BEFORE THE PUBLIC UTILITIES COMMISSION
OF THE STATE OF CALIFORNIA

Order Instituting Rulemaking Pursuant to Assembly Bill 2514 to Consider the Adoption of Procurement Targets for Viable and Cost-Effective Energy Storage Systems.	Rulemaking 10-12-007 (Filed December 16, 2010)

OPENING COMMENTS OF SOLARRESERVE, LLC ON ASSIGNED COMMISSIONER'S RULING PROPOSING STORAGE PROCUREMENT TARGETS AND MECHANISMS

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July 3, 2013

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Pursuant to Assigned Commissioner Carla Peterman's ruling of June 10, 2013 ("Ruling") in the above-captioned proceeding ("Energy Storage OIR"), SolarReserve, LLC ("SolarReserve") hereby submits these opening comments in accordance with the California Public Utilities Commission's ("Commission's" or "CPUC's") Rules of Practice and Procedure.

I. INTRODUCTION

SolarReserve appreciates the leadership and vision expressed in the Ruling and applauds Commissioner Peterman's willingness to take bold steps towards the effective deployment of storage technology. We particularly appreciate the recognition of SolarReserve's 150 MW Rice Solar Energy Project (the "Rice Project"). The Rice Project deserves full credit for the storage attributes inherent to the SolarReserve technology in which molten salt storage is fully integrated with concentrating solar power ("CSP") generation.

SolarReserve's comments are organized into General Comments, Responses to Questions, and then a Technical Discussion on CSP technology.

SolarReserve is a solar energy project development company developing large-scale CSP projects with fully integrated molten salt storage. Fully integrated molten salt storage means that storage is inseparable from the operation of the solar generation facility and thus the facility can produce firm, non-intermittent, fully dispatchable solar energy. Specifically, integrated molten salt storage technology involves heating molten salt directly with sunlight. Because the sun's energy is captured by the same molten salt used for storage, the entire output of the plant is a direct product of this storage technology. Integrated molten salt storage improves the efficiency and the cost-effectiveness of this concentrating solar thermal technology, and gives it

unprecedented flexibility in dispatch. Enhanced reliability and control deliver a high-value and fully renewable product to the utility.

Unlike other CSP technologies, the SolarReserve technology allows for large amounts of cost-effective storage. Energy can be produced up to 24 hours a day according to system need or demand. SolarReserve facilities can also provide ancillary services, similar to other storage technologies. However, integrated molten salt storage is fundamentally different in its operational characteristics than most other forms of storage; SolarReserve's storage is fully integrated into, and inseparable from, a solar energy generating facility. This marriage of storage and renewable generation thus provides SolarReserve with a unique perspective regarding the issues being considered in this proceeding.

The Rice Project is a fully permitted project located on private land in California. It has secured a Commission-approved power purchase agreement ("PPA") with Pacific Gas & Electric ("PG&E") for the entire output of the facility. To SolarReserve's knowledge, this PPA is unique among solar PPAs in California insofar as it includes certain dispatchability provisions allowing PG&E to benefit from the storage capability of the solar generation facility. The Rice PPA has a Commercial Operations Date ("COD") in 2016 and the project is currently on schedule to break ground in the coming months. As described in the Technical Discussion section below, the Rice Project is equipped with eight hours of molten salt storage, meaning that it could run at full output for eight hours using only stored energy.

Only one CSP tower with integrated molten salt storage is in operation today, worldwide. SolarReserve's Crescent Dunes project will be the second, and Rice will likely be the third. Additional deployment of CSP with integrated molten salt storage (i.e., more than just three plants worldwide) is needed for the industry to advance. Costs will decline as projects are built and the supply chain is exercised. Benefits will increase as utilities, operators, and developers gain experience in optimal CSP dispatch. Investment in new CSP projects will fund additional technology improvement efforts. Without a regulatory framework supporting CSP, this industry will not be able to continue contributing to California's clean energy portfolio. Thus this storage proceeding is a critical and necessary step in the advancement of CSP with integrated molten salt storage.

II. GENERAL COMMENTS

SolarReserve appreciates the CPUC's efforts in this proceeding and recognizes that there are many stakeholders with diverse perspectives involved in a very complex decision-making process. In order to guide the process, we would suggest that the following objectives be adopted:

1. Support a diverse portfolio of multiple technologies that are both new and beneficial.
2. Improve the environment, and avoid taking steps which would increase carbon emissions.
3. Align procurement policies in California – such as storage, renewable energy, and flexible capacity – to ensure that, in the long run, procurement is optimized for ratepayers.
4. Structure a procurement policy that is fair, technology neutral, and a model for other policymakers in California and around the world.

We also appreciate the efforts by CPUC staff to create cost-effectiveness models for use in evaluating storage technologies. However, despite the prominence of the Rice Project, neither the KEMA model nor the EPRI model addresses the use case for CSP with integrated molten salt storage. Unfortunately, we believe it would be difficult to develop a cost-effectiveness model for the SolarReserve technology in the time remaining in this proceeding. While we appreciate the need for prioritization, it is important that the cost-effectiveness models not create a technology bias, and we urge the Commission not to rely entirely on these models.

SolarReserve encourages the Commission to clarify that the entire 150 MW Rice Project be counted towards the procurement target. The full output of the Rice Project is a product of its storage technology. We further encourage the Commission to clarify that any other CSP with integrated molten salt storage be qualified for storage procurement target compliance in the future, even if cost-effectiveness methodologies are not developed through this proceeding. If there is a concern that the Rice Project would go too far towards satisfying PG&E's storage target to the detriment of other storage technologies, we urge the Commission to set higher targets rather than impose an arbitrary de-rating of the Rice Project. The large size of the Rice Project improves its value to ratepayers by enhancing cost-effectiveness through economies of scale, and cost-effectiveness should be encouraged.

We also note that while storage is typically a separate issue from generation, they are inexorably linked in the case of CSP with integrated molten salt storage. Any attempt to segregate the storage decisions from the generation decisions will be unfairly biased against this technology. We urge the Commission to consider energy procurement alongside storage procurement whenever possible in order to remove this bias.

In SolarReserve's experience, the lack of any quantification of the value of storage within the context of RPS procurement has been a major hurdle for CSP technology. This should be addressed in this proceeding. Without such quantification, CSP with integrated storage can appear too expensive for RPS procurement. Similarly, failure to account for renewable generation may make CSP technology appear too expensive for storage procurement. In sum, CSP with molten and salt storage provides a valuable bundled product and both the RPS and the storage evaluation processes should account for such value.

In terms of compliance with storage procurement targets, SolarReserve generally supports utility flexibility, provided that there is the appropriate level of Commission direction and oversight. Further, storage procurement should be technology neutral. This means all viable technologies should be eligible and the Commission should ensure that storage procurement results in a diverse portfolio of solutions, including large and small projects, and projects with short and long construction times. Different technologies provide different products and not all products can or should be priced the same. A multi-attribute analysis should be employed rather than a simple least costs analysis. Utilities should have flexibility in the cost of procurement, particularly when that procurement comes along with other attributes, such as CSP with integrated molten salt storage which offers both storage and renewable energy.

Utilities also should have flexibility in the timing and amount of storage procurement; otherwise, with procurement targets set as low as they are per year and per category, the largest and most cost-effective technologies may be disadvantaged. Utilities should be allowed to count one project across multiple years of compliance. Similar to what is done in generation, procurement from a particular storage project should be allowed to be divided among the utilities.

The proposed framework does not make it clear how storage integrated with generation would be evaluated, versus storage without generation. It is important that there not be a bias

against CSP with integrated storage which could result in higher overall ratepayer costs, or violate the principle of fairness.

SolarReserve supports the MW basis of the procurement targets, but recommends that a MW only be counted towards the target to the extent that the following two criteria are met:

1. All energy delivered by the project is a product of the storage technology
2. The full MW amount is frequently or customarily used by the project and the off-taking utility

This framework would ensure that California is receiving an entire storage product when each megawatt is procured.

For a diverse portfolio, a RAM is probably not the best model; a more inclusive Request for Offers ("RFO") format is a better one as long as the CPUC has approved a procurement plan in advance which ensures that the State's objectives will be met. A well-considered RFO would also allow for RPS and flexible capacity attributes to be incorporated more naturally into the offer analysis. The utilities should conduct open, transparent, and iterative procurement processes which allow subject matter experts to inform future evaluations; in this way, they will "learn by doing," which we believe is the best way to capture the real value of storage.

III. RESPONSES TO QUESTIONS

A) Please comment on this proposal overall, with emphasis on the proposed procurement targets and design.

As discussed throughout the last section, the proposed procurement targets and design are steps in the right direction. However, more specificity around compliance and flexibility for large-scale technologies is needed. If over-procurement is justified by economies of scale, then utilities should have some flexibility to over-comply with one category in exchange for another category, and should be permitted to apply one year's over-procurement to multiple years. Otherwise, there will be an arbitrary bias towards smaller solutions, which may result in less storage at a higher cost.

The standardized RAM contract format would likely not be the appropriate choice for CSP with integrated molten salt storage, due to the differences between this technology and other storage products. It is difficult to imagine a standardized comparison capable of cutting across multiple use cases and being applied to multiple technologies. A more inclusive RFO format would be more appropriate. As part of the storage procurement, we also recommend that utilities be granted the ability to enter bi-lateral agreements.

It is critical that the proposed procurement timelines not disadvantage those technologies with longer construction times. If utilities speculate that future storage costs will decline, they will be incentivized to select only projects in a given year which satisfy immediate storage obligations. In other words, they will wait until 2017 to address the 2018 procurement goal. This will bias selection away from technologies like CSP, which take three years or more to finance and construct. The Commission can prevent this by ensuring that the utilities select diverse portfolios with diverse construction times, not only quick or modular projects, and that speculation on future prices is limited.

A diverse portfolio is of the highest importance. Without sufficient diversity, California risks one-sided storage procurement with unintended consequences. SolarReserve believes that RPS procurement has been insufficiently diverse because of an overemphasis on contract price rather than on other valuable attributes; overemphasis on price has incentivized procurement of lower-value but lower-cost intermittent renewables, which intermittency is one reason why there is such a need for storage in the first place. A balanced and diverse portfolio is best.

The CPUC should ensure that the utilities employ a "learn by doing" strategy which utilizes open and transparent multi-attribute analyses of proposals. As experience is gained, the models should be adjusted. This will allow the procurement process to continue to adapt as storage resources become better understood.

B) Comment on whether any of the projects proposed to count toward the procurement targets be excluded, or any additional projects included, and on what basis.

SolarReserve does not recommend excluding any of the projects or including any additional projects. As mentioned in the prior section, we also support the inclusion of the Rice Project. CSP with integrated molten salt storage is well-recognized nationally and internationally as a leading energy storage technology, but the Rice project is the first of its kind in California and the only one currently under PPA to a California utility. All energy from the Rice project is a product of storage, and the full 150 MW capacity will be utilized on a daily basis. If Rice is not fully counted towards the storage procurement target, any further CSP development in California would be severely limited. If there is concern over the size of the Rice PPA relative to PG&E's total procurement target, the target should be raised.

C) Comment on how actual operational deployment should be defined for PIER- and EPIC-funded projects potentially eligible to count toward a utility's procurement target.

SolarReserve has no comment on this issue.

D) Comment on how any utility's procurement that exceeds a target in one year should be addressed and considered for future procurement targets.

If a utility over-procures in one year due to the cost-effective deployment of a large project with economies of scale, it should be permitted to count that procurement towards obligations in other years. The first priority should be to make up any past under-achievement of a target. Following that, the utility should be permitted to apply the compliant amount flexibly across multiple years. If over-achievement of the target is not allowed, this will bias the process towards smaller technologies, which will be less cost-effective and will result in the loss of the benefits associated with the leading larger storage technologies.

E) Comment on whether and to what extent utilities should be permitted flexibility in procuring among the use-case "buckets" (transmission, distribution, and customer-sited) of energy storage within one auction, and whether a minimum amount in each "bucket" must be targeted.

SolarReserve believes that a reasonable balance should be struck between the "buckets," but that this balance should be flexible to accommodate market realities. For the storage industry, certainty that the demand exists is far more important than the specific number in each category. In particular, as is the case with counting procurement across multiple years, there should be flexibility if the size of a cost-effective technology with economies of scale is larger than a particular "bucket." Constraining procurement to rigidly defined categories, particularly when each category is significantly smaller than a typical CSP plant, will create a technology bias against CSP with integrated storage.

F) Comment on the appropriate "off ramps" for relief from procuring up to each target and what metrics should be used to evaluate the appropriateness of the off ramps.

If there is sufficient flexibility in compliance, "off ramps" are not needed. In SolarReserve's opinion, there is ample evidence of a sufficiently robust and diverse energy storage market to serve the needs envisioned here. A means to escape from procurement compliance may prove distracting when the parties should instead be focused on deploying these

new solutions. If a need to revisit targets surfaces, the CPUC can address that need, but no pre-determined "off ramps" should be adopted.

G) Comment on how this proposal may be coordinated with Renewable Portfolio Standard procurement plans, as set out in Public Utilities Code section 2837.

This is a major issue which currently limits the market for CSP with integrated molten salt storage. The storage and generation attributes of this technology cannot be separated from each other; it would be nonsensical to procure molten salt storage in one process and this CSP technology in another. If procurement is not coordinated, then utilities may disjointedly select separate generation products and storage products which are inexpensive in isolation but suboptimal for the ratepayer in combination. The CPUC should strive to capture the value of the fully integrated CSP product.

Ideally, to the extent that they comply with the relevant targets, procurement through one program should count towards targets in the other. In theory, the renewable attributes acquired through storage procurement should count towards RPS procurement in the appropriate portfolio content category, and RPS procurement which incorporates storage should count towards storage procurement appropriately. However, RPS procurement must be accomplished under the RPS docket. One solution to this problem would be for the storage proceeding to set priorities which would then be implemented in other proceedings. Thus procurement of storage could be accomplished in the RPS proceeding and/or in the LTPP. We encourage the Commission to examine how best to create a linkage between these proceedings.

With respect to the RPS proceeding, SolarReserve believes that as soon as possible this proceeding should establish deadlines for amendments to RPS implementation plans to include storage in accordance with the guidance provided in Public Utilities Code Section 2837. SolarReserve believes that the legislature has provided a good list of the purposes that this RPS plan amendment should serve. Public Utilities Code Section 2837 reads as follows:

> 2837. Each electrical corporation's renewable energy procurement plan, prepared and approved pursuant to Article 16 (commencing with Section 399.11) of Chapter 2.3 of Part 1, shall require the utility to procure new energy storage systems that are appropriate to allow the electrical corporation to comply with the energy storage system procurement targets and policies adopted pursuant to Section 2836. The plan shall address the acquisition and use of energy storage systems in order to achieve the following purposes:
> (a) Integrate intermittent generation from eligible renewable energy resources into the reliable operation of the transmission and distribution grid.

(b) Allow intermittent generation from eligible renewable energy resources to operate at or near full capacity.
(c) Reduce the need for new fossil-fuel powered peaking generation facilities by using stored electricity to meet peak demand.
(d) Reduce purchases of electricity generation sources with higher emissions of greenhouse gases.
(e) Eliminate or reduce transmission and distribution losses, including increased losses during periods of congestion on the grid.
(f) Reduce the demand for electricity during peak periods and achieve permanent load-shifting by using thermal storage to meet air-conditioning needs.
(g) Avoid or delay investments in transmission and distribution system upgrades.
(h) Use energy storage systems to provide the ancillary services otherwise provided by fossil-fueled generating facilities.

In this storage proceeding, however, the Commission should go further than merely ordering the utilities to implement Public Utilities Code Section 2827. The Commission should clarify that utilities should incorporate the value of storage in their evaluation of *all* RPS RFO responses, not just storage RFOs, to the fullest extent possible using the most current analysis available, and vice-versa for the value of renewable energy associated with storage procurement. SolarReserve believes that without such a step, the utilities are largely unable to assign any value at all to storage in the RPS evaluation, which is a disadvantage to CSP with integrated molten salt storage in particular.

The Commission should also employ a "learn by doing" strategy as discussed in the first comment response, above. This will support continued cross-pollination of ideas, metrics, and best practices among the procurement programs.

Because relatively few offers will be applicable to both a storage and a renewable procurement process (although they are likely to be of a large scale) it would be beneficial to allow utilities also to engage in bi-lateral negotiations around procuring the output from such projects.

H) Comment on the options presented for ESPs and CCAs to either a) be required to procure an equivalent amount of storage projects commensurate with the load they serve or b) have their customers assessed the costs of the IOU procurement of energy storage projects through a cost allocation mechanism.

SolarReserve has no comment on this issue.

I) Comment on how the preliminary results of the cost-effectiveness models should be applied to the question of setting procurement targets.

The cost-effectiveness models have not examined CSP with integrated storage and have specifically excluded the relevant use case from their analyses. As such, preliminary results

from these models cannot be meaningfully applied to procurement of CSP with integrated molten salt storage.

J) Based on the preliminary results, should the utilities set a cost cap for offers to be submitted in the 2014 auction? If yes, what should the cap be and how should the auction be structured to incorporate the cap?

Utilities should not use the preliminary results of the cost-effectiveness models because those models specifically excluded certain technologies. They are not indicative of the entire storage landscape because they have not examined CSP with integrated storage; the methodologies that they employ may not even be relevant to this technology.

CSP with integrated molten salt storage cannot logically be separated into its component storage and generation parts; thus any application of a cost cap to the storage element of this technology would be distorted.

This question presumes that an auction will be the procurement format. We reiterate our opinion that a standardized auction is not the appropriate framework for procuring CSP with integrated molten salt storage among other diverse storage technologies.

IV. TECHNICAL DISCUSSION

This section will briefly describe CSP with integrated molten salt storage, discuss the differences between this technology and other CSP technologies, and touch upon one recent study of the value of CSP which was undertaken outside of this Proceeding.

SolarReserve's CSP design uses a field of flat, dual-axis tracking mirrors called heliostats, which turn throughout the day to focus sunlight on a tall tower at the center of the field. Atop the tower is a roughly cylindrical bundle of black tubes called a receiver. As reflected sunlight is concentrated on the black tubes, they reach high temperatures of over 1,000 degrees Fahrenheit (or 1,000°F). Nitrate salts (a blend of sodium nitrate and potassium nitrate), which are kept in a hot liquid (or "molten") state, are used to gather the heat from the receiver. At the base of the tower, molten salt is stored in the "cold" tank at 500°F; it is pumped up the tower and through the receiver tubes, whereupon its temperature rises to 1,050°F, and then it flows back down the tower and into the "hot" tank. On demand, the hot salt can be routed through a closed-loop heat exchanger with water to create steam and revert the salt to its cold state. The superheated steam is sent to a conventional steam turbine generator, which creates electricity.

This type of project typically involves a large volume of salt storage (millions of gallons) which effectively decouples the timing of sunshine with the delivery of electricity to the grid. Molten salt storage can be used to shift the timing of energy delivery between hours and between days. This decoupling also allows the steam generator to run more efficiently, rather than running at partial loads when the sun is not at its brightest, and can increase the utilization of fixed cost assets. It also allows the solar power output to be optimized in order to provide maximal value to the grid, which typically includes value from the following:

- Electricity delivery during times of highest demand or highest market prices
- Capacity that is reliably available at peak times when it is needed most
- Provision of grid-stabilizing ancillary services (rather than requiring additional stabilization from the grid) which can include frequency regulation, spinning reserves, load following, and ramping
- More efficient and stable operations of the fuel-burning generation fleet
- The option value of adjusting dispatch strategies at a later date
- Fully renewable solar energy with zero carbon emissions

CSP with integrated molten salt storage is different from other CSP technologies. Integrated storage is unique because the molten salt is heated directly by the sun; thus molten salt is used as the heat transfer medium as well as the storage medium. Other CSP technologies heat other media with sunlight (either a mineral oil or water) and, if they incorporate storage at all, must go through multiple heat exchange steps to move thermal energy into and out of storage. These other technologies may also have limitations on temperature (for instance, mineral oil will degrade at roughly 750°F) which limit the ability to deploy storage or increase its effective cost. Integrated storage offers a more flexible solution and the lowest cost for bulk energy storage.

In SolarReserve's experience, the National Renewable Energy Laboratories (NREL) has the most sophisticated ability to model CSP with integrated storage in the industry today. NREL recently released a paper evaluating the value of CSP with storage in California under a 33% renewable penetration scenario.[1] The report concludes that a certain CSP configuration would generate energy worth up to $51/MWh more than the output of a flat baseload resource, and up

[1] *See* Denholm et al., "An Analysis of Concentrating Solar Power with Thermal Energy Storage in a California 33% Renewable Scenario", March 2013, NREL Technical Report TP-6A20-58186.

to $40/MWh more than the output of a photovoltaic facility. We encourage CPUC staff, utilities, and any other interested parties to contact NREL if their supporting analysis would be helpful.

V. CONCLUSION

CSP with integrated molten salt storage is a highly valuable technology ready for near-term, large-scale deployment, which is nevertheless at a disadvantage due to disjointed regulatory policies and an insufficient appreciation in procurement processes. Utilities, regulators, and other stakeholders need additional experience with this technology's unique dispatch capabilities in order to facilitate its deployment in California. We urge the Commission to include all projects like Rice in the storage procurement process, and enable the utilities to procure CSP with integrated molten salt storage in a flexible, cost-effective, and coordinated manner. We encourage the Commission to actively support and monitor the unbiased acquisition of a diverse portfolio of storage projects. Prompting utilities to develop a more informed evaluation of CSP with integrated molten salt storage is necessary if the technology is to become a significant part of California's energy portfolio.

SolarReserve appreciates the opportunity to contribute these comments and to participate in this proceeding. We recognize that California is a world leader in renewable energy and technological innovation, and we look forward to continuing to participate in this market.

Respectfully submitted,

By:_____/s/_____

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Dated: July 3, 2013