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

Order Instituting Rulemaking Regarding Policies, Procedures and Rules for the California Solar Initiative, the Self-Generation Incentive Program and Other Distributed Generation Issues.	Rulemaking 10-05-004 (Filed May 6, 2010)

OPENING COMMENTS OF THE CALIFORNIA ENERGY STORAGE ALLIANCE ON ADMINISTRATIVE LAW JUDGE'S RULING REQUESTING COMMENTS ON CONSULTANT'S COST-EFFECTIVENESS REPORT

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The California Energy Storage Alliance ("CESA")[1] hereby submits these reply comments on *Administrative Law Judge's Ruling Requesting Comments on Consultant's Cost-Effectiveness Report*, filed on May 3, 2011 (the "ALJ's Ruling").

I. <u>INTRODUCTION</u>.

CESA's Opening Comments on the *Self Generation Incentive Program (SGIP) Staff Proposal, Part II* ("Staff Report II") explain in general terms why the "Itron Report"[2] has little or no value in evaluating the costs and benefits of energy storage.[3] These comments explain in greater detail why a fresh approach is needed, and in particular, why Itron's distributed generation ("DG") cost-effectiveness methodology is not suitable for evaluation of energy storage. CESA views Itron's analysis of energy storage as fundamentally, if not fatally, flawed

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[1] The California Energy Storage Alliance consists of A123 Systems, Altairnano, Applied Intellectual Capital/East Penn Manufacturing Co., Inc., Beacon Power Corporation, CALMAC, Chevron Energy Solutions, Debenham Energy, Deeya Energy, Enersys, EnerVault, Exide Technologies, Fluidic Energy, General Compression, Greensmith Energy Management Systems, HDR, Inc., Ice Energy, International Battery, Inc., LightSail Energy, Inc., MEMC/SunEdison, Powergetics, Primus Power, Prudent Energy, RedFlow, RES Americas, Saft America, Inc., Samsung SDI, SANYO, Seeo, Sharp Labs of America, Silent Power, Sumitomo Electric, Suntech, SunPower, Sunverge, SustainX, Xtreme Power, and Younicos. 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] Itron, Inc. Report titled *CPUC Self-Generation Incentive Program: Cost-Effectiveness of Distributed Generation Technologies Final Report* (Feb 9, 2011).

[3] Opening Comments Of The California Energy Storage Alliance, filed May 2, 2011.

on many levels—including its treatment of cost-effectiveness calculations, selection of applications and assumptions, and choice of energy storage technology.

As discussed below, the Itron Report incorrectly assumes that Li-ion technology, one specific type of electrochemical battery storage technology, is representative of all energy storage technologies. This is done even though the Itron Report itself says that advanced lead acid, Zn/Br flow batteries and emerging Zn/air and Fe/Cr were generally found to have potential for low capital expenditure and the smallest gaps to support the energy storage business case. The Itron Report also arbitrarily and inexplicably assumes that Li-ion is a good match for an application that requires a four-hour duration for load shifting purposes.

II. THE COST-BENEFIT EVALUATION APPROACH AND UNDERLYING CALCULATION ENGINE USED IN THE ITRON REPORT ARE NOT SUITED FOR EVALUATION OF ENERGY STORAGE.

Based on a depth and detailed review of Itron's cost-effectiveness model, it is clear that all Self Generation Incentive Program ("SGIP") technologies' were analyzed using the same underlying calculation engine. For example, all input workbooks use the same template to list input assumptions. These assumptions are then fed into the calculation engine, which calculates results using the same methodology for all technologies. While using the same process for all SGIP-eligible technologies is a seemingly reasonable approach to modeling, energy storage is utilized very differently from the other SGIP technology classes. The primary operational difference between energy storage and the other SGIP-eligible technologies is the *dispatchability* of energy storage. In other words, a "host customer"[4] will be able to choose when to charge and discharge its energy storage system. Such choices will be geared toward maximizing potential savings from the customer's investment in energy storage – this value is critically dependent on the particular customer's load profile and specific electricity tariff, and the capabilities of the energy storage system employed. As such, any calculation engine used to evaluate the costs and benefits of energy storage must therefore take into consideration all of these key operating parameters.

[4] At page 3-12, in footnote number 9, the Itron Report notes: "However, storage systems were evaluated using an arbitrage assumption under which electricity was provided back to the grid under certain favorable economic pricing situations."

These dispatchability issues will directly affect all cost-effectiveness measures, including Total Resource Costs ("TRC") and Participant Cost Tests ("PCT").[5] For example, adjusting the dispatch schedule of the energy storage system will impact the avoided cost calculations for the TRC because there are different assumed values for generation, transmission, and distribution avoided costs for each hour of the day throughout the calendar year. The dispatch schedule will also have a dramatic effect on the PCT because the host customer will optimize the use of his/her storage system based on the economics of the host customer's load profile and tariff structure. The dispatchable nature of energy storage is decidedly different from other distributed energy resources; therefore any cost-effectiveness calculation must take this difference into account.

The Itron calculation engine simply assumes generation as a given and fails to take into account rate differentials between peak and off peak. Given CESA's understanding of Itron's model, and the unique dispatchable nature of energy storage, CESA submits that the Itron model is not the appropriate tool to measure the cost-effectiveness of energy storage for the SGIP, and the Commission should investigate alternative, better options for modeling the cost-effectiveness of energy storage.

III. <u>ITRON'S ANALYSIS OF ENERGY STORAGE FAILS TO MODEL THE SPECIFIC APPLICATION OF ENERGY STORAGE, IN WHICH ALL OPERATIONAL VALUE STREAMS COME FROM ELECTRIC BILL SAVINGS.</u>

The Itron Report appears to fundamentally misunderstand the sources of value produced from behind the meter energy storage systems. Behind the meter energy storage system applications are not eligible for net metering or any other "back-to-the-grid" sale or export of power. While most distributed renewable generation resources are allowed to "net meter" in California, energy storage systems do not operate in this manner on the customer side of the meter; rather they charge off-peak from the grid and are utilized to reduce a customer's on-peak demand when it is economically beneficial for the customer to do so.

Thus, Itron's "arbitrage assumption" is divorced from the reality of how grid-connected, customer-sited energy storage systems would be operated today. The Itron Report indicates that three applications of energy storage were evaluated:

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[5] *See*, *California Standard Practice Manual Economic Analysis Of Demand-Side Programs And Projects.*.

> "Three storage applications were modeled: peak shifting, distribution deferral, and energy arbitrage. For each application the battery was assumed to charge and discharge once a day in normal operation throughout the year. The battery is charged over five hours in the lowest-cost Off-Peak hours and discharged for four hours On-Peak during the highest priced hours. The one-hour difference is due to the 20% round-trip efficiency loss. For the peak shifting application, the battery is not discharged and kept full for the top 150 system load hours, and for a window of four hours before and after. For distribution deferral, the battery is similarly kept full for the 150 hours with the highest temperatures. In practice, the three scenarios produced very similar cost- effectiveness results, so the results for the energy arbitrage application were used." (p. A-90).

In the statement quoted above, it is apparent that Itron's model only assumes utility-level applications that produce value streams. This is a fundamentally incorrect assumption because SGIP projects are located on the customer side of the meter. While the TRC and PAC tests are calculated correctly based on Itron's assumed dispatch schedules/applications for energy storage, these are not the way real-life, customer owned and sited energy storage systems will be dispatched in the field. SGIP energy storage projects will capture retail tariff avoided energy cost savings, not utility-level wholesale value streams. While the Itron model does utilize retail tariffs for avoided energy costs to the customer in the PCT and TRC, the three applications that it has chosen for energy storage are incorrect. Given that SGIP energy storage projects are on the customer side of the meter, the value streams to measure should be the customer's energy bill management in addition to any utility benefits. This includes time-of-use energy charge reduction and demand charge reduction. This nuance is quite different from what Itron's report states as wholesale "energy arbitrage" and "peak shifting" based on system-wide dispatch assumptions, not customer load and tariff-specific assumptions.

Although the primary operational drivers of value for SGIP-eligible energy storage projects are on the customer side of the meter, there will also be transmission, distribution, and generation benefits that the customer can't receive economic value from within the existing regulatory structures in California. This is why an SGIP incentive is critical. Without this incentive program in the current regulatory environment, the additional value of having energy storage assets on the customer side of the meter cannot be transferred to the energy storage system's owner. These additional value streams include at least the following examples:

- Transmission and distribution upgrade deferral
- Line loss reductions
- Transmission and distribution congestion relief

The Commission's Standard Practice Manual lays out a framework for evaluating these additional value streams appropriately. [6]

Additionally, Itron's basic methodology for calculating system value associated with energy storage dispatch in each of these "applications"[7] is fundamentally flawed. While the Itron model produces extensive historical and future trend analysis of various electric utility tariffs, customer electric bill savings are drastically oversimplified for purposes of calculating the true value of energy storage and its dispatchability:

- Electric bill savings in the calculation of the pro forma levelized cost of electricity are rolled up into one $/kWh value. [8] These energy and demand charges significantly impact the economic dispatch of the energy storage system for the customer to maximize electric bill savings. In fact, many of the tariffs used by commercial customers today lend themselves primarily to demand charge savings for energy storage systems.
- Since SGIP projects are on the customer side of the meter by definition, dispatch schedules should be based on a customer's load profile and imposing retail tariff. Itron's dispatch schedules are based on "system-level" peak days only. "System-level" implies the entire CAISO region or *wholesale* market pricing. SGIP customers are *not* incented based on the "system-level"; they pay electric bills based on their respective tariff schedules at the *retail* level. Itron is confusing *wholesale* and *retail* markets in its analysis.
- Itron's dispatch schedules are not different for each of the electric utilities, thus highlighting the inaptness of any results for determination of energy storage cost-effectiveness.

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[6] *California Standard Practice Manual Economic Analysis Of Demand-Side Programs And Projects*

[7] Itron Report, page A-90

[8] Actual commercial tariffs structures for the electric utilities' include both energy ($/kWh) and demand charges ($/kW).

The discussion of energy storage in the Itron Report makes it painfully clear that the report's authors failed to understand the sources of value that would truly compensate system owners for their investment in grid connected energy storage. The Itron model does not simulate the way a storage system owner would operate the system in real-world scenarios. Such projects would rely entirely on electric bill savings results from shifting consumption of electricity from peak to off-peak periods, customer demand charge savings, and the SGIP incentive itself.

IV. BECAUSE THE ITRON REPORT ONLY MODELS ONE ENERGY STORAGE TECHNOLOGY, THE RESULTS RELATED TO ENERGY STORAGE SHOULD BE DISREGARDED BY THE COMMISSION.

CESA raised this fundamental and critical recommendation in its Opening Comments and reiterates its key points below:

First, the Itron model incorrectly assumes that Li-ion technology, one specific type of electrochemical battery storage technology, is representative of all energy storage technologies. In general, energy storage represents a broad range of technology classes (e.g. thermal, electrochemical, mechanical and gravitation storage), and within each of these classes, there are many different technology types – for example, there are many different types of batteries (e.g. flow, Li-ion, lead acid). To have any value at all, the Itron Report would need to evaluate cost-effectiveness of energy storage at the technology class level, comparable to its approach taken with distributed generation technology classes (e.g. microturbines, CHP, fuel cells, wind) It would have been equally egregious to assume that the economics of a single type of "electric fuel cell" or "wind turbine" is representative of all distributed generation as an asset class, and then—based solely on the cost effectiveness of only electric fuel cells - to conclude that *all* distributed generation technologies are not cost-effective.

Second, it arbitrarily and inappropriately assumes that Li-ion is a good match for an application that requires a four-hour duration for load shifting purposes. Li-ion is certainly technically capable of providing this service, but it is not the most economic selection for a four-hour peak shifting application. Li-ion is a technology that is widely used for high power applications that require rapid response and a small volumetric footprint, such as mobile electronics, electric vehicles or frequency regulation. Further, not all Li-ion batteries are created equal. There are ranges of chemistries and solutions that make sense for different applications. Any true cost-effectiveness study must consider this fact, and match right solutions to the right applications in order to demonstrate cost-effectiveness. Generally speaking, however, Li-ion is not the most cost-effective solution for long duration, multi-hour peak shifting, nor are Li-ion's relatively minor volumetric advantages particularly needed for grid storage applications.

Third, CESA is completely perplexed as to why the Itron report arbitrarily selected li-ion for its analysis, as the Itron report itself states that "advanced lead acid, zn/br flow batteries and emerging zn/air and fe/cr were generally found to have potential for low capital expenditure and the smallest gaps to support the energy storage business case (we assume for peak load reduction applications) for battery technologies."

Any future cost-effectiveness analysis to be relied on by the Commission needs to not only consider various energy storage technology classes (thermal, electrochemical, mechanical etc.), but also more fully disclose and publicly vet the basis of the assumptions used in the analysis, including, but certainly not limited to:

- Capital cost
- Cost of electricity used to charge the system
- Total cost of ownership (including preventive and ongoing maintenance assumptions)
- Time horizon of the analysis (e.g. 20 or 25 years)
- Ownership model

Finally, upon extensive review of the model's assumptions, it seems that Itron selected only Lithium-Ion to model because it appears to have obtained the most data on this technology versus other energy storage technologies. This is not a rational selection methodology for obtaining substantive, decision-making results.

V. MANY KEY ASSUMPTIONS USED IN ITRON'S MODELING OF ENERGY STORAGE ARE FATALLY FLAWED OR INCONSISTENTLY REPORTED.

In addition to the very fundamental assumptions discussed above, the Itron Report includes numerous specific assumptions that negatively impact any analysis of energy storage and would benefit from greater transparency, including vetting in a public forum. Examples include the following:

- The 15-year MACRS depreciation schedule assumption should be 7 years (potentially even 5-year MACRS when integrated with renewables).

- There is an inconsistency in how round trip efficiency was used for the analysis, namely 80% vs. 90% round trip efficiency respectively in Itron's report vs. model input workbooks.
- Itron's costing includes a 20% minimum depth of discharge ("DoD")[9] stipulation. This results in an artificial cost increase in which there is an effective installed price adjustment. Most energy storage system suppliers already include the DoD adjustment in their quotes. While Itron's model relies heavily on costing from a report published by EPRI[10], a thorough investigation of the assumptions used by EPRI is justified because of the significance of unwarranted price adjustments on cost-effectiveness calculations.
- A 2%/year annual degradation assumption for Li-Ion is an order of magnitude too high. Also, for many batteries, the degradation curve is not linear at all (*e.g.* many chemical batteries have insignificant degradation throughout most of their life, then degrade rapidly at the end of their useful lives).
- Modeling residential tariffs that have only tiered structures is inappropriate for energy storage since residential customers that install energy storage would most likely opt for a time of use tariff, because tiered tariffs provide no incentive to shift load during different times of the day.
- Dispatch schedules do not account for the tariff differentials of weekdays vs. weekends and holidays.
- Dispatch schedules for energy storage systems are static, and are not based on the critical drivers of value, which should include at the very least the following:
    - Location (electric utility, tariff, weather patterns)
    - Customer load profile (tariff, dispatch decisions to maximize electricity bill savings)
    - On-site generation (such as SGIP-eligible renewable technologies)

[9] Depth of discharge is a percentage of rated capacity of the storage device that is utilized during operation (e.g. if a storage device is rated at 100kWh, an 80% depth of discharge corresponds to 20kWh still stored in the storage device and available for discharge.)

[10] EPRI Report titled *Electric Energy Storage Technology Options: A White Paper Primer on Applications, Costs and Benefits*. EPRI, Palo Alto, CA, 2010. 1020676 ("EPRI Report).

VI. A NEW, MORE ANALYTICALLY RIGOROUS METHODOLOGY SHOULD BE DEVELOPED IN THE COMMISSION'S ENERGY STORAGE RULEMAKING PROCEEDING.

As discussed in CESA's Reply Comments on Staff Proposal II[11], cost-effectiveness should not be a requirement for SGIP eligibility. As indicated by Assembly Member Skinner's letter addressed to Commission President Peevey and attached to CESA's Reply Comments, the intent of SB 412 to always include energy storage as part of this SGIP, so energy storage should be immediately eligible for incentives, including standalone storage and storage coupled with SGIP-eligible and CSI-eligible renewable technologies.

The Commission should immediately discontinue using Itron's model to calculate the cost-effectiveness of energy storage and should not draw any conclusions based on its energy storage modeling results. In the short-term, other existing models that are appropriate for modeling energy storage should be used. This implies models that can optimize the dispatch of an energy storage system based on:

- Specific tariffs for each customer class
- Customer load profiles
- On-site generation resources
- Specific energy storage parameters (including CAPEX, OPEX, efficiency, etc.)

CESA recommends the use of a model similar to that utilized by the Commission in 2009 to characterize the value of energy storage in the SGIP.[12] The Commission should also further investigate the relevance and usefulness of reports such as the EPRI Report. In the longer-term, the Commission should order development of an energy storage cost-effectiveness model that is tailored specifically to the needs of the SGIP.

[11] CESA's Reply Comments, filed May 9, 2011.

[12] CPUC Energy Division Staff Proposal: *Advanced Energy Storage: Costs, Benefits and Policy Options An Analysis of Customer-Side Technologies*, Prepared for the California Public Utilities Commission (May, 2009).

VII. CONCLUSION.

CESA thanks the Commission for this opportunity to comment on the Itron Report and looks forward to working with the Commission and stakeholders going forward.

Respectfully submitted,

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May 11, 2011

CERTIFICATE OF SERVICE

I hereby certify that I have this day served a copy of ***Opening Comments of the California Energy Storage Alliance on Administrative Law Judge's Ruling Requesting Comments on Consultant's Cost-Effectiveness Report*** on all parties of record in proceeding ***R.10-05-004*** 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 May 11, 2011, at Woodland Hills, California.

Michelle Dangott

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