BEFORE THE PUBLIC UTILITIES COMMISSION
OF THE STATE OF CALIFORNIA

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Order Instituting Rulemaking to Develop an Electricity Integrated Resource Planning Framework and to Coordinate and Refine Long-Term Procurement Planning Requirements.	Rulemaking 16-02-007 (Filed February 11, 2016)

(NOT CONSOLIDATED)

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COMMENTS OF CALPINE CORPORATION ON REPORT AND NEXT STEPS FOR DEVELOPMENT OF RENEWABLES INTEGRATION COST ADDER

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COMMENTS OF CALPINE CORPORATION ON REPORT AND NEXT STEPS FOR DEVELOPMENT OF RENEWABLES INTEGRATION COST ADDER

Pursuant to the May 11, 2016 *Joint Administrative Law Judge's Ruling Seeking Input on Report and Next Steps for Development of Renewables Integration Cost Adder* ("ALJ Ruling"), Calpine Corporation ("Calpine") offers the following comments on the questions set forth in the ALJ Ruling and the April 4, 2016 report, entitled, *Southern California Edison's (U 338-E) Renewable Integration Cost Adder Report* (the "RICA Report").

Calpine has consistently encouraged the California Public Utilities Commission ("Commission") and other state agencies to consider all the costs and benefits of procurement of different renewable technologies. For instance, Calpine actively supported Assembly Bill 2363, which modified the California Public Utilities Code to require the consideration of integration costs in the investor owned utilities' ("IOUs") least-cost best-fit ("LCBF") evaluation methodologies.[1] At the same time, Calpine recognizes that renewable integration costs, particularly the variable integration costs that were considered in the RICA Report, are a single

[1] *See* Pub. Util. Code §§ 399.13(a)(4)(A)(v)(II) and 454.5(k).

and small element of the net costs and benefits of renewable resources. Consequently, in light of the many important issues that the Commission currently has to consider, Calpine does not recommend further extensive analysis of variable integration costs. Instead, Calpine urges further attention to other elements of LCBF – such as curtailment costs and capacity value – which are potentially larger and vary more across renewable technologies.

Questions on the Specific Analysis in the RICA Report

1. Do you agree with the primary conclusion of SCE's report that the results of this study (calculations of variable integration costs), as calculated using the tools and methodology described in the report, are unreliable? Explain why or why not.

Calpine agrees that the RICA Report demonstrates convincingly that the estimates of variable integration costs summarized in the report are unreliable. Specifically, the RICA Report details the following compelling reasons why variable integration costs are unreliable:

1. The estimates are based on results of optimizations that failed to converge;[2]

2. The estimates are derived from results of simulations that were infeasible in the sense that they violated "hard constraints";[3] and

3. The magnitude of the calculated integration costs are within the precision of the solutions to the simulations that were used to derive them (i.e. the calculated variable integration costs are just as likely to reflect random variation in the model solutions as genuine integration costs).[4]

2. Do you agree with SCE's conclusion of four major lessons learned from this study:
   a. The database should be designed for the purpose of the study;
   b. The methodology should be designed with the confines of the model in mind;
   c. Uncertainty in the modeling approach should be considered; and
   d. A better understanding of reserve requirements and their relationship with increasing renewable penetration is needed.

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[2] *See* RICA Report, at 11-12.

[3] *See* RICA Report, at 12-13.

[4] *See* RICA Report, at 16.

Why or why not? Elaborate on which aspects of the database require further attention, which "confines" of the model must be better considered, what uncertainties are most critical (and perhaps overlooked), and/or what alternative approaches to reserve requirements should be considered.

Calpine generally agrees with the RICA Report's conclusions regarding what aspects of production cost modeling using PLEXOS and Long-Term Procurement Planning / Integrated Resource Planning ("LTPP/IRP") inputs might have to be changed to yield more reliable variable integration cost estimates.[5] In particular, Calpine agrees that variable integration cost estimates should not be driven by penalty parameter assumptions.[6] The fact that LTPP/IRP penalty parameter assumptions yield implausible integration cost adder estimates begs the question of whether the same penalty parameters yield reasonable results in LTPP/IRP operational flexibility modeling.

Calpine also agrees with the RICA Report's conclusion that it is critical to better understand the relationship between increasing renewable penetration and ancillary services ("AS") and reserve requirements.[7] In fact, a better understanding of this relationship could constitute the basis for a greatly-simplified variable integration cost adder. In prior comments filed in R.11-05-005, both the California Wind Energy Association ("CalWEA") and Calpine recommended that the relationship between the increasing penetration of renewables and AS/reserve requirements could be used to calculate a variable integration cost adder by calculating the product of: (a) the impact of a resource on AS and reserve requirements; and (b) price estimates for such corresponding AS and reserve products.[8] Recent historical market

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[5] *See* RICA Report, Section VI, at 23-24.

[6] *See* RICA Report, at 15-16.

[7] *See* RICA Report, Section VI, at 23-24.

[8] *See e.g.*, Comments of Calpine Corporation in Response to Questions Raised in Assigned Commissioner's Ruling, July 2, 2014 (R.11-05-005); Comments of the California Wind Energy

prices for AS and reserve products, to the extent that they exist, could be used to develop near-term estimates of variable integration costs. Projections of AS and reserve products, perhaps calculated from one or a few production cost simulations (*e.g.*, PLEXOS produces AS and reserve prices as outputs), could be used to develop long-term estimates of variable integration costs.

3. Do you agree with the report's description of how uncertainty in the total production simulation costs and the calculated "difference of differences" masks the variable integration cost being measured? Explain why or why not. Are there other sources of uncertainty that should be considered, and if yes, how?

Calpine agrees with the RICA Report's description of uncertainty in the total production cost estimates produced by the PLEXOS simulations summarized in the RICA Report.[9] Production cost simulations are large optimizations. Large optimizations may find a range of solutions depending on constraints placed on the optimization, such as the Mixed Integer Programming gap discussed in the RICA Report.[10] If constraints are placed on an optimization to force it to identify a tighter range of solutions, the optimization may fail to converge to find any solution.

4. The RICA methodology modeled a "counterfactual" electric system by removing operating constraints for all flexible generation as well as flexible reserve commitment requirements attributed to wind and solar generation. The methodology then used a "difference of differences" calculation of variable (production) cost differences between normally (flexibility-) constrained vs. counterfactual cases both with and without an added increment of wind or solar generation. Is this a viable approach for calculating variable integration costs? Why or why not?

Theoretically, the "difference of differences" approach is a reasonable way to estimate variable integration costs because it carefully isolates production cost differences that are: (1)

Association on Draft 2014 RPS Procurement Plans and Related Questions in Assigned Commissioner's Ruling, July 2, 2014 (R.11-05-005), at 18-26.

[9] *See* RICA Report, at 17-22.

[10] *See* RICA Report, at 16-20.

attributable to renewables; and (2) not typically captured in other aspects of LCBF valuation methodologies such as energy value. However, as the RICA Report demonstrates,[11] it is hard to implement such an approach in practice and thus it is likely not the best use of the Commission and parties' resources at this time.

5. Can production cost models (not necessarily only PLEXOS) in general be used to calculate variable integration costs, or are such tools fundamentally limited, for example because variable integration costs are difficult to isolate (they are intertwined with energy value, curtailment costs, penalty costs) and/or because they lack the required precision and accuracy? Why or why not?

The RICA Report demonstrates that it is very difficult to use production cost models and the "difference of differences" approach to estimate variable integration costs.[12] Based on Calpine's experience with similar models, Calpine would not expect other production cost models to yield more reliable estimates using the same "difference of differences" approach. Consequently, to the extent that the Commission seeks to refine estimates of variable integration costs, Calpine recommends the exploration of other approaches, such as the approaches previously recommended by Calpine and CalWEA.[13]

6. What should the Commission conclude about the calculation of variable integration cost adders for wind and solar, based on the results described within SCE's April 4, 2016 report?

The Commission should not approve the Investor Owned Utilities' ("IOUs") use of variable integration cost adders derived from the approach summarized in the RICA Report in the IOUs' LCBF valuation methodologies. Moreover, the Commission should not attempt to develop more robust variable integration cost adders using the methodology explored in the RICA Report. Instead, the Commission should require that the IOUs continue to rely on the

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[11] *See* RICA Report, at 16-20.

[12] *See* RICA Report, at 4.

[13] *See supra*, Response to Question 2, at fn. 8.

current interim adders until more robust estimates of variable integration costs are developed using alternative methodologies, possibly including the methodologies previously recommended by Calpine and CalWEA.[14]

7. Should the Commission continue development of methods to isolate variable integration costs? If yes, how?

a. Should alternative methods be developed, such as a simpler single cost differential? If yes, how? Consider that such simpler methods would need to discern energy value (production savings from using lower cost wind and solar energy to displace higher cost energy) from variable integration costs (production costs from operating the system to balance the variability and uncertainty of wind and solar energy).

As discussed above, the Commission should consider simpler means of estimating variable integration costs, including the approach that Calpine and CalWEA have previously proposed. Such methods involve estimating the impact of a renewable resource on AS and reserve requirements. The cost of incremental reserves can be estimated using projections of prices of the relevant AS and reserves, normalized by the expected output of a resource to determine a $/kWh variable integration cost adder.

b. How should any method of calculating variable integration costs based on multiple cases treat differences in constraint violations and curtailments between the cases?

Calpine does not advocate additional production cost modeling at this juncture to determine variable integration costs. To the extent the Commission decides to pursue additional production cost modeling to determine variable integration costs, it would be inappropriate to compare the results of production cost simulations with different constraint violations and curtailments to estimate variable integration costs. Such a comparison could potentially work if the constraint violations and curtailment are priced in a manner that accurately monetizes the effects that such constraint violations have on reliability and RPS compliance. Otherwise,

[14] *Id*.

integration cost estimates from the comparison of different production cost simulations may reflect differences in reliability and RPS compliance, not actual variable integration costs.

8. Should the Commission discontinue efforts to isolate variable integration costs and instead holistically calculate renewables integration costs without separating the components (variable integration costs, curtailment, and fixed costs)? Why or why not? If the Commission seeks to calculate renewables integration costs holistically, how should such a holistic calculation be undertaken? Specify any models or methods that would be required.

Calpine believes that changes to LCBF should focus on the elements of LCBF that are likely to be the most quantitatively-significant, including capacity value and curtailment costs (curtailment costs arguably are not distinct costs but rather an element of energy value). The LCBF valuation methodologies that the IOUs currently use in their RPS solicitations – to the extent that the assumptions in such methodologies are transparent – are conceptually sound. However, Calpine suspects that the assumptions the IOUs have historically used in their LCBF methodologies, particularly with respect to how higher penetrations of solar might impact energy and capacity values, have tended to understate how higher penetrations of solar could depress the energy and capacity value of solar. These inaccurate assumptions have consequently tended to overvalue solar resources. Therefore, Calpine urges greater attention to the forward energy and capacity price assumptions used in the IOUs' LCBF valuation methodologies.

Questions Related to Policy Considerations and Next Steps

9. What future activities would you recommend the Commission undertake to further refine calculation of renewables integration costs according to the legislative requirements, considering that the result should also have a productive impact on both renewables and broader resource planning and procurement? How high a priority should it be for the Commission to undertake such activities, if any? Explain.

As indicated above, Calpine agrees with the recommendation in the RICA Report that "a better understanding of reserve requirements and their relationship with increasing renewable

penetrations is needed."[15] Such an understanding could be used to derive a direct estimate of variable integration costs without comparing the results of multiple production cost simulations. In addition, understanding this relationship is important because it is used to develop AS and reserve requirement inputs to the production cost modeling that has been used to explore operational flexibility requirements in the LTPP proceeding and which presumably will be continued in the IRP proceeding.[16]

In its own production cost modeling of operational flexibility requirements, the California Independent System Operator ("CAISO") has used a proprietary model to estimate the relationship between reserve requirements and renewable penetrations. Increased transparency into the CAISO's model or an alternative model would likely help stakeholders and the Commission better understand this relationship.

10. Should the adopted interim values for the variable component of the renewables integration cost adder be retained for use in the RPS Calculator and least-cost best-fit evaluation in RPS procurement? If not, what should replace them?

Calpine supports the continued use of the interim variable integration cost adders until better estimates are supported and vetted.

11. Should renewables integration cost adders be developed for geothermal and biomass resources to reflect costs to the system for the relative inflexibility of these resources? If yes, how should these adders be calculated? How should such a methodology recognize that any resources that are not infinitely flexible will likely have some "integration" costs?

Calpine believes that *all* renewable resources should be evaluated using uniform criteria. To the extent that other renewable technologies such as geothermal and biomass increase

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[15] RICA Report, at 23.

[16] In the CAISO's modeling of operational flexibility requirements, the CAISO refers to the estimation of reserve requirements (as a function of renewable penetration) as Step 1. *See e.g.,* CAISO, Summary of Preliminary Results of 33% Renewable Integration Study – 2010 CPUC LTPP Docket No. R.10-05-006, at Slide 8, *available at* http://www.caiso.com/Documents/Summary_PreliminaryResults_33PercentRenewableIntegrationStudy_2010CPUCLongTermProcurementPlanDocketNo_R_10-05-006.pdf.

variable integration costs, they should be ascribed adders that reflect their contributions to variable integration costs. However, Calpine does not believe that geothermal and biomass resources significantly increase the need for AS and reserves that should be captured in a variable integration cost adder. To the extent that the supposed inflexibility of geothermal and biomass resources requires them to operate in periods in which they may be curtailed or their energy value is low, the supposed inflexibility of these resources should be captured in the energy valuation component of LCBF.

In addition, Calpine notes that not all geothermal resources are inflexible. As discussed at a recent California Energy Commission workshop, Calpine's geothermal plant at The Geysers routinely varies its output by hundreds of megawatts in response to CAISO dispatch, both through CAISO markets as well as Exceptional Dispatch.[17]

12. Should the Commission modify its previous work to develop a renewable integration cost adder specifically targeted to inform RPS planning and procurement, and instead, inform RPS planning and procurement via a comprehensive integrated resources planning process (for example, an analysis that optimizes for reliability, low carbon emissions, and least cost across all resource types)? Why or why not?

a. How would such an analysis be conducted?

b. How would any resulting optimized portfolio(s) inform procurement of individual resources?

c. If the idea of a separate renewables integration cost adder with California-specific fixed and variable components, is no longer pursued, how would the Commission fulfill its legislative requirement to calculate renewables integration costs?

Calpine offers no views on sub-questions a. and b. at this time because the Commission has already committed to undertake the referenced analysis in this proceeding. While such an analysis may be helpful to understand long-term resource requirements, it is unclear that it would completely supplant the LCBF valuation methodologies that the IOUs currently use.

[17] *See* Calpine, Operational Flexibility of Geothermal Power, at Slide 6, *available at* http://www.energy.ca.gov/research/notices/2016-01-28_workshop/presentations/Operational_Flexibility_of_Geothermal_Power.pdf.

With respect to sub-question c., Calpine believes that the Commission could fulfill its legislative mandate with respect to integration costs[18] by either (a) allowing the IOUs to continue to use the interim adders that they are currently using; (b) approving alternative adders based on simpler methodologies, potentially including the methodologies previously recommended by Calpine and CalWEA.

13. How should parties most effectively participate in any future development of integration cost analysis pursued by the Commission (e.g. small working groups, a series of workshops, collaborative effort by parties with modeling capabilities, etc.)?

Working groups similar to the working groups that were used to address modeling issues in the most recent LTPP proceeding might be an effective vehicle for pursuing additional integration cost analysis.

Respectfully submitted,

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[18] *See* Pub. Util. Code § 399.13(a)(4)(A)(v)(I) ("The commission shall adopt, by rulemaking, all of the following…(A) A process that provides criteria for the rank ordering and selection of least-cost and best-fit eligible renewable energy resources to comply with the California [RPS] Program obligations on a total cost basis. This process shall take into account all of the following: … (v)(I) Estimates of electrical corporation expenses resulting from integrating and operating eligible renewable energy resources, including, but not limited to, any additional wholesale energy and capacity costs associated with integrating each eligible renewable resource.").

VERIFICATION

I am the attorney for Calpine Corporation, and I have been authorized to make this verification on its behalf. Said party is located outside of the County of San Francisco, where I have my office, and I make this verification for said party for that reason. I have read the foregoing document and based on information and belief, I believe the matters therein to be true.

I declare under penalty of perjury that the foregoing is true and correct.

Executed on June 3, 2016 at San Francisco California.

_____/s/_____
Patrick Ferguson