BEFORE THE PUBLIC UTILITIES COMMISSION
OF THE STATE OF CALIFORNIA

Order Instituting Rulemakingto Continue Implementation and Administration of California Renewable Portfolio Standard Program.	Rulemaking 11-05-005 Filed May 5, 2011

REPLY COMMENTS OF ORMAT TECHNOLOGIES ON THE ASSIGNED COMMISSIONER'S RULING IDENTIFYING ISSUES AND SCHEDULE OF REVIEW FOR 2014 RENEWABLES PORTFOLIO STANDARD PROCUREMENT PLANS

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I. Introduction

Pursuant to Rule 14.3 of the Commission's Rules of Practice and Procedure, Ormat respectfully submits these reply comments on the ACR as well as on the July 21 email from Energy Division, titled "Integration Adder - Questions to Guide Reply Comments," which further identified specific questions to address in reply.

Ormat has taken these lengths to address the questions in this proceeding because they are highly relevant to the bid valuation of existing and new geothermal energy resources to serve California ratepayers and meet the state's RPS targets. California has the most ambitious emissions reductions objectives for the electric power sector in the United States and perhaps the world. While we continue to refine the existing policy and regulatory mechanisms for achieving those goals, perhaps most notably to date the RPS, the existing Commission proceedings have not yet developed a comprehensive framework for development and valuation of a portfolio of resources that can support continued progress towards climate goals beyond 2020, and do so on a least-cost basis while ensuring power system reliability. In our prior comments in this proceeding, Ormat discussed findings from two studies, by the Aspen Environmental Group and the Geothermal Energy Association, and made some new points, on barriers to the accurate comparative valuation of geothermal

under least cost, best fit (LCBF) valuation rules, including lack of consideration of integration costs. For that reason, we support the effort to include a reasonable approximation of long-term variable energy resource integration costs in LCBF valuation. A critical point in such analysis, which seems to have been missed by some commenters, is that most new renewable resources procured in 2015 will be a dditions to a portfolio that is already likely to be at 33% and greater RPS by the time that such new projects come on-line. The percentage of variable resources in California's overall generation mix in the next few years will be much higher than it is today. Hence, current integration costs in the current CAISO markets are not a good indicator of the integration costs of such future projects. The surveys of integration costs provided in comments by PG&E, Ormat and Calpine, sugg est that these costs may be significant in the choice of renewable resources procured as the California power system moves more rapidly to high penetration scenarios.

In the remainder of our Reply Comments, we first address the Energy Division questions, and subsequently add some responses to other stakeholders' comments.

II. Responses to Energy Division Questions

1. *There is general consensus among parties that an integration adder should be dynamic, updated frequently and differ based on technology and location. Furthermore, most parties agree that an adder should only include the indirect costs associated with integrating variable energy resources such as costs associated with regulation, ramping and cycling. If this is the case, should the term "integration adder" be changed to reflect these agreed upon attributes if what ends up being calculated are unique costs for each technology based on changes in electrical systems' portfolio mixes over time? What is your recommendation and what standard "term" and "definition" do you believe the CPUC should adopt?*

Ormat has no particular views on new names for the integration adder, which the question implies might alternatively be called "indirect cost adder". However, based on the comments and the discussio n here, it may make sense to list the actual components of an integration adder, whatever its name, into specific cost categories rather than bundle them into a single aggregated cost (or aggregated net cost, since some technologies may

simultaneously increase and decrease particular integration cost components).[1] We note some advantages and possible disadvantage of the two approaches. One advantage of calculating each component separately is that the market will get more information on where the higher value could be when addressing integration requirements. It may turn out that some integration cost components are much higher than others, which would be masked in an aggregated "adder". A second advantage is that it will allow the analysts to more transparently collect costs from different types of studies. For example, additional O&M due to cycling of combined cycle plants may be gathered from different sources than wholesale ancillary service costs. One disadvantage may be that if results from integration cost analyses from other locations are used, as discussed below, they may not dis-aggregate the components sufficiently. So there may be a situation for some time in which both aggregated and dis-aggregated numbers are used, and need to be interpreted carefully.

The dis-aggregated integration adder would likely include the following cost components, as shown in the columns of the table below. Several of these components would be measured from a baseline prior to the addition of variable energy resources.

- Regulation Up/Down
- Flexi-ramp constraint/product
- Real-time energy load following/ramping costs (as reflected in real-time CAISO energy prices)
- Day-ahead forecast errors (as identified in LBNL simulation studies)
- Frequency response and inertial response reserves (not yet defined by CAISO, but identified in NERC requirements and CAISO studies)
- Start-up costs
- Variable O&M costs, e.g. cycling of fossil-fuel based power plants
- Flexible capacity requirements
- Other long-term fixed costs associated with meeting integration requirements

The table below also provides an assessment of where the data on these costs could come from, as discussed in more detail below and in other comments. These include the following:

[1] For example, the frequency of regulation may decrease with increasing portfolios of variable energy resources, while ramps may simultaneously increase.

- The first column, "CAISO wholesale market or administrative prices" refers to prices or costs relevant to the integration adder that would come directly from market data or other prices set in the CAISO tariff (such as backstop capacity prices). In some cases, the CAISO may have to modify the way certain costs are calculated to support the integration analysis.
- The second column, "Other CPUC/CAISO data," refers to other non-market data or analysis that could inform the calculation of the integration adder. For example, the CAISO now forecasts flexible capacity requirements and also allocates those requirements among load and different variable energy resources. In some cases a variable ene rgy resource can mitigate system ramps in certain ramps due to the prevailing load shape. This characteristic may be difficult to see in an aggregated integration adder.
- Finally, the third column, "California long-term simulation studies," refers to simulation studies, such as the current LTPP framework that could be used to estimate longer-term integration costs under different scenarios. In some cases, such modeling could also be used to fill in particular integration costs components by technology that the CAISO markets do not currently identify such as start-up costs.

Our point is to show that some integration cost components can be derived across a range of market, non-market and simulation data sources, and all these sources may be relevant to the analysis. We have not completed this survey, but hope that the basic point is clear.

	CAISO wholesale market or administrative prices	**Other CPUC/CAISO market data**	**California long-term simulation studies**
Regulation Up/Down	Yes		Yes, an output of LTPP production cost models
Flexi-ramp constraint/product	Yes		Yes, overlaps with load-following reserve in LTPP production cost

			models
Real-time energy load following (as reflected in real-time LMPs)	Yes, but would need analysis by CAISO to differentiate impact of variable energy resources		Yes, overlaps with load-following reserve in LTPP production cost models
Start-up costs	Currently "bid cost recovery" costs which include start-up costs are reported by CAISO in too aggregate a form for consideration in integration costs calculated by technology		Yes, an output of LTPP production cost models and can be calculated by technology
O&M costs	Variable O&M costs not reported by unit type.	Long-term fixed O&M calculated for different generation resources by CEC.	Variable O&M costs can be estimated on a $/MWh basis and calculated in the LTPP production cost models
Flexible capacity	Yes.	For bilateral resource adequacy capacity transactions, prices will be non-transparent, reflected in bilateral contracts. CAISO annual forecasts of flexible capacity provide a requirements	Yes, with some additional steps (e.g., the PG&E modeling framework) can be an output of LTPP production cost models

2. *If integration adders were developed in the LTPP Proceeding, would updating the adders best be achieved by including that as part of the biennial LTPP process? If not, what frequency and manner would be ideal? How would those results be introduced into the LTPP record?*

A biennial review in the LTPP would be most consistent with Commission processes and proceedings relevant to long-term procurement. However, the Commission should also find that determination of how often to update depends in part on empirical data. If the CAISO

finds that system conditions change rapidly year to year with increasing wind and solar production, and evidence that RPS procurement taking place in between biennial LTPP proceedings should take that information into account, then there should be some process for considering such information. For example, as noted above, the CAISO has recently begun releasing next-year forecasts for flexible capacity, data which could be used qualitatively in evaluating comparative integration costs or requirements of differen t resources. Until there are market prices for flexible capacity, estimates of likely costs would have to come through models such as proposed in the PG&E modeling framework.

3. *Three general approaches to calculating integration adders were identified by parties – 1) using values from publicly available studies, 2) using market-based cost data from CAISO's regulation and upcoming flexible capacity markets, and 3) using the operational flexibility studies currently scoped in the LTPP proceeding to inform the development of integration adders. Please comment on the advantages and disadvantages of each approach and recommend a procedural framework for implementing your preferred approach. If your recommended framework utilizes more than one approach please be specific regarding the procedural steps and timeline that the CPUC should follow in developing integration adders.*

As already discussed, Ormat recommends that a ll three approaches are used more or less simultaneously to help set a range of possible costs. We believe that all three approaches can be developed sufficiently and on time to support 2014 RPS procurement.

First, as discussed by PG&E in their comments , results from publicly available studies of other regions could be used to provide proxy values for resources in particular locations that are not yet being modeled otherwise. PG&E notes that these studies are primarily of wind integration, with fewer studies of solar integration. In our comments, Ormat recommended not using studies from utilities or power systems outside California, as did several other commenters, but we would support this approach as an interim measure in the absence of California-specific analysis, or perhaps simply as a che ck on any California analysis . The disadvantage of using results from external studies is obviously that they could be significantly different from actual California costs, whether higher or lower.

The timeline for implementing this approach is fairly straightforward – there are many surveys of these costs and any further work to compile and compare study results could be completed by the Commission and reviewed by external stakeholders in 2-3 months.

Second, as we noted above and as discussed by several commenters, including CalWEA and Calpine, CAISO market data and other types of market data (e.g., for resource adequacy capacity) is another source of information about integration costs. There are both advantages and disadvantages to using this data. The significant advantage is that such costs reflect actual market outcomes rather than simulations.

The major disadvantages are that such costs will always be historical only, and there is no accurate way to forecast or extrapolate them for future years given the rapid changes that will be taking place. In particular, since the CAISO markets have not yet experienced significant operational constraints, but could over the next 2 -3 years, the use of current data will be a misleading signal for long-term RPS contracts. However, there may also be times where CAISO market outcomes could suggest higher costs than external system results or than the LTPP models or other simulation models. For example, the incidence of over - generation in the CAISO footprint may be higher and sooner than indicated in the LTPP models. Hence, actual market data will be helpful in decision -making in each iteration of RPS procurement, but should be interpreted carefully and in conjunction with longer -term simulation models.

The timeline for implementing this approach is also fairly straightforward – as pointed out by CalWEA, Calpine and others - the CAISO market data is readily available, but in some instances, the CAISO may need to do further calculations not currently being done. Calpine also does some simple estimates of flexible capacity costs, in the event that such additional resources are needed, using current system resource adequacy capacity prices. Hence, the Commission should reserve 2 -3 months to determine what CAISO data and other data is needed and to give time for any additional calculations.

Third, the LTPP models – and similar mo dels – will be necessary to anticipate changes on the power system as renewable penetration increases, and to analyze alternative renewable portfolios. PG&E believes that it will take at least one year to derive integration costs using

the LTPP models or related ones. Ormat believes that modeling methods similar to what PG&E proposes for California analysis have been completed in much less than one year.

In sum, in response to the Commission's questions and the views of other commenters, Ormat recommends that the Commission allows for values from all three approaches to be considered and the IOU s to use judgment when using these values to compare alternative renewable resource offers. Where it is appropriate, one type of value could be substitut e for another – e.g., if the CAISO market price suggests a higher cost for a particular operational requirement than a model used in LTPP , it should be used if that higher cost appears to result from operational constraints not modeled in LTPP . However, i f the current market price is lower for a component than what a long -term model suggests for operations under future system conditions, then the LTPP model result should be used.

4. *Do you think it is important for the Commission to determine a methodology for the development of integration adders as well as calculate the values to be used in LCBF? Or is it more appropriate that the IOUs be responsible for calculating integration cost adders based on the methodology developed by the CPUC? Please recommend your preferred approach by weighing the strengths and weaknesses of allowing for IOU-based values. In considering your recommendation, how important is it that the values calculated be verifiable by parties?*

Both approaches should be utilized. First, the Commission should develop at least some long-term estimates through the LTPP modeling and other sources so as to provide some benchmarks to the market (both project developers and technology innovators) . The IOUs should comment on these benchmarks and ind icate whether they are similar to the IOU s' internal estimates. Second, because the IOUs have proprietary valuation models which could include additional types of analyses, they should also have some discretion to develop their own estimates, especially for use in evaluating non-conventional renewable technologies (e.g., incorporating storage or otherwise offering operational flexibility). When reviewing IOU recommended projects, t he CPUC will have to use judgment if IOU estimates depart significantly from the benchmarked values.

5. *Do you think it is important for the CPUC to adopt a methodology to calculate integration adders in time for the 2014 RPS Solicitation beginning in early 2015? If*

so, can any of the three general approaches mentioned in Question 3 meet this objective while also providing reasonable and defensible cost estimates? In addition, do you believe integration adders, if calculated using one of the three approaches, will be significant enough to alter procurement decisions?

Yes, if not f inal integration adders , then at least proxy ones that could be used to justify procurement of a more expensive, but simpler to integrate renewable resource, when compared to a less expensive one that is more highly variable or could experience high curtailment rates.

The question of whether integration adders will be significant enough to alter procurement decisions is difficult to answer. As discussed in our opening comments, as renewable portfolios evolve, there will be changes in several benefit and cost components that will contribute to affecting procurement decisions. For example, comparative capacity value is changing between different types of resources. Integration costs may or may not be the key component depending on the resources being compared. To gain insight into this, it is important to begin the analysis to determine how significant these costs might be for comparative valuation under long-term, high penetration scenarios. Moreover, if the quantitative LCBF calculation sufficiently closes the gap between incremental RPS resources, other qualitative factors, such as the objective of technology diversity, could further influence the procurement decision. Judging from the results of multiple studies that estimated the cost of renewab le integration, we believe that there is a good possibility that implementing such an adder could level the playing field between certain renewable technologies depending on their impact on long -term integration requirements, and could have a noticeable impact on procurement decisions.

6. *In its comments, PG&E provided a framework for calculating integration adders using production cost modeling. If parties agree that production cost modeling should be utilized to determine the costs associated with integrating renewables, do you agree with the framework that PG&E has proposed? Are there any modifications to the framework that you would make? If so, provide a modified framework in your response.*

Ormat supports PG&E's framework as a starting point f or analysis. There are details left out of the framework that need to be filled in, such as what quantity of variable energy resources are being removed from the LTPP scenario in Step 1 to create the reference case. In addition, some steps are not yet cl ear. For example, Step 3 is supposed to add "the amount of additional flexible capacity" but the methodology isn't clear about how this will be done, e.g., how the mix of flexible capacity resources is chosen. Such details probably need to be discussed a nd clarified through a workshop, but the basic framework appears consistent with the modeling objective and similar to other studies that have done comparative analysis of different variable energy resources using production cost or similar models, such as those by the National Renewable Energy Laboratory (NREL) and Lawrence Berkeley National Labs (LBNL) cited in Ormat's comments and those of other commenters.

As noted above, PG&E's framework is not the only type of analysis that should be used to inform th e development of the integration adder, but the PG&E approach or some similar method is one of the key components.

7. *Integration costs may rise as the saturation level of renewable resources increases over time. If production cost modeling is used to assist in developing integration adders, what level of renewable saturation should be assumed and what is your rationale?*

Ormat believes that both 33% and 40% renewable portfolios should be evaluated using the LTPP models in the PG&E framework or a similar approach. The Commission should further allow 1 -2 scenarios with 50% renewable portfolios. While the 40% - 50% RPS scenarios do not yet correspond to RPS policy decisions, they are consistent with the general expectation of actual renewable penetration of above 33% in 2020 and with California greenhouse gas emission reduction goals and highlight factors that may prove to be significant in achieving those goals. Based on the few studies already conducted, the 50% RPS scenarios are the most suggestive that geothermal resources may be more competitive with wind and solar resources if integration and curtailment costs are taken into account.

8. *In its comments, CalWEA provided a framework for calculating the short-term, medium-term and long-term costs associated with renewable integration. Please*

comment on the practicality of this framework and whether you think it could meet the objective of developing integration adders that are reasonable and defensible. What refinements need to be made to the proposed framework for it to achieve the stated objectives?

While Ormat believes that CalWEA has identified some elements of integration costs correctly, we do not support the conclusions and intent of CalWEA's proposal , which essentially would not begin to address integration costs until actual operational issues become more severe on the California power system or some future LTPP study determines an additional infrastructure requirement . Given that we already know that the IOUs have committed to portfolio s equivalent to 33% -40% RPS, with many projects coming on -line before 2020, w e recommend an anticipatory approach, as do the IOUs and several other commenters. While in some cases, power system analysts have over-estimated the integration and curtailment costs associated with wind and solar penetration, in many others they did not anticipate those impacts correctly, resulting in more curtailment than might have been necessary. In the case of California, there is the opportunity to use sophisticated analysis with the ability to utilize a diversity of available renewable resources to develop an operationally feasible, reliable portfolio.

CalWEA's estimates of close to $0 integration costs for incremental variable wind and solar resources procured in 2015 may be roughly consistent with present moment conditions – which reflects positively on the operational flexibility of the California gas fleet and the adjustments in scheduling and system operations made to date by the CAISO – but is not consistent with a ny of the non-California western utility integration costs or longer -term integration cost studies cited by different commenters (notably PG&E). Also, CalWEA ignores several components of integration costs that others have identified, including NREL and LBNL.

There is a simple test for CalWEA's assertions about medium -run and long-run estimates of integration costs, which is to run PG&E's modeling sequence using the current LTPP scenarios and possibly one or two 50% RPS scenarios. We believe that this can be done in a timely fashion and can help clarify what CalWEA calls medium-run and long-run integration costs.

III. Additional Reply Comments

1. Capacity Value (Section 7.1)

Given the response of stakeholders, Ormat is confident that the Commission will allow for a positive system resource adequacy capacity value to be used in 2014 RPS procurement, and reject the arguments against a positive value put forth by CalWEA. We agree with the various arguments presented in support of a positive value, which are summarized in the table below. Ideally, there should be greater consensus on the forecast of the actual Net System Balance at this time, but short of that, the IOUs should be allowed to determine reasonable long-term net system balance forecasts and capacity values.

Comments	Section 7.1, Question 1: Arguments in support of positive system resource adequacy value
Ormat, LSA	Some CPUC Net System Balance scenarios show capacity needs earlier than 2030
Ormat, Calpine, CalWEA	CPUC Net System Balance forecasts reflect over-estimates of solar capacity value, which will be revised downwards using CPUC ELCC model.
SCE	There is some degree of uncertainty whether the supply resources assumed in the long-term Net System Balance will actually be operational
LSA	Buyers and sellers should have latitude to determine long-term market capacity value
PG&E	Current resource adequacy capacity prices remain positive despite capacity surplus because existing generators have to be compensated for their going forward costs
SCE	IOUs already consider the effect of surplus capacity on capacity value in valuation

2. Renewable Integration Adder (Section 7.3) by Question

We offer reply comments on selected questions on the integration adder. For the remaining questions, we believe that most other comments were consistent with our views or that the relevant issues were addressed above.

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Question 1

Ormat agrees with PG&E and SDG&E that there may be other transmission and distribution system integration costs not currently considered under LCBF. PG&E observes that "the present comments focus only on generation-related integration costs. There may be additional transmission and distribution integration costs not currently captured in interconnection studies that need to be considered as the Commission's effort to address integration costs evolves." SDG&E also argues that distribution-system impacts should be considered, but offers no examples. The Commission could explore further what such costs are and whether they can be readily quantified, but this should not be a reason to delay implementing a renewable integration adder.

Question 5

Although it isn't clear in each case, it appears that most parties acknowledge that a positive long-term integration cost adder is appropriate even if new resources are not needed specifically for integration. This is important on a comparative basis, especially if curtailment costs are also considered in the LCBF analysis. The Commission should thus reject CalWEA's argument that long-term costs should only be considered if new resources are identified as needed in the LTPP proceeding, and allow for analysis of the variable integration costs listed above as well as the costs of more expensive flexible capacity as a substitute for cheaper, less flexible capacity.

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Conclusions

Ormat appreciates the opportunity to submit these Reply Comments and looks forwa rd to working with the Commission and parties on the further development of the RPS least cost , best fit methodology.

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Dated: July 30, 2014

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VERIFICATION

I, Bob Sullivan, am the Vice President of Business Development for Ormat Technologies, Inc. I am authorized to make this Verification on its behalf. I declare under penalty of perjury that the statements in the foregoing copy of **COMMENTS OF ORMAT TECHNOLOGIES ON THE ASSIGNED COMMISSIONER'S RULING IDENTIFYING ISSUES AND SCHEDULE OF REVIEW FOR 2014 RENEWABLES PORTFOLIO STANDARD PROCUREMENT PLANS** dated July 2, 2014 are true of my own knowledge, except as to the matters which are therein stated on information and belief, and as to those matters I believe them to be true.
I declare under penalty of perjury that the foregoing is true and correct.

Executed on July 30, 2014 at Reno, Nevada.

/s/ BOB SULLIVAN
Bob Sullivan
Vice President of Business Development, Ormat Technologies, Inc.