BEFORE THE PUBLIC UTILITIES COMMISSION

OF THE STATE OF CALIFORNIA

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

POST-WORKSHOP COMMENTS OF THE CALIFORNIA ENERGY STORAGE ALLIANCE ON RENEWABLE INTEGRATION MODELING METHODOLOGY

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Pursuant to the California Public Utilities Commission's ("Commission's") Rules of Practice and Procedure and the *Administrative Law Judge's Ruling Requesting Comments on Renewables Integration Models* issued by Administrative Law Judge Victoria S. Kolakowski on September 8, 2010, as supplemented by a September 17, 2010 notice of ruling granting a one week extension of time for filing reply comments ("ALJ's Ruling"), the California Energy Storage Alliance ("CESA")[1] provides the following comments.

I. INTRODUCTION.

In its comments on resource planning assumptions,[2] CESA stated that it plans to work with the Commission, and parties to advance implementation of the recommendations related to energy storage contained in the "White Paper" published by the Commission on July 9, 2010.[3] At the same time, CESA also noted its appreciation of the statements concerning energy storage

[1] The California Energy Storage Alliance consists of A123 Systems, Altairnano, Applied Intellectual Capital, Beacon Power Corporation, Chevron Energy Solutions, Debenham Energy, Deeya Energy, East Penn Manufacturing Co., Inc., Enersys, Enervault, Fluidic Energy, Ice Energy, International Battery, Inc., Primus Power, Powergetic, Prudent Energy, PVT Solar, ReStore Energy Systems, Samsung SDI, SEEO, Suntech, Sunverge, SustainX, and Xtreme Power. The views expressed in these Comments are those of CESA, and do not necessarily reflect the views of all of the individual CESA member companies. http://www.storagealliance.org.

[2] *Comments of the California Energy Storage Alliance on Resource Planning Assumptions – Part 2 (Long Term Renewable Resource Planning Assumptions) – Track 1*, filed July 9, 2010. (Page 1).

[3] *Electric Energy Storage: An Assessment of Potential Barriers and Opportunities*, *Commission Policy and Planning Division White Paper,* July 9, 2010

contained in the California Independent System Operator's ("CAISO's") contemporaneously published "Discussion Paper."[4]

CESA is therefore profoundly disappointed with the materials presented and the general tenor of the dialogue at the Workshop held on August 24-25, 2010 ("Workshop") in this proceeding on the subject of "Renewable Integration Modeling" ("RIM")[5]. These comments accordingly begin with a strong general criticism of the apparently completely intentional exclusion of energy storage from the first phase of what is evidently proposed as a two-phase modeling effort. Rather than responding to mechanically each of the specific questions posed in the ALJ's Ruling. CESA then describes some of the most egregious illogical and impractical consequences of such a fundamental error. From CESA's perspective, the only reason why a Phase 1 effort that excludes energy storage maybe worthwhile is to compare two alternate scenarios: with and without energy storage. If this is the intent of the two-phase effort, then Phase 2 should be launched concurrently with Phase 1.

II. THE PG&E APPROACH TO RENEWABLE INTEGRATION MODELING PRESENTED AT THE WORKSHOP IS PROFOUNDLY FLAWED AND SHOULD BE REJECTED BY THE COMMISSION. THE CAISO APPROACH SHOULD IMPLEMENT PHASE 2 CONCURRENTLY WITH PHASE 1.

Based solely on the public record of studies and actions of PG&E and the CAISO, failure to take account of any energy storage-related resources in development of the RIM is unsupportable in view of the already existing and well documented amount of energy storage deployment today and foreseeable over the next few years. PG&E characterizes the purpose and scope of the study described in the Notice of Availability filed by PG&E, and its attached Appendix A, is follows:

> "This study is designed to use detailed simulations of minute-by-minute renewable generation as well as complex production simulation models to estimate integration requirements and costs." (p. 1). '*The RIM model has been used to help support and supplement the CAISO results and provide additional insights.* The RIM's main contribution is its simple, but sophisticated, approach to estimating integration requirements and costs that enables greater modeling flexibility and transparency than the more detailed simulation models that

[4] Discussion Paper, *Renewable Integration: Market and Product Review*, July 8, 2009 (referred to herein as "CAISO RIM Discussion Paper").

[5] *See, Notice of Availability of Pacific Gas and Electric Company's Renewable Integration Model and Results* filed August 16, 2010 (referred to herein as "Notice of Availability"), and related power point presentation titled *Renewable Integration Model and Methodology*, presented at the Workshop held on August 24-25, 2010.

> underlie the CAISO effort.' (p. 2). . . . Some of the more important simplifying assumptions include the following: . . . 2. The cost estimation module assumes that new conventional resources are used to meet the incremental operating flexibility requirements. *Alternatives such as operational changes, demand response, energy storage, or renewable curtailment are not evaluated by RIM*. [Emphasis added]" (pp. 3-4).[6]

Since PG&E describes it role in the RIM development as subordinate to that of the CAISO in this context, it is necessary to turn immediately to the CAISO for explanation of the RIM. It should be noted, however, that PG&E has provided substantial evidence of its own generally positive public position on the important role of energy storage elsewhere, including applications for approval of large compressed air and pumped hydro energy storage projects in its service territory.[7] In Decision 10-01-025, issued January 21, 2009, the Commission approved PG&E's request for approval to begin work on a compressed air energy storage project. The Commission relied, of course, on PG&E's description of the merits of the project as follows:

> "PG&E asserts the CAES Project will be beneficial to ratepayers and California because it will reduce greenhouse gas emissions by enabling large-scale deployment of intermittent renewable resources and peak load management capabilities using only 35% of the natural gas that a simple-cycle combustion turbine currently uses. Next, PG&E states it will improve grid reliability, flexibility, security and interoperability with available and reliable bulk storage capabilities to integrate renewable resources and to respond to smart grid signals from the CAISO for spinning/non-spinning reserve, VAR/voltage support, and self-healing grid commands. Finally, PG&E contends it will lower electric power system costs and enhance cost effectiveness by charging the CAES plant during lower-priced off-peak periods, reducing the use of expensive gas turbine "peaking" plants during on-peak periods, and increasing overall grid asset utilization. (pp. 9-10).

In its Application for approval of its proposed pumped hydro project (A.10-08-011), PG&E observes: "In anticipation of an additional renewables requirement, PG&E began in 2007 to assess the need for additional storage capacity to integrate the expected development of substantial new renewable resources." (pp. 3-4). Here also PG&E relies on the publicly stated position of the CAISO - in this case to justify its public positions on energy storage: "The

[6] In Appendix A, attached to its Notice of Availability describes the reason for adopting a two-step approach as follows: "Providing the flexible resources required to integrate IRs comes at a cost. The RIM estimates the costs of providing this flexibility with conventional resources. These costs can then be utilized as a benchmark against which other integration alternatives can be evaluated." (p.1).

[7] See, Application 09-09-019, filed September 29, 2009 (compressed air), and Application 10-08-011, filed August 20, 2010 (pumped hydro). PG&E also has long been a supporter of thermal storage [cite].

CAISO "envisions the development of new storage and demand response regulation energy capabilities to meet regulation requirements when more renewable generation is on-line." (p. 5).

At the Workshop, the CAISO's representatives stated that the RIM would be a phased study process, with Phase 1 focused largely on defining grid operational requirements in terms of conventional fossil generation. In the CAISO's proposal, Phase 2 would then go on to separately address the same operational requirements with a combination of generation (presumable including all types of renewable resources), energy storage, demand response and dispatchable wind and solar resources.[8] The CAISO's presentation at the Workshop is roughly consistent with the CAISO Discussion Paper on energy storage it was based on,[9] as was the White Paper that preceded the Discussion Paper.[10] The Discussion Paper also states that the CAISO expected to have the ability to model non-generation resources: "The functionality needed for full integration of limited energy storage resources will probably not be available until the second software release for MRTU, which is known as the Markets and Performance (MAP). MAP is currently scheduled for release in early 2010 and it has design features that are compatible with Participating Load Demand Response and could correspond to participating energy storage resources, such as allowing Bids when storage is load." (p. 8).

Although the second full MRTU software release has yet to occur, MAP Reports have been posted on the CAISO's web site since January 2010 and there appears to be no reason that energy storage should not be considered as part of Phase 1 of the RIM modeling effort. Further, CAISO itself acknowledges the commercial readiness of storage in its 2009 Discussion Paper as follows:

> "Small-scale or limited energy storage technology has evolved and matured over the past several years. *The technology has now reached the stage where it is being commercially deployed in California and elsewhere*. Observers and participants have noted that the expansion and impact of limited storage resources could be further facilitated by permitting providers to directly participate in the organized markets for Ancillary Services (A/S) – regulation and operating reserves – operated by ISOs/RTOs (and possibly by defining new services, such a load-following product or "fast" regulation, that also reward fast ramping capability). In this regard, the Federal Energy Regulatory Commission (FERC)

[8] *Study of Operational Requirements and Market Impacts at 33% RPS, Selected Simulation Results Available as of August 24, 2010* (modified version), Slide 7. Slide 25 also states that "Pump storage is not considered as part of the actual load and the load forecast."
[9] *Infra*, footnote 4.
[10] *Discussion Paper, Participation of Limited Energy Storage Resources in CAISO Electricity Markets*, January 16, 2009.

> directed the ISO/RTOs to change their tariffs to allow non-generation resources, such as energy storage resources to participate in A/S markets. The CAISO has filed tariff language with FERC in compliance. The next step is to address any barriers and obstacles that could impede limited energy storage and other non-generation resources from actively participating in the A/S markets. [Emphasis added]" (p. 1).

Similarly, in its 2010 Transmission Plan[11] the CAISO accepted the commercial readiness of battery storage energy technology, when it stated that it considered a number of proposed battery energy storage solutions for a variety of local applications and rejected them for unrelated operational reasons:

> "As discussed in the sections set forth in Table 6-4, the ISO evaluated battery storage as an alternative to the reliability solutions proposed by PG&E or the ISO to determine whether PG&E should be required to install battery storage devices to address the identified reliability concerns. For each reliability concern, the ISO determined that PG&E should not install battery storage technology because the ISO or PG&E's proposed alternative project, presented a more comprehensive solution, or there was no reliability need for any mitigation solution." (p. 266).

The CAISO clearly has the capability to model energy storage coupled with renewables, because the CAISO also stated:

> "During discussion of the Conceptual Plan at the October 26 stakeholder meeting it was stated that only one type of solar technology was assumed for modeling purposes. It would be helpful to know what this technology was, as well as what might be the consequences of more diverse assumptions, such as contrasting PV versus CSP output profiles. Also, we may now be at a useful starting point for going forward in the future, and examining the transmission implications of different kinds of solar generation, of solar generation with thermal storage, and of wind and solar generation with other kinds of storage." (p. 337).

At the same time, the CAISO has been steadily enabling greater use of non-generator resources such as demand response and energy storage in tariff filings at the Federal Energy Regulatory Commission ("FERC"). In conditionally approving the CAISO's proposed Non-Generator Ancillary Services tariff,[12] the FERC stated its energy storage policy perspective as follows:

> "We are mindful of the benefits of reducing barriers to participation of storage resources in the provision of ancillary services in the CAISO markets, particularly as the percentage of variable resources within CAISO's total generation portfolio increases. At the same time, we find that delaying acceptance of the instant tariff

[11] *Final California ISO 2010 Transmission Plan*, April 7, 2010.
[12] *Order Conditionally Accepting Tariff Revisions*, 132 FERC ¶61, 2011, issued September 10, 2010.

> amendments until all tariff mechanisms necessary to fully integrate storage resources are developed would unnecessarily impede the participation of other non-generator resources in CAISO's ancillary service markets. We find that the potential harm of further delaying the timely implementation of the proposed CAISO tariff revisions may outweigh the potential benefits of requiring complete functionality upon initial implementation.
>
> Further, we believe that impeding non-generator participation by rejecting the CAISO Proposal would run contrary to the goals of Order Nos. 890 and 719. Accordingly, we accept CAISO's tariff revisions because they represent an incremental step towards comparable treatment of non-generators resources in the ancillary services markets and enhance CAISO's ability to operate its system reliably." (p. 11).

As both PG&E and the CAISO have been studying and deploying pilot energy storage projects since at least 2007, and between them are presently implementing compressed air, pumped hydro and battery energy storage projects it is shocking to read the most recent statement of the CAISO on the subject of energy storage:[13]

> "The starting point for the present analysis is that while there is substantial interest in storage and demand response to provide integration capabilities, at least during the next few years, **support for integration of renewable resources during normal operating conditions will need to be provided largely through the flexibility of existing, re-powered, and new thermal generation.** This generation fleet will also need to have the ability to provide sufficient ancillary services, particularly regulation up and regulation down and possibly some additional operating reserves." [Emphasis added]. (p. 19).

With such a large body of pre-existing work on energy storage by PG&E and the CAISO, there is simply no justification for the two-step proposal study proposal put forward by the CAISO. This should be perfectly obvious in view of the recent report published by the California Energy Commission report which modeled the impacts of wind generation, solar generation and energy storage on the grid, and evaluated the relative benefits of deploying energy storage versus conventional generation.[14] The most important conclusions reached by KEMA, the authors of the report, call for energy storage as a solution to the impacts of renewable integration can be distilled as follows:

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[13] *Integration of Renewables, Operational Requirements and Generation Fleet Capability at 20% RPS*, August 32, 2010.

[14] *Research Evaluation of Wind Generation, Solar Generation and Storage Impact on the California Grid* California Energy Commission, June 2010.

- **System degradation became "extreme" under a 33% Renewables Portfolio Standard ("RPS") Scenario**

- **Large-scale storage can improve system performance through regulation and ramping services, without emissions penalties and limited energy cost penalties.**

- **Existing storage technologies are capable of managing renewables integration.**

- **For regulation, storage can be 2-3 times as cost-effective as a combustion turbine.**

- **Without storage, equipment maintenance costs and greenhouse gas ("GHG") emissions may increase.**

III. THE CAISO MODELING APPROACH SEEMS TO FACTOR IN ALL CONSEQUENCES OF RENEWABLE INTEGRATION, INCLUDING FOR EXAMPLE, OVERGENERATION, HOWEVER, SPECIFIC COMMENTS ARE NOT POSSIBLE BECAUSE THE MODEL IS NOT A PUBLIC DOCUMENT.

The Discussion Paper on the CAISO's model appears to indicate that the CAISO is considering all the salient issues surrounding renewable integration. Specific comments on the model's structure are not possible, since it is not available publicly, but the general model structure laid out during the workshop appears to **be** sound. Primary improvements over PG&E's RIM model are considerations for over-generation in the CAISO's modeling effort. However, in the Discussion Paper, the CAISO mentions that solutions to renewable integration need to come sooner rather than later. In this spirit of expediency, CESA strongly recommends that Phase 2 of the CAISO modeling take place concurrently with Phase 1 to understand more thoroughly and quickly how alternatives to conventional combustion turbine and combined cycle generation resources such as energy storage can combat the issues surrounding renewable integration.

IV. THE PROPOSED PG&E RENEWABLE INTEGRATION MODEL HAS NO POTENTIAL USE AS A BASIS FOR AUTHORIZATION OF ANY RENEWABLE INTEGRATION-RELATED PROCUREMENT NEED IN LONG TERM PROCUREMENT PLANNING.

In its CAISO RIM Discussion Paper,[15] the CAISO states very clearly that over generation and increased starts and stops and unit cycling will be a significant factor in renewable integration:

[15] *Integration of Renewables, Operational Requirements and Generation Fleet Capability at 20% RPS*, August 32, 2010.

> "To date, renewable integration has largely been managed by the ISO through additional forecasting improvements and existing operational tools and market rules, including the Participating Intermittent Resource Program (PIRP). However, as the ISO examines the requirements of variable energy resource integration at the 20 percent RPS level and then the 33 percent RPS level, the ISO expects more significant operational impacts including:
>
> - increased regulation requirements;
> - increased load following requirements, perhaps requiring an additional commitment of reserves;
> - *greater frequency and magnitude of over-generation; and*
> - *other changes in the operations of conventional units, such as increased starts and stops and unit cycling.* [Emphasis added]" (p. 5).

However, the RIM specifically ignores over generation in its simulations. This omission of over generation considerations has the potential to greatly underestimate the need for additional resources under the various RPS modeling scenarios. In addition, over generation cannot be mitigated with the traditional combined cycle or combustion turbine resources that the RIM focuses on. Other resources, such as energy storage should be considered in Phase 1 of the RIM simulations to account for over generation.

The CAISO RIM Discussion Paper also points to "increased starts and stops and unit cycling" as an impact to the system. While the RIM includes CO_2 impacts due to the inefficiencies introduced by these increased starts and stops and unit cycling, the model does not take into account other air quality impacts such as NOx, SOx, and PMs. Many storage technologies do not incur negative impacts to efficiency or air quality when cycling – rather, energy storage technologies have the benefit of *improving air quality*.[16]

The RIM simulations do not account for locational issues associated with transmission and distribution congestion or constraints. Ignoring these locational issues will overlook additional resource costs required for the RPS scenarios. Traditional fossil generation resources requirements have inherent siting issues that will limit their effectiveness in addressing transmission and distribution constraints, whereas other resources such as energy storage can be more easily sited in modular form where needed most at the transmission and distribution level. If energy storage technologies can assist with these locational issues, but fossil generation

[16] See*, Emissions Comparison for a 20 MW Flywheel-based Frequency Regulation Power Plant*, KEMA, May 18, 2000; and see *Air Emissions Due to Wind and Solar Power*, Carnegie Mellon Electricity Center, October 23, 2008.

resources cannot, then the RIM simulations should take these additional benefits into account, so all resource options are compared on a level playing field with respect to value to the grid and all ratepayers.

The RIM only calculates the required increase in megawatt capacity of frequency regulation for the RPS scenarios. While capacity is an important metric, the RIM simulations fail to take performance into account. Technologies that can perform frequency regulation with faster response times than traditional fossil generation resources (*e.g.* fly wheels) should be considered in the model. The cost, performance and air quality benefits of faster performance have been well documented by Pacific Northwest National Laboratories, KEMA and others.[17]

V. TO EFFECTIVELY INCORPORATE THE PERFORMANCE CAPABILITIES OF ENERGY STORAGE FOR RENEWABLE INTEGRATION, ENERGY DIVISION STAFF NEEDS TO AUGMENT ITS DATA REQUEST OF STAKEHOLDERS TO INCLUDE ENERGY STORAGE

The CPUC's data request should include collection of information for energy storage. Specifically, the data request for energy storage should include all the same requests for information as conventional CT and CC resources:

3. MW of *energy storage* needed to provide:
    a. Regulation up
    b. Regulation down
    c. Load following up
    d. Load following down
    e. Spin
    f. Non-spin
    g. Any other operating response not covered by the above

4. Cost of *energy storage* units in $/kW-year including:
    a. Capacity cost of said units
    b. Variable costs of said units
    c. Total cost of said units
    d. Other integration costs
    e. Total integration costs

5. The ability of *energy storage* to provide all of the above for seven scenarios that will be finalized in the LTPP Scoping Memo.

[17] *See,* Benefits of Fast Response Storage Devices for System Regulation in ISO Markets, Prepared for AES by KEMA, June 2008.

In addition to the energy storage information that mirrors the information required for conventional CT and CC resources above, CESA recommends the following data requests:

- Energy storage capacity in MWh (not just MW) required to perform each of the above functions in the seven scenarios
- Energy storage performance characteristics relative to conventional CT and CC resources (e.g. response time to frequency regulation signals)
- Locational benefits of energy storage siting
- Any other potential renewable integration functions energy storage can perform beyond the ability of conventional CT and CC resources

VI. CONCLUSION.

CESA thanks the Commission for this opportunity to comment, and looks forward to a collaborative dialogue with parties and the Commission

Respectfully submitted,

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September 21, 2010

CERTIFICATE OF SERVICE

I hereby certify that I have this day served a copy of ***Post-Workshop Comments of the California Energy Storage Alliance on Renewable Integration Modeling Methodology*** on all parties of record in proceeding ***R.10-05-006*** by serving an electronic copy on their email addresses of record and by mailing a properly addressed copy by first-class mail with postage prepaid to each party for whom an email address is not available.

Executed on September 21, 2010, at Woodland Hills, California.

Michelle Dangott

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