide advice to end-use customers. Rather, they are simply providing a useful framework to help educate and guide end-use customers as to the cost categories they should consider as part of their purchase decision.

IX. SEVERAL ADDITIONAL CHANGES TO THE SELF GENERATION INCENTIVE PROGRAM COULD BE MADE IN ORDER TO INCREASE PROGRAM SUCCESS FOR DISTRIBUTED ENERGY STORAGE SYSTEMS.

CESA has identified several additional program changes that may substantially increase the success of distributed energy storage projects. For example, application fees could be reduced or waived for smaller energy storage systems. Also, owners of multiple project sites could be permitted to submit a single aggregated application in order to reduce application overhead and transaction cost.

The current four hour continuous discharge requirement may be too onerous for certain types of very 'peaky' loads. For example, loads for municipal transit authorities, car shredders, container cranes and arc furnaces tend to use peak power in higher but shorter duration power cycles. These commercial facilities could all reduce their stress on the grid during peak times by managing their loads by using fast energy storage that can smooth out the jagged load transients that cause inefficient use of the power system during peak usage hours. This would be done by smoothing out the load curve to provide power during load transients and filling in for that power in the power troughs. The facilities would then be represented by a much flatter more manageable load curve to the LSE.

In addition, some of these loads may provide an opportunity to utilize regenerative power instead of dissipating this energy in the form of heat. For example, stationary energy storage can be used to 'capture' braking power from light rail applications at a particular station and then the stored braking power can be discharged when the light rail vehicle departs the station. For this reason, CESA recommends that the minimum continuous discharge requirement be reduced to two hours with a possible exception for certain types of highly transient loads.

X. <u>CONCLUSION</u>.

CESA appreciates this opportunity to comment on the Ruling, and looks forward to working with the Commission and the parties to see Senate Bill 412 implemented in a manner that will allow the SGIP to reach its full potential

Respectfully submitted,

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Counsel for the
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Date: December 15, 2009

APPENDIX A

CESA's New Technology
Eligibility Proposal and Program Modification Request

1. Detailed System Description

Energy storage technologies, including technologies that store energy by means of 'electro-mechanical', 'electro thermal' and 'electro chemical' approaches should be eligible for SGIP incentives, as all of these technologies have the ability to store energy and displace on peak electrical generation. Please refer to Attachment A-1 through A-4 to this Appendix A for examples of eligible energy storage technologies, including detailed system descriptions outlining:

- Picture/image of the technology
- Detailed Description of the energy storage process
- Thermodynamic energy balance
- List of major system components including ancillary equipment
- Fuel type and sources
- Emission characteristics
- Electric conversion efficiency (AC to AC round trip efficiency)
- Overall system efficiency
- Expected useful life of equipment

This list is not intended to be exhaustive and energy storage, as a class, will have many different types. If a new energy storage technology meets the program requirements and other stipulated certification requirements, they should be considered for eligibility[1].

2. Proposed Incentive Level

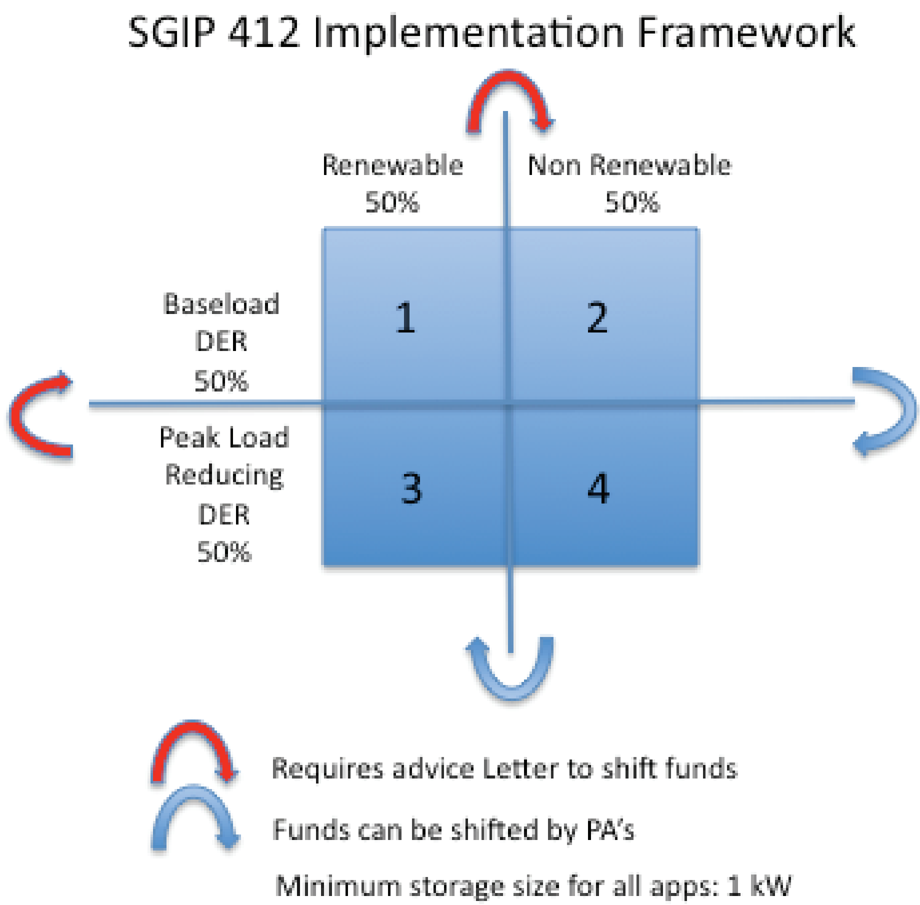
CESA recommends that the SGIP incentive for energy storage structurally remain the same, at $2/Watt. However, consistent with the funding framework established for fuel cells whereby fuel cells receive a higher per watt incentive for renewable resource-fueled applications, CESA recommends that incentives for energy storage coupled with renewable-fueled distributed energy resources also receive a higher incentive per watt -- $2.50/W. This will encourage greater deployment of energy storage coupled with renewables and help facilitate the integration of variable renewables onto the grid. Attachments A-1 through A-4 to this Appendix A

[1] CESA intends to submit additional examples of eligible energy storage technologies over time.

additionally provide an overview of installed system costs and project examples for each of the technologies listed.

Regarding changes to overall SGIP Funding Framework

In Decision 01-03-073, the Commission created the SGIP as a 'peak load reduction program' in response to AB 970. Consistent with this goal, CESA recommends that the current funding framework be extended so that in addition to renewable and non renewable allocations, there are also allocations for peak load reducing and baseload distributed energy resources, essentially creating four funding categories as follows:



New eligible technologies applying for SGIP incentives would apply for one of these four funding categories. Energy storage would only apply to Peak Load Reducing DER funding and should be eligible for Category 3 and Category 4 incentives as follows:

Category 3: Energy storage coupled with any form of renewable distributed energy resource (*e. g.* wind, solar, ocean, fuel cells operating on renewable fuel)

Category 4: Energy storage operating 'standalone' as well as energy storage technologies coupled with any form of distributed energy resource using non renewable fuels (*e. g.* fuel cells operating on natural gas)

In both of the above categories, energy storage should be permitted to charge off of the grid at night, and to be discharged during peak times. This will serve to improve California's load factor substantially and help reduce the amount of peak demand. Energy storage should also be permitted to charge directly from the renewable resource itself (wind/solar) and or use regenerative power (*e.g.* otherwise wasted mechanical or heat energy that can be converted for use later).

An advice letter should be required if the Program Administrators wish to move funds from 'Peak Load reducing DERs' to 'Baseload DER' categories.

Further, because energy storage technologies can offer multiple benefits, CESA additionally proposes that energy storage units that receive SGIP funding also be allowed to provide emergency backup power to end customers, and or provide ancillary services to the California Independent System Operator ("CAISO") or utilities if they are technically able to do so, and still meet the onsite customer's peak demand reduction performance requirements.

Given recent activity in SGIP applications especially related to new fuel cell applications, CESA recommends that fuel cell incentives fall under the same funding framework and that the per watt incentive be set at equal levels as storage to help preserve funding for multiple technologies and to ensure that many cost-effective new projects are enabled by the limited SGIP funds as possible.

3. Projected Market Potential

For a thorough discussion of market potential please refer to CESA's comments to the Ruling, page 7 under Section V titled: "'Standalone' energy storage installed on the customer side of the meter, as well as energy storage 'coupled with other distributed energy resources', should be eligible for Self Generation Incentive Program incentives"

4. Commercial Availability

A broad range of energy storage technologies are commercially available today. This Appendix A additionally provides an example list of commercially available storage technologies, including:

- History of commercial operation
- Number and locations of installations
- Vendors/distributors
- Warranty Period/coverage

5. Certifications and Testimony

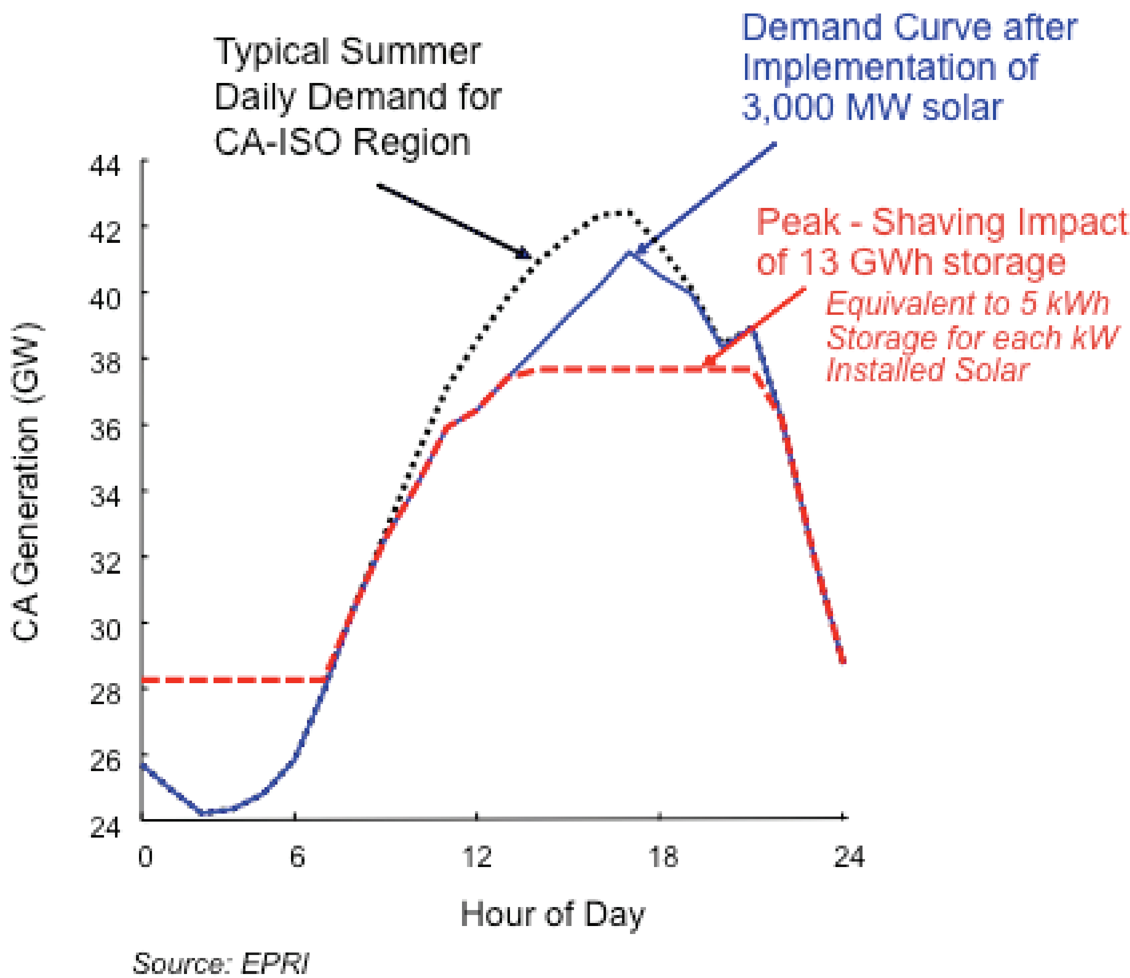
The attached samples of eligible energy storage systems provide more information on required certifications and testimony.

6. Available Capacity Sizes and Range

Energy storage should be subject to the same size requirements as currently is stipulated for fuel cells. For residential applications, a minimum size of 1kW should be sufficient.

7. Peak load reduction potential

Distributed energy storage technologies present tremendous peak load reduction potential for CA ratepayers. To illustrate this potential, the following chart provided by EPRI provides an overview of what the CAISO's load curve would look like if 5kW were installed with each kW of PV resources under the California Solar Initiative:



California's peak demand would essentially be 'flattened' and the overall system load factor dramatically improved.

8. Waste Heat and Reliability Requirements

Storage as a technology class, because it does not utilize fossil fuels, should not have minimum waste heat requirements. However, if a storage technology can demonstrate that it has the ability to capture waste heat or offset other onsite energy loads such as from electric air conditioning or electric water heating, these efficiency gains should be included in the energy storage device's overall AC-to-AC system efficiency[2].

[2] System efficiency should be defined as the AC to AC round trip system efficiency and should include inverter losses and other parasitic energy losses from the energy storage system itself, including losses resulting from the energy storage system's balance of system components. Minimum efficiency must be achieved across all ambient operating temperatures and humidity levels for the area the device is operating.

Regarding reliability requirements, the existing warranty and reliability requirements in the SGIP for energy storage systems coupled with wind or fuel cells is sufficient.

9. Renewable Fuel option

As was discussed in Section 2, above, CESA recommends that a new category of funding be set aside for peak load reducing distributed energy resources. Energy storage would fall into this major category, and can be further split into renewable and non renewable applications:

Category 3: Energy storage coupled with any form of renewable distributed energy resource (*e.g.* wind, solar, fuel cells operating on renewable fuel, or storing regenerative mechanical or waste heat energy)

Category 4: Energy storage operating 'standalone' as well as energy storage technologies coupled with any form of distributed energy resource using non renewable fuels (*e.g.* fuel cells operating on natural gas).

10. Greenhouse gas emissions requirement

For a thorough discussion of CESA's proposed greenhouse gas emissions requirements for energy storage as a class, please refer to CESA's comments to the Ruling, page 4 under Section IV titled: "'Greenhouse gas compliance can be tracked at the technology class level, by establishing minimum efficiency and other performance requirements"

ATTACHMENT A-1

ICE ENERGY, INC.

1. *Detailed System Description*
    a. *Class of Advanced Energy Storage Technology*
        i. *Electro-thermal distributed energy storage*
        ii. *Stores electrical energy in the form of thermal energy and delivers that energy in-lieu of electrical energy on a schedule during the on-peak period or as called by the schedule coordinator, or utility, or CAISO.*
        iii. *Primary use*
            1. *Load shifting of coincident peak residential and non-residential direct expansion building air conditioning systems*
        iv. *Pre-requisites for SGIP incentive*
            1. *Must be listed by the California Energy Commission as an approved direct expansion Ice Storage Air Conditioner*
            2. *Link to CEC website of approved vendors and model numbers*[1]
    b. *Applicant*
        i. *Ice Energy, Ice Bear electro-thermal distributed energy storage*[2]
    c. *Manufactured by Ice Energy, each Ice Bear unit includes:*
        i. *Energy storage module nominal specifications*
            1. *35 kWh*
            2. *8 kW generator source equivalent peak demand reduction*
            3. *6 hours of continuous operation at full load*
            4. *Unlimited cycles, full and/or partial discharging*
            5. *Electrolyte 450 gallons tap water, does not consume water*
            6. *12-14 years to first major maintenance (20 year + life)*
            7. *1 MW = 1 GWh load shift annually (greater in hot zones)*
        ii. *Electro-thermal energy storage conversion sub-system*
            1. *10 hours (typical) to fully recharge the energy storage module*
            2. *Stores off-peak electrical energy 10 pm – 8 am (typical)*
            3. *3.5 kW compressor*
                a. *electrical to thermal energy conversion*
                b. *Three phase and single phase options*

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[1] California Energy Commission Webpage listing approved Ice Storage Air Conditioners: http://www.energy.ca.gov/title24/2005standards/special_case_appliance/compliance_options/2008-06-20_APPROVED_ICE_STORAGE_AIR_CONDITIONERS.PDF

[2] Ice Energy Website: http://www.ice-energy.com/

c. *No utility interconnection requirements*
   i. *Simple over-the-counter permit*
   ii. *Set by timer or on-demand by utility*
   iii. *Charging cycle is automatic (no external control required)*

d. *No inverter, no inverter losses*

e. *No emission sources, zero emissions*

iii. *CoolData Smart Grid Controller*

1. *Imbedded measurement and data logging*
2. *Remote (on-line) validation, optimization, automated diagnostics, dynamic alerting, performance monitoring, scheduled and/or on-demand control*
3. *Highest industry Smart Grid readiness rating performed by Erich Gunther and EnerNex (90 of 100)* [3]
4. *Remote Terminal Unit*
   a. *Current sensors used to determine*
      i. *Energy storage kWh*
   b. *Pressure and temperature sensors*
      i. *Automated diagnostics and performance monitoring*
   c. *On-line, two way control*
      i. *Standard wireless card (G3 AT&T typical)*
      ii. *Unlimited connectivity options as specified*
   d. *Webserver*
      i. *Supports field service using I-Phone or portable computers*
   e. *Datalogger*
      i. *Records sensor values up to twice a minute. Memory holds approx 100,000 values.*
   f. *Sensorbus*
      i. *Extensible I/O*
         1. *Supports existing building continuous commissioning with monitoring and performance management of building HVAC equipment*
      ii. *Supports direct load control for automated demand response*
   g. *Optimization*

[3] SmartGrid News Website:
http://www.smartgridnews.com/artman/publish/reviews/Ice_Bear_Energy_Storage_System_90_out_of_100.html

                i. *Supports advanced control capability such as PID control for improved HVAC control, building pre-cooling, HVAC unit cycling*
        h. *Ice NOC*
                i. *Network operations center for Ice Bear units*
                ii. *Polls and collects data from individual Ice Bear units*
                iii. *Push reprogramming of individual Ice Bear units*
                        1. *Enables utility on-demand, day of, day ahead, and seasonal scheduled control*
                        2. *Supports individual unit and aggregated command sets for individual Ice Bear store energy, use stored energy control: by building, by distribution feeder, by substation, or by wide area*
                iv. *Data Historian and Archival*
                        1. *OSIsoft Pi Enterprise Server*
                        2. *Supports measurement and validation reporting*
                        3. *Meets and exceeds security requirements*

d. *Thermodynamic Efficiency*
    i. *Interconnected to the utility on the customer side of the meter*
    ii. *Net Zero energy balance (zero annual round trip energy losses) as measured by the building electrical meter*
    iii. *Listed as an approved device by the California Energy Commission*[4]
        1. *Title 24 Building Energy Efficiency*
            a. *2008 Non-Residential and Residential Code manual*
        2. *Extremely high energy efficiency compliance credit for HVAC equipment*[5]
        3. *Qualifies for LEED Energy & Atmospheric Points*
    iv. *30% or greater reduction in generator source energy fuel (typical*[6]*)*

e. *Equipment Life*
    i. *12-14 years to first major maintenance*
    ii. *20+ years asset life*

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[4] California Energy Commission Webpage listing Ice Bear 30 unit approval: http://www.energy.ca.gov/title24/2005standards/special_case_appliance/compliance_options/2008-06-20_APPROVED_ICE_STORAGE_AIR_CONDITIONERS.PDF
[5] Source California Energy Commission Staff Report: CEC-400-2006-006-SF
[6] Source California Energy Commission Staff Report: CEC-P500-95-005

iii. *Over 3 million hours of field run time*
iv. *Over 200 existing installations*
v. *Over 20 successful utility 2 year field trials*
    1. *Including California Investor Owned Utilities, SCE, Sempra, PG&E, and California Public Utilities: SMUD, Redding, Anaheim, Azusa, Burbank, Glendale, IID, LADWP, Pasadena, Riverside*
vi. *Zero lost customers*
vii. *Annual preventative maintenance schedule ~ 1 hour labor*
viii. *Continuous real time Equipment Health Management with scheduled, predictive, and reactive maintenance alerts.*

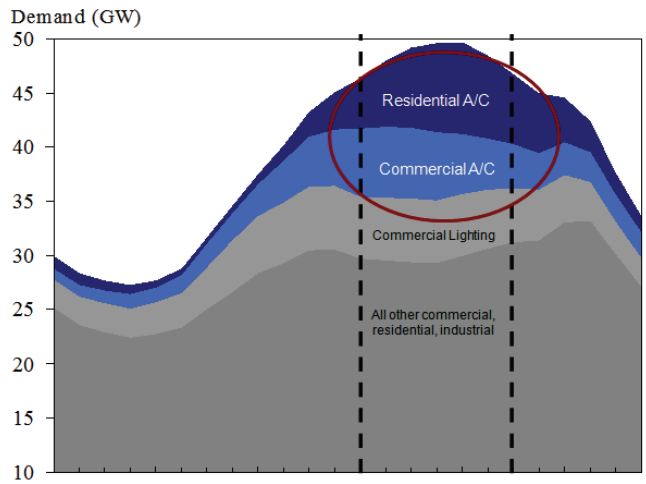
f. *Pictures of Equipment*
   i. *Informative technical video*
      1. *Visit California, Redding Electric Utility Website*
         a. *http://www.reupower.com/*
         b. *Click on the Ice Energy Logo*
         c. *Sound required, runs 4 minutes*

   ii. *Picture of Napa Community College*

iii. Picture of National Chain Movie Theatre

iv. Picture of National Chain Box Retailer

g. *California Market Potential*
   i. *380,000 Units ~4 Gigawatt Total Addressable Market*
      1. *15 GW summer thermally driven peak*
         a. *~ 20% associated with Residential buildings and*
         b. *30% associated with Commercial Buildings*
         c. *California Summer System Load Profile*



   ii. *Primary Market*
      1. *93% of existing and new non-residential buildings*
         a. *office, restaurant, retail, education, municipal buildings*
         b. *Military, Government, Institutional buildings*
      2. *Small data centers*
      3. *Telecom and Cell site*
   iii. *All buildings in combination with Solar*
   iv. *Secondary Market*
      1. *Residential buildings*
         a. *New construction residential buildings*
         b. *Retrofit residential buildings*
      2. *Refrigeration*
         a. *Grocery store racks*
         b. *Outdoor air pre-cooling*

END OF ELECTRO-THERMAL SGIP APPLICATION

<u>**ATTACHMENT A-2**</u>

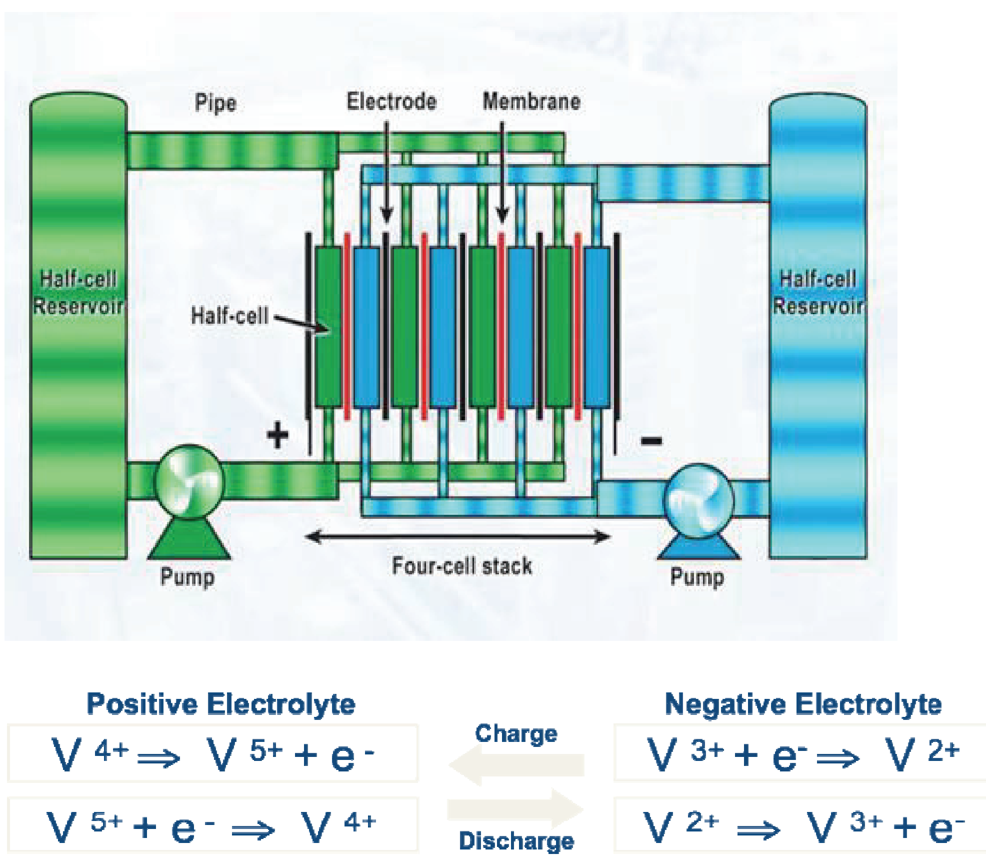
PRUDENT ENERGY, INC.

Prudent Energy Inc. (Prudent Energy) is an energy storage technology developer, manufacturer and systems integrator, specializing in the patented VRB Energy Storage System (VRB-ESS™). With a global market focus, Prudent Energy provides high-quality environmentally safe, energy storage systems and solutions (VRB-ESS) to improve power quality and reliability, enable large-scale penetration of renewable energy generation, and improve the efficiency of energy distribution.

1. <u>Detailed System Description</u>

The VRB Energy Storage System (VRB-ESS) is an electrical energy storage system based on the patented vanadium-based redox regenerative fuel cell that converts chemical energy into electrical energy. Energy is stored chemically in different ionic forms of vanadium in a dilute sulphuric acid electrolyte. The electrolyte is pumped from separate plastic storage tanks into flow cells across a proton exchange membrane (PEM) where one form of electrolyte is electrochemically oxidized and the other is electrochemically reduced. This creates a current that is collected by electrodes and made available to an external circuit. The reaction is reversible allowing the battery to be charged, discharged and recharged.

1.1 <u>System Illustration</u>



- 4MW x 1.5 hour (50% pulse factor) VRB-ESS Grid-Coupled Wind Smoothing Tomamae, Japan – started in 2005
- Accurate continuous on line SOC measurements – no overcharge risk no split charge / discharge strings
- 270,000 partial cycles in 3 years

1.2 Fuel Type and Resource.

The VRB-ESS is charged either from grid power or from on-site resources, such as wind or solar.

1.3 Emission Characteristics.

There are no emissions from the VRB-ESS system when operating.

1.4 Overall System Efficiency

The round-trip DC/DC efficiency is 80-85%. Round-trip AC/AC efficiency is 70-75%.

1.5 Expected Useful Life.

Cell stack replacement is required in 12-15 years. Performance life of the cell stacks is in excess of 10,000 full depth charge/discharge cycles. Balance of plant items, such as pumps, are replaced on a 10-12 year cycle. During the charge/discharge cycle the vanadium element ranges over the four different valence states, merely a function of oxidation levels. Consequently there is no cross-contamination of the electrolyte between positive and negative sides of the system, resulting in an infinite life of the electrolyte.

1. Proposed Incentive Level

Capital costs range from $5,000/kW for a 30 kW system to $2,700/kW for a 5 MW system. Proposed incentive levels are $2/watt and $2.50/watt depending upon application.

2. Projected Market Potential.

To support a proposed 33% RPS by 2020, it is estimated California will require 4GW of energy storage. Annual fast storage deployment (<15 min duration) for frequency regulation is estimated at 50MW. Annual deployment of storage for load management (~ 5 hours duration) is 450MW.

3. Commercial Availability

The VRB-ESS is available in two basic modules, 5kW and 150 kW. The 150kW module is used as the building block for systems up to 10MW. The unique nature of the VRB-ESS enables it to be independently scaleable in power and energy. Power is determined by the number of cell stacks and the rating of the power conversion system. Energy is determined by the amount of electrolyte to be stored. Standard warrant policy is 2 years of coverage. Extended warranty coverage is available as an option.

The largest commercial installation is illustrated in section 1.1. The largest installation in the USA was a 250kW – 2MWh system installed as a capital deferral project at Castle Valley, Utah for PacifiCorp.

4. Certifications & Testimony

Not available.

5. Available Capacity Sizes & Range.

The eminently scalability of the system allows systems to be configured that meets the minimum and maximum project size requirements of 30kW and 5MW.

6. Peak Load Reduction Potential.

The VRB-ESS is able to manage peak reduction in a number of ways. It can be charged with off peak energy, which is stored and later discharged to effect peak reduction. It can also be used to make the solar peak coincident with the load peak. The flexible nature of sizing the VRB-ESS means that the amount of electrolyte needed to accommodate such a shift in peak can easily be installed at the appropriate location.

7. Waste Heat

Not applicable.

8. Renewable Fuel Operation.

The VRB-ESS has a role in integrating renewable resources onto the grid. However, it does not consume fuel in its operation.

1. Greenhouse Gas Emissions Requirement.

The VRB-ESS assists in greenhouse gas emission reduction by managing the peak load requirement and thus converting high emission on-peak generators to lower emission base-load generators typically used in the off-peak periods. In addition, where VRB-ESS is used in a wind-diesel hybrid or solar-diesel hybrid installation, the run-time of the diesel generator is significantly reduced. In addition, the diesel generator sees the VRB-ESS as a constant load and thus runs at a more efficient level with a much reduced emission signature. The July 2008 U.S. Department of Energy (DOE) report "20% Wind Energy by 2030: *Increasing Wind Energy's Contribution to U.S. Electricity Supply" discusses the scenario in which integration of 300 gigawatts (GW) of wind energy into the U.S. grid is achieved. To deal with the variability of the wind energy output, approximately 50 GW of new peaking plant gas turbines would be used to supplement or compensate for the variability of the wind power's output. Energy storage could serve a portion of this needed capacity.*

ATTACHMENT A-3

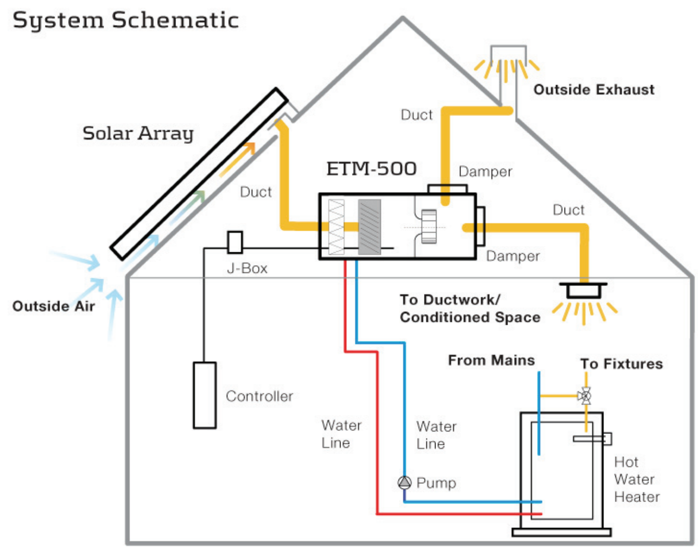
PVT SOLAR, INC.

1. Detailed System Description

a. Applicant:
   i. PVT Solar, Inc.[1]

b. Technology:
   i. Echo Solar System

c. Echo Solar System Schematic



d. System Storage Components:
   i. PVT-1000 System Controller
      1. Two-way communication
      2. Captures system data every 15 minutes
   ii. Pre-cooling / Pre-heating Algorithms
   iii. Graphical User Interface for remote web access
      1. PC/internet access
      2. i-phone application access
   iv. User-defined high and low temperature set points
   v. Building Thermal Mass
   vi. Solar Hot Water Tank
   vii. ETM-500 Energy Transfer Module for Water Heating
   viii. Enterprise Data Server for monitoring and verification of load shifting
      1. Stores system energy data in 15-minute intervals
      2. Unlimited data storage capacity

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[1] PVT Solar Website: http://www.pvtsolar.com

        3. Secure data access
    ix. (Storage components are installed in conjunction with a PV and/or Thermal modules array, though the array is not part of the storage system.)

e. How it works:
    i. Cooling: Cool night air is used to lower the building temperature as close to the low set point temperature as possible. Pre-cooling strategies use the building's air conditioning to lower the building's temperature prior to peak demand hours. Cool energy stored in the building's thermal mass shifts part of the building's peak cooling demand to off-peak hours.
    ii. Heating:
        1. Hot air from the solar array is used to raise the building temperature to a high set point temperature and thereby 'soaks' the building's thermal mass. Pre-heating strategies may also use the building's heating system to raise the building's temperature to the set point. Warm energy stored in the building's thermal mass shifts the building's peak heating demand to off-peak hours. This especially applies to summer heating in marine climates.
        2. Hot air from the solar array is used to raise the solar water tank temperature to the set point. Pre-heating strategies may also use the water tank's electric heating capacity to raise the water temperature to the set point. Warm energy stored in the water tank's thermal mass shifts the peak heating demand to off-peak hours.

f. Market:
    i. All buildings in combination with solar
        1. Residential Buildings – primary market
        2. Non-Residential Buildings – secondary market
    ii. About 75 systems existing or under contract

g. Storage Class: Electro-thermal distributed energy storage
    i. Stores thermal energy and delivers that energy in-lieu of electrical energy during the on-peak period.
    ii. Primary use is peak load shifting for cooling in residential and non-residential buildings
    iii. Secondary use is peak load shifting for heating in residential and non-residential buildings with electric heating.

h. Source Fuel
    i. Utility base-load electricity
    ii. Cool night air + radiant night sky cooling

i. System Energy storage Information
    i. 15 kWh capacity
    ii. 1.8 kW generator source equivalent peak demand reduction
    iii. Unlimited cycles, one cycle per day
    iv. 14 hours (typical) to fully 'soak' the building's thermal mass

j. System Efficiency:
   i. Thermodynamic Efficiency: 100%
   ii. Electric Conversion Efficiency: ~120%
   iii. Overall System Efficiency: 120+%

k. Emission Characteristics:
   i. Reduces emissions
      1. Shifts load from peak to off-peak as described; with marginal emissions from peaker plants at about 167% of base-load combined cycle plants
      2. Comfort band set-points, in addition to enabling peak-load shifting, also enable energy savings during off-peak periods.

l. System Maintenance Requirements
   i. 10 years to first major maintenance (20+ year life)

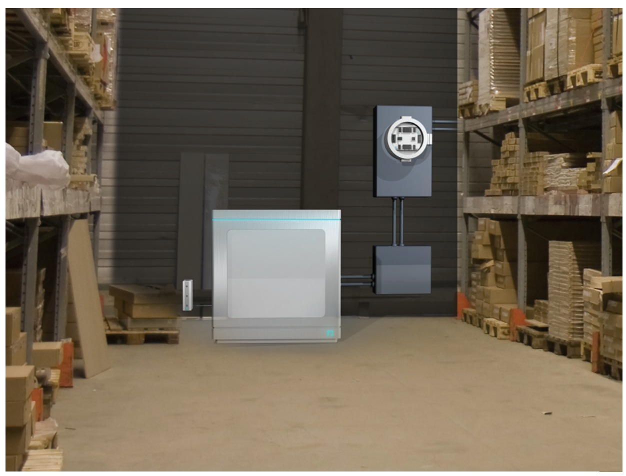
<u>**ATTACHMENT A-4**</u>

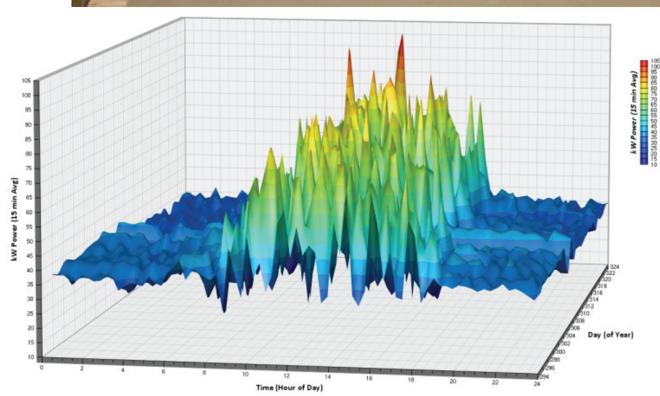
POWERGETICS INC.

1. Detailed System Description

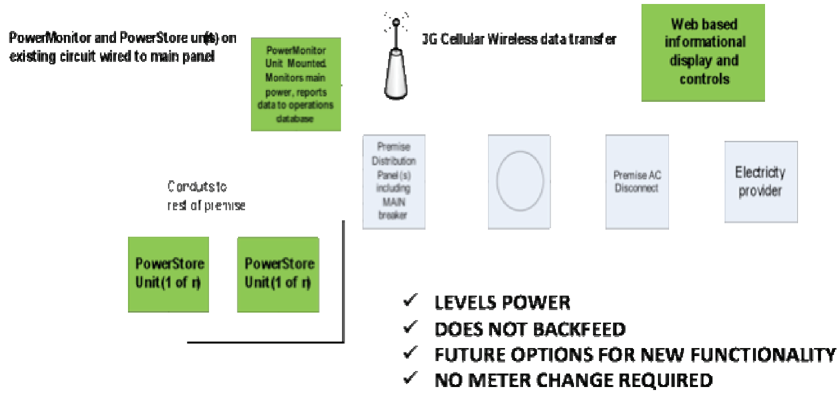
The Powergetics systems is a multi-function advanced energy and power control storage system that relies on highly accurate metering and telemetry functionality added immediately downstream of the utility meter on the customer's side of the utility connection. Driven by advanced predictive models, the system is operated by a small, onboard computer system built on industry standard, commercial-off-the-shelf (COTS) operating systems. Networking of multiple units to one another and the central control facility is enabled with the use of commercially available wired and wireless networks. The on-premise smart grid distributed storage units are advance Lithium-iron-phosphate and Lithium-iron-magnesium-phosphate batteries manufactured commercially in the United States.

System Illustration:



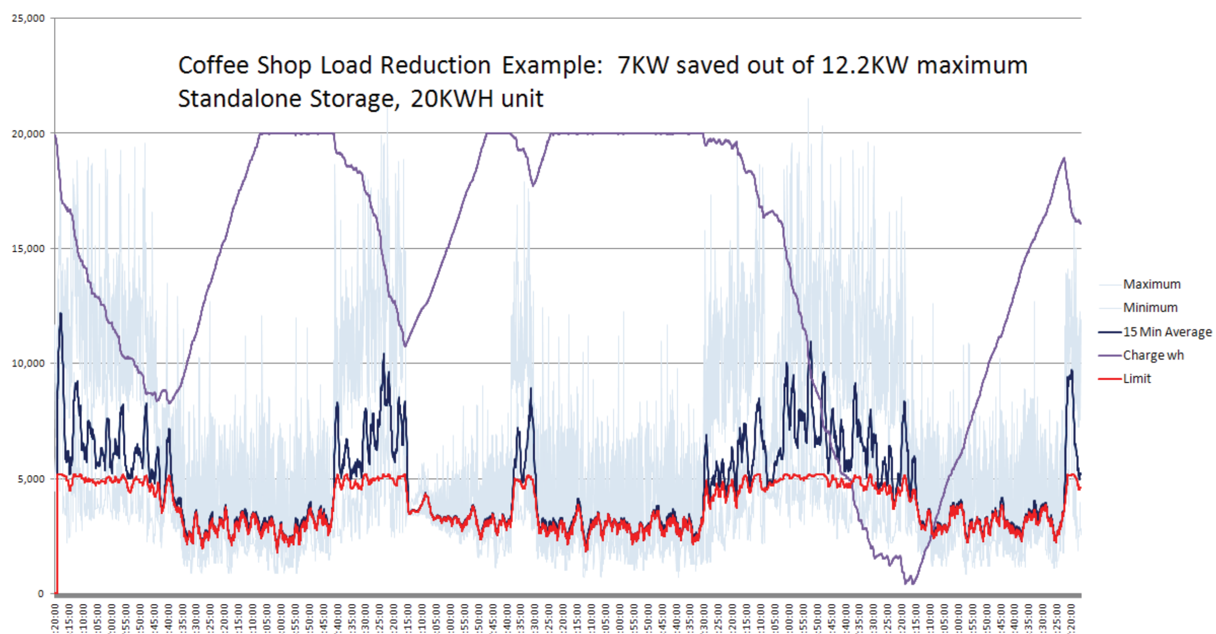


Example system installation showing power meter, associated SIM, SMP, ESU and External Communications Unit.



These capabilities result in a smoother and leveled power appearance to the utility and reduce the peak demand levels reached by any given site. This limiting of the demand and smoothing results in significant savings for the commercial customer and eases the volatility seen by the grid operator. If a renewable power source is present at the site, the system, using patent pending techniques, takes the power generation characteristics of that generator into account in determining its charge/discharge timing so as to maximize the power impact over time for the site. The customer is able to view, with minimal delay, the power activity in their premise.

This system has been fielded and shown to reduce peak power levels significantly as shown in this illustration from one of Powergetics' field test sites:



Connecting to the Customer and the Grid

Powergetics systems consist of installation methods and tools consisting of a dedicated workforce using industry standards as set by the National Electrical Code and local building departments for grid connected generation (IEEE 1547). Installer teams consist of licensed electricians with some specialized training for Powergetics equipment.

The following connection specifications are adhered to:

- Through permanent non-service interrupting process, the equipment is installed at customers via the physical placement, and electrical/communication interconnections of devices. All equipment is UL/CSA approved. Connections and placement adhere to local/state/federal codes and NFPA 70 safety procedures, protection and precautions.
- All installed equipment include methods to maximize security through tamper prevention/detections. In the event of system intrusion or tampering, the charge/discharge function is disabled by an interactive failsafe control and requires resetting by qualified personnel.
- Installation data management and capture is secured by IPSEC 128 bit (or better) encryption, and controlled by workforce management tools (remote wireless enabled terminals) that ensure efficient, accurate and secure deployments.
- End-to-end validation and proper function is performed onsite via a specialized software application prior to commissioning and departure from the site.
- Internal communications is via powerline carrying encrypted TCP and higher layers. The PLC communication is designed to be secure, and fully non-interfering with other PLC systems on the same premise.

Data Collection

System operation is monitored and system effectiveness is measured with remote system deployments with an extensive data monitoring and collection infrastructure. Data sensors measure data at various points in the system and forward the encrypted, compressed data to the central data store.

Data collected at the deployment sites is transferred securely (through a VPN/IPSEC tunnel) to the central data store for analysis using the data transmission infrastructure. All data communications is digitally certified and encrypted using multiple cryptographic layers, such that the data source is verified, and the transmission is protected from compromise.

Data collected and reported from all of the remote storage system deployment sites is consolidated in a central data store for various downstream uses. Centralized trend and pattern analysis can be performed, and single site, and multiple site aggregation, can be reported.

Operating the System to Enhance Smart Grid Functions

Power and energy measurements are collected and transmitted to the onsite controller where power release or charge is performed for each site. Various power and voltage characteristics can be derived and monitored both by site and system wide (including geographic placement). These include: Power Factor, Voltage, Distortion, actual power levels and power levels as they would have been without a system in place. The customer data on activity is consolidated, compressed and securely transmitted to the systems operations center where it is uploaded and enabled for viewing via secure web pages with differing data presented for end customers, company operating and maintenance personnel and necessary utility/ISO partners.

Patent pending advanced control techniques will also tie in any distributed Solar, Wind or Fuel Cell generation being performed on a customer premise. Based on current customer site tests (and corroborated by larger scale tests run by ZBB[1] with PG&E in San Ramon[2]) analysis has shown the system to enhance power contribution effectiveness of these variable generators from a fraction of their rated power (i.e. Solar at 1KW delivers only a fraction of that in terms of average Demand reduction) to a near one-to-one relationship. This improves the financial and technical performance of these normally expensive and variable generation sources. In PG&E territory under existing rate schedules this has as much as a 33% to 87% improvement in the financial return for a customer and up to a 100% improvement in STABLE power contribution from a variable sources such as Solar.

Assessing and Optimizing for the Smart Grid

All operational performance data both during baseline and ongoing operations is collected and stored in the company's secure datacenter to enhance and refine the load leveling and Demand Reduction capabilities of the system.

Fuel Type and Source

As the Powergetics system is charged from AC power it uses either grid supplied power or local generation as available in the customer location.

Emission Characteristics

No emissions are generated by use of the Powergetics system. As detailed in later sections Powergetics sees that use as planned will reduce GHG generation.

Electric Conversion Efficiency

Inverter efficiency is 95% nominal under full load. Charger efficiency is 97% under full load.

Overall System Efficiency

Overall efficiency in typical use as intended is 90% round trip. This si subject to some variance due to local system conditions, grid quality and site load.

Expected Useful Life

System life is warranted for not less than 10 years with ¼ of 1% capacity reduction per year in normal use. Excessive or harsh use out of specified parameters will reduce. Current MTBF/FIT estimates show a 15+ year useful life with high confidence.

[1] Sandia National Laboratories, *Energy Storage Systems*, http://www.sandia.gov/ess/About/cec-doe.html

[2] ZBB Energy Systems, ZBB…*Achieves Milestone Performance Results for Energy Storage System*, http://www.zbbenergy.com/pdf/ZBB_AnnounceCalTestResults.pdf

2. Projected Market Potential

The information derived from this table is based off of a FERC study of customers with elastic demand who can participate in demand reduction. This is the floor of the market as storage technology can be utilized by commercial and industrial customers who have inelastic or elastic demand.

Commercial Customers who can provide Demand Response revenue through Load Shedding (ELASTIC). This is a FLOOR estimate of customer demand that storage can serve by removing need to diminish operations while still reducing demand.					
	2010	**2011**	**2012**	**2013**	**2014**
Primary market only					
20-200 kW CA only	310,598	315,165	319,799	324,501	329,272
20-200 kW U.S. penetration	2,254,164	2,284,855	2,315,982	2,347,552	2,379,570
Primary and secondary markets combined (including residential and very small commercial)					
0-200 kW CA only	1,942,881	1,971,447	2,000,433	2,029,845	2,059,690
0-200 kW U.S. penetration	18,661,887	18,900,937	19,143,242	19,388,849	19,637,805

3. Commercial Availability

Powergetics equipment has been in deployment since 2008 and should standalone AES be listed as an eligible application technology, Powergetics will submit via the PMG to the SGIP working group as new technology. Powergetics technology is UL1741/IEEE1547 compliant and meets appropriate nationally recognized standards.

4. Available Capacity Sizes and Range

Powergetics systems are modularized with a battery array which can be configured between 5 kW to 24 kW. The Powergetics systems installed in a location will not be greater than the customer's peak power consumption. Units may be "stacked" for larger overall capability or multiple phase support.

5. Peak Load Reduction Potential

Economic Benefits of Grid Connected Energy Storage

Lower Electricity Cost by Customer

Flatten load curve (peak period load is flat): As power is leveled and volatility of the power demand is reduced, the amount of electricity that end customer is charged is reduced. Businesses with demand charges can expect to reduce the gross electric bill for by up to 15%.

Lower Peak Demand

A given customer can expect to reduce the peak demand for their businesses by up to 40% of their monthly peak demand on average.

Lower Transmission and Distribution losses

Optimized Transmission and network: As the unit is charged and stored during off peak periods this load will not be present during peak hours.

Generation closer to load (distributed generation): In this situation, Powergetics smart power system improves the power impact of distributed generation sources, such as solar and wind by up to 100%. These distributed generation resources become more effective in reducing peak demand and extending distribution and transmission capacity.

Reduced Transmission and Congestion Costs

Increased transmission transfer capability without building additional transmission capacity is anticipated due to the flattened peak period load profile when the product is in operation and sufficiently deployed. This increases the effective value of a connected transmission resource as more usable power can be delivered via the same resource.

Reduced Cost of Power Interruption

Fewer shortages of power are expected due to the additional reserve that is firm and dispatchable.

6. Greenhouse Gas Emissions Requirement

Environmental Benefits

Reduced Damages As A Result Of Lower GHG/Carbon Emissions

Lower electricity peak demand usage: By shifting and converting energy stored at night when greenhouse gas emissions for base load generation are very low due to the high percentage of nuclear, large hydro, and wind to offset peak period demand which is powered by much more polluting fossil plants. Up to 30% of California's daily power mix during peak hours is coal/oil fired from out of state according to data collected under AB32 and reported by California Electric Commission. Our study indicates that each unit in full operation will reduce peak period carbon production by approximately 3.4 pounds per day or approximately 12,418.5 lbs per unit over 10 years, not counting the renewables impact of stabilizing locally connected solar or wind.

Lower T&D losses from generation closer to load distributed generation is achieved through the combination of preinstalled and new solar installations.

Lower emissions from generation from

(a) Increase efficiency of renewable energy (RE) and releasing energy at peak demand. 40% improvements from synergy alone.

Synergy Example:

Advanced Energy Storage (Powergetics) combined with Solar at Gas Station

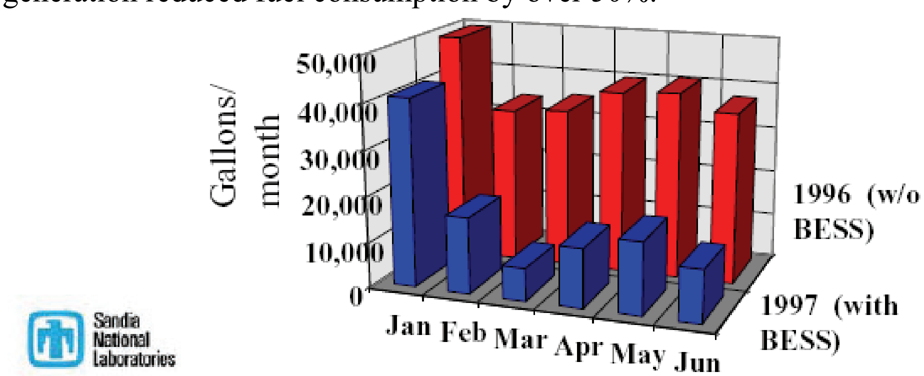
Solar: 20KW Solar PV (Sanyo 205W panels with Enphase micro inverters)

AES: 55KW Discharge Powergetics SmartPower System

Gas Station Site: 87.41 KW Peak Demand (15 min), Average KW: 41.86

	Load Max Demand	Max Demand with System:	Net KW Demand Reduction:
Powergetics AES & Solar Combined	**87.41**	**44.92**	**43**
Powergetics AES Alone:	**87.41**	**58.69**	**29**
Solar Alone:	**87.41**	**77.45**	**10**
		Net Synergy (KW):	***4.00***

(b) Operating generators efficiently because of a flattening and stability of the demand curve (1) and proven by Sandia National Labs study of Metlakatla Island in Alaska where they showed coincident installation of energy storage with generation reduced fuel consumption by over 50%.



(c) Avoiding additional generator dispatch with load response is achieved by the flat load profile presented by equipped businesses. Although this will not totally flatten the load profile, it will substantially smooth it resulting in reduced generator fuel consumption.

(2) Metric:

(a) Each of our products saves 3.4 pounds of carbon emissions per day/20kWh unit or 1,241 lbs per year.

(i) An average car emits 10,000 lbs of carbon per year.

(ii) Approximately 8 Powergetics units remove the equivalent of a car off the road.

Statewide Impacts of Energy Storage:

1) Different power sources in regions have different CO2 outputs:

Table 4. Estimated Carbon Dioxide Emissions Rate From Generating Units at U.S. Electric Plants by Census Division, 1997 and 1998
(Pounds per Kilowatthour)

Census Division	1997					1998				
	Average [a]	Coal	Petroleum	Gas	Other [b]	Average [a]	Coal	Petroleum	Gas	Other [b]
New England	1.215	2.046	1.814	1.128	2.845	1.091	1.873	1.748	1.054	2.480
Middle Atlantic	1.091	2.067	2.052	1.122	3.466	1.119	2.059	1.889	1.366	3.328
East North Central	1.683	2.114	2.536	1.115	1.696	1.676	2.105	2.233	1.249	1.609
West North Central	1.738	2.274	1.540	1.515	3.369	1.768	2.262	1.751	1.596	2.864
South Atlantic	1.370	2.046	1.827	1.085	3.804	1.349	2.022	1.827	1.162	3.311
East South Central	1.453	2.042	1.898	1.726	NM	1.445	2.048	1.507	1.733	3.791
West South Central . . .	1.456	2.204	2.976	1.317	NM	1.431	2.213	2.810	1.270	NM
Mountain	1.540	2.204	1.864	1.254	NM	1.572	2.179	2.803	1.255	-
Pacific Contiguous	0.382	2.211	2.198	1.288	2.431	0.421	2.158	2.385	1.283	1.819
Pacific Noncontiguous .	1.598	2.221	1.904	1.373	3.108	1.532	2.223	1.726	1.375	2.791
U. S. Average	**1.350**	**2.123**	**1.943**	**1.255**	**2.948**	**1.352**	**2.112**	**1.857**	**1.277**	**2.580**

[a]Average output is the ratio of pounds of carbon dioxide to total kilowatthours produced from all energy sources (fossil fuels and nonfossil energy sources) in a region or the Nation.
[b]Other includes municipal solid waste, tires, and other fuels that emit anthropogenic CO_2 when burned to generate electricity.
– = Not applicable.
NM = Data are not meaningful because generation and fuel consumption for this fuel type respresented less than 0.5 percent in the region.
Note: Data for CO_2 emissions for 1998 are preliminary.
Sources: • Energy Information Administration, Form EIA-759, "Monthly Power Plant Report";Form EIA-767, "Steam-Electric Plant Operation and Design Report; Form EIA-860B, "Annual Electric Generator Report - Nonutility," 1998; and Form EIA-867, "Annual Nonutility Power Producer Report," 1997. • Federal Energy Regulatory Commission FERC Form423, "Monthly Report of Cost and Quality of Fuels for Electric Plants."

California imports ~30% power for part/peak use, with varying carbon footprints of that power based on time of day it is used

2007 Total System Power in Gigawatt Hours

Fuel Type	In-State Generation	Northwest Imports	Southwest Imports	Total System Power	Percent of Total System Power
Coal*	4,190	6,546	39,275	50,012	16.6%
Large Hydro	23,283	9,263	2,686	35,232	11.7%
Natural Gas	118,228	1,838	16,363	136,063	45.2%
Nuclear	35,692	629	8,535	44,856	14.8%
Renewables	28,463	6,393	688	35,545	11.8%
Biomass	5,398	837	1	6,236	*2.1%*
Geothermal	12,999	0	440	13,439	*4.5%*
Small Hydro	3,675	4,700	18	8,393	*2.8%*
Solar	668	0	7	675	*0.2%*
Wind	5,723	857	222	6,802	*2.3%*
Total	**209,856**	**24,669**	**67,547**	**302,072**	**100.0%** [3]

[3] California Power by source (CEC Data)

2) California power by source crossed against fuel type carbon

		Share of Fuel type		
	Lbs of CO2 per KWH (US Average)	In-State Generation	Northwest Imports	Southwest Imports
Oil:	1.8570			
Coal:	2.1125	1.39%	2.17%	13.00%
Hydro:	0.0000	7.71%	3.07%	0.89%
Natural Gas:	1.2770	39.14%	0.61%	5.42%
Nuclear:	0.0000	11.82%	0.21%	2.83%
Renewables:		9.42%	2.12%	0.23%
Biomass	2.5800	1.79%	0.28%	0.00%
Geothermal:	0.0000	4.30%	0.00%	0.15%
Small Hydro:	0.0000	1.22%	1.56%	0.01%
Solar:	0.0000	0.22%	0.00%	0.00%
Wind:	0.0000	1.89%	0.28%	0.07%
** Embedded energy not calculated.				
http://www.eia.doe.gov/fuelelectric.html		69.47%	8.17%	22.36%

ANNUAL Carbon Savings (tons) at Market Penetration (CA Only)		*Equivalent Cars Removed from Road*	*Equivalent Acres of Trees Planted*
1%	240,364	69,691	185,842
5%	1,201,820	348,455	929,212
10%	30,207,200	8,758,249	23,355,330
25%	75,518,000	21,895,622	58,388,325

3) Shifting Low Carbon Energy to displace High Carbon Energy using Storage can reduce CO2 without any Generator, T&D or other upgrades and does not require any behavioral change by the consumer.

APPENDIX B

StrateGen
Strategies for Clean Energy

APPENDIX B

StrateGen AES Model

Model Notes

General Notes:

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Assumptions:

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StrateGen
Strategies for Clean Energy

StrateGen AES Model

Model Inputs

General Project Specifications

Electricity Price Escalation Rate	4.5%		Real + General Inflation, increases are applied to current peak and off peak rates today
Off Peak Electricity Price	0.0650	$/kWh	Average off peak electricity price in Year 1
Discount Rate	7.0%		7% Recommended; also the target IRR for MAP
O&M Escalation Rate	2.0%		2.0% Recommended
Insurance Escalation Rate	2.0%		2.0% Recommended
Physical Address of Project	Street, City, CA Zip		Street, City, CA Zip
Average Ambient Air Temerature at Summer Peak	95	deg F	Likely 12 to 6:00PM during the Summer
Average Ambient Air Temerature at Summer Off-Peak	70	deg F	Likely 10PM to 8AM during the Summer

Use Case Specifications

Hours of Discharge per cycle	6	h	Assume full operation range of discharge per full cycle
Days of Discharge Cycles per Year	260	d	
Cycles per Day	1		May be important for life cycle cost input

Storage Specifications

Nominal Power Rating (kW)	350	kW	Used for all cost calculations
Nominal Energy Ratings (kWh)	1,400	kWh	Used for all cost calculations
Roundtrip AC Efficiency (%)	70%		AC to AC Roundtrip Efficiency on peak during summer months (include affects of ambient air temperature summer on-peak)
Operational State of Charge Constraints			
Maximum State of Charge (kWh)	1,400	kWh	Used for optimizing operation of storage system
Minimum State of Charge (kWh)	0	kWh	Used for optimizing operation of storage system
Capital Expenses			
Power	4,000.00	$/kW	All-in cost ($/kW) including storage, BOS, and building costs
Energy	0.00	$/kWh	All-in cost ($/kWh) including storage, BOS, and building costs
Transaction Costs	250,000		Fixed Fee
Salvage/(Disposal) Value			
Power	0.00	$/kW	
Energy	0.00	$/kWh	
Annual O&M Expenses			
Annual Variable O&M	0.0500	$/kWh	O&M cost based on the quantity of kWh discharged
Annual Fixed O&M	0.2000	$/kW	O&M cost based on the Power (kW) size of the storage
Annual Fixed O&M	0.1000	$/kWh	O&M cost based on the Energy (kWh) size of the storage
Insurance Cost	0.75%	$/kW	% of system CAPEX spent on insurance; 0.75% Recommended

Periodic Fixed O&M		Year:	1	2	3	4	5	6	7	8	9	10
Periodic Fixed O&M	SEE RIGHT -->	$/kW:	0.00	0.00	0.00	0.00	0.25	0.00	0.00	0.00	0.00	0.00
Periodic Fixed O&M	SEE RIGHT -->	$/kWh:	0.0000	0.0000	0.0000	0.0000	0.0100	0.0000	0.0000	0.0000	0.0000	0.0000

StrateGen AES Model

Pro Forma: Life Cycle Cost

Period	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
OPEX											
Off Peak Charging Cost		(33,800)	(35,321)	(36,910)	(38,571)	(40,307)	(42,121)	(44,016)	(45,997)	(48,067)	(50,230)
Annual Variable O&M		(18,200)	(18,564)	(18,935)	(19,314)	(19,700)	(20,094)	(20,496)	(20,906)	(21,324)	(21,751)
Annual Fixed O&M		(210)	(214)	(218)	(223)	(227)	(232)	(236)	(241)	(246)	(251)
Periodic Fixed O&M		-	-	-	-	(102)	-	-	-	-	-
Insurance		(10,500)	(10,710)	(10,924)	(11,143)	(11,366)	(11,593)	(11,825)	(12,061)	(12,302)	(12,548)
Total OPEX		(62,710)	(64,809)	(66,988)	(69,251)	(71,702)	(74,040)	(76,574)	(79,206)	(81,940)	(84,780)
Salvage/(Disposal) Value		-	-	-	-	-	-	-	-	-	-
Total Expenses (Net of Salvage Value)		(62,710)	(64,809)	(66,988)	(69,251)	(71,702)	(74,040)	(76,574)	(79,206)	(81,940)	(84,780)
Project Costs											
Storage CAPEX	(1,400,000)										
Transaction Costs	(250,000)										
Total Project Costs	(1,650,000)										
Total Free Cash Flow to Equity	(1,650,000)	(62,710)	(64,809)	(66,988)	(69,251)	(71,702)	(74,040)	(76,574)	(79,206)	(81,940)	(84,780)
Cumulative Free Cash Flow to Equity	(1,650,000)	(1,712,710)	(1,777,519)	(1,844,508)	(1,913,759)	(1,985,460)	(2,059,500)	(2,136,074)	(2,215,280)	(2,297,219)	(2,381,999)
Net Present Value (at 7.0%)	**(2,154,639)**										

Pro Forma Supporting Calculations

Charge/Discharge Calculations

Average On-Peak Energy Discharge (kWh/yr)	*364,000*
Average Off-Peak Energy Charge (kWh/yr)	520,000

CERTIFICATE OF SERVICES

I hereby certify that I have this day served a copy of the foregoing ***Opening Comments of the California Energy Storage Alliance on Administrative Law Judge's Ruling Requesting Comments on the Implementation of Senate Bill SB 412 and Noticing Workshop*** on all parties of record in ***R.08-03-008*** by serving an electronic copy on their email addresses of record and, for those parties without an email address of record, by mailing a properly addressed copy by first-class mail with postage prepaid to each party on the Commission's official service list for this proceeding.

This Certificate of Service is executed on December 16 2009, at Woodland Hills, California.

Michelle Dangott

Michelle Dangott

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