BEFORE THE PUBLIC UTILITIES COMMISSION

OF THE STATE OF CALIFORNIA

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FIT COALITION COMMENTS ON RENEWABLES INTEGRATION MODELS 2ND PHASE 1 WORKSHOP OCTOBER 22ND 2010

Kenneth Sahm White
FIT Coalition
16 Palm Ct
Menlo Park, CA 94025
(805) 705 1352

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The FIT Coalition respectfully submits these comments pursuant to the Administrative Law Judge's Initial Ruling ("ALJ Ruling"), dated November 17, 2010, and pursuant to Rules 1.9 and 1.10 of the California Public Utilities Commission's ("Commission") Rules of Practice and Procedure.

The FIT Coalition is a California-based advocacy group focused on smart renewable energy policy. The FIT Coalition's mission is to identify and advocate for policies that will accelerate the deployment of cost-effective renewable energy. We believe the right policies will result in a timely transition to renewable energy while yielding tremendous economic benefits, including long term energy security, cost savings and stability, new job creation, increased public and private revenue, and the establishment of an economic foundation that will drive growth for decades. Toward these goals, we advocate primarily for vigorous feed-in tariffs and "wholesale distributed generation," which is generation that connects to distribution lines on the supply-side of the meter close to demand centers. Our members are active in proceedings at the Commission, Air Resources Board, Energy Commission, the California Legislature, Congress, the Federal Energy Regulatory Commission, and in various local governments nationally.

I. General Comments

It bears repeating that no single model is likely to be adequate to support policy judgments regarding future resource needs. Multiple sources will provide perspectives and key insights missing from any single approach taken to forecasting resource needs and optimal responses. California's experience with modeling such factors as the level of variability associated with solar PV over large scale (megawatts) and geographical diversity is very much in the early stages, and modeling is thus as much art as science.

In the face of substantial uncertainty, current excess resource adequacy, and anticipated near- term advances in modeling, real time load forecasting, and alternative means of addressing system requirements, we concur with the broad range of comments from across the spectrum in calling for a "**least regrets**" set of actions, to be undertaken only as appears necessary under a wide range of assumptions and **having relatively limited potential for creating stranded investment**.

At the same time, we join with others in noting that modeling efforts are improving all the time, as detailed later in these comments, and commend CAISO and the Energy Division for their receptiveness and timely responsesin incorporating these advances.

As we move forward in efforts to model and estimate the system requirements for large-scale integration of intermittent resources, we feel **it is essential to validate model results and cost estimates against empirical evidence and the actual experience of existing large-scale integration.** Germany currently meets 8% of its electrical use just through wind and PV solar, and new installed connections in 2010 alone will increase the proportion of national supply from both of these sources by 1% each, successfully adding an additional 10 TWh of actual energy into their grid this year. Ontario is embarking on a similar path, replacing its 18% coal generation entirely with new renewables. These and other grid systems are planning and achieving integration of intermittent renewables at scales comparable to California, largely through distributed generation.

Last, all modeling in this proceeding should **assess and compare the <u>full</u> costs of existing procurement and full marginal cost of any new procurement to that of renewables** and WDG especially, and ensure that integration of all sources is treated

comparably. All types of integration need integration (even high-capacity factor power plants like nuclear and coal); **integration strategies for renewables should, accordingly, not be considered specific to renewables only**.

II. Response to Questions for Party Comment Following October 22, 2010 Workshop

CAISO and PG&E Renewable Integration Model Methodologies

PG&E Step 2 Inputs, Assumptions, and Methodologies

1.

a. Overall methodology (all aspects) used to calculate megawatts of additional flexible resources required to integrate renewables above the amount of resources required to meet the planning reserve margin (PRM)

The FIT Coalition has no additional comment at this time.

b. Estimation of integration resource requirements using the incremental hourly net load, i.e., the difference between base year hourly net load and study year hourly net load, as opposed to using total hourly net load in the study year as CAISO model does.

The FIT Coalition has no additional comment at this time.

c. Assumption that the existing system contains no untapped operational flexibility, so that incremental flexibility needs must be met by incremental resources, e.g., units in service in the base year (e.g. 2008) cannot alter their operation or otherwise increase their provision of flexibility for the study year (e.g. 2020)

Response: Clearly this is not the case. As such, the model should be understood as defining only the additional flexibility needed, not the need for new resources to meet this flexibility. Any meaningful estimate of the costs of meeting a scenario's system flexibility requirements will require a separate modeling of quantified available least cost options for achieving the flexibility, and the marginal cost of each increment.

d. Assumption that, for resources exceeding the PRM which provide additional required flexibility (currently modeled as simple or combined cycle gas turbines), each megawatt of total nameplate capacity added provides a full megawatt of actual flexibility services, such as regulation or load following.

Response: This is not an accurate assumption, especially in relation to the actual resources used, as we see in the CAISO modeling of 5 minute load-following capacity under high hydro and wind conditions. However, it is not a material factor for the modeling purposes of determining the required scale and responsiveness of system flexibility. When seeking to optimize the mix of flexible resources and their associated costs, this assumption shouldnot be used.

e. Assumption that sufficiency of flexible resources can be assessed based on 'up' flexibility requirements (ability of system resources to rapidly increase output), without explicitly considering ability to meet 'down' flexibility requirements by rapidly decreasing output.

Response: Our response is similar to (d) above. Both the technical capacity of a particular generation source to either rapidly increase or decrease its output, and the costs associated with cycling through such variations, is dependent on factors not captured by these RIM model assumptions,

including the economic operating ranges of each generation technology and potential variability in its preceding capacity status.

f. Assumption that study year imports and exports have the same impact on operating flexibility requirements and the system's ability to meet them as they did in the base year (i.e., they are not part of Step 2 calculations).

Response: Because timing the delivery of imports and exports creates substantial ramp up and down requirements, and is scheduled under contract, the FIT Coalitoin feels that it is inappropriate to assume that the delivery times will remain constant. The model may accurately reflect the flexibility required by base year schedules, but potential adjustment to these resource delivery schedules should be treated as opportunities for meeting integration flexibility based on cost-effectiveness, not as preordained consumption of existing flexibility capacity. Assigning flexibility capacity to these contracts without schedule modification is liable to substantially increase the modeled capacity requirements and may inappropriately assign higher marginal integration costs to intermittent renewable resources.

g. Assumption that 100% of generation from the specified RPS portfolio must be integrated within California (model user may adjust portfolio size accordingly, so as to include whatever portion of out-of-state renewables is assumed to be integrated within California).

Response: This assumption may result in a significant overestimate of integration requirements because RPS projects out-of-state may often use out-of-state non-renewable resources for integration and delivery into California. Generally speaking, we feel that the integration requirement assumptions of renewablesshould not be higher than those applied to any other generation.

h. Input specifying that 100% (some other value could be entered by the model user) of the resource capacity counted towards PRM, which may be less than 100% of nameplate capacity, is also available to meet hourly flexibility requirements

Response: Accurate modeling requires avoiding double counting, but also requires optimization of available resources. PRM resources should be available to meet hourly flexibility requirements under most circumstances, but the rare events under which they would not be available must be accounted for and the marginal cost of options for responding to these events evaluated for relative value. It is not necessarily appropriate to apply the cost of maintaining or achieving PRM to hourly flexibility requirements of intermittent renewable resource integration, or vice versa. The marginal cost of each should be visible for economic optimization or overt selection between alternatives.

i. Calculation of the fixed cost of integration based on the cost of new simple and/or combined cycle gas turbine capacity added above PRM to meet flexibility requirements (minus a credit for these resources' estimated energy market income).

Response: **The FIT Coalition believes that estimating integration costs on this basis is *highly inaccurate*** and failure to consider lower cost integration options will likely result in *substantial cost overestimates*. Both the RIM and CAISO models are appropriate for estimating integration flexibility requirements only as measured in energy units. The FIT Coalition strongly opposes using the cost of new natural gas plants as an assumption for integration costs of renewables. As the LTPP modeling advances toward supporting estimation of integration costs, **all viable approaches, including changes in dispatch, improvement in forecasting tools and scheduling, should be considered in meeting integration requirements.** Future procurement should not be based upon on an

assumption that all aspects of grid operation will remain unchanged. The possibility of additional technological improvements should be taken into account, as well as the potential for renewable resources output to be shaped, time shifted, and more accurately forecast.

j. Calculation of the variable components of integration costs, including estimates of start-up costs, part-load efficiency penalties, higher costs of increasing reserves during morning load pickup and emissions costs.

Response: As noted above, it is not possible to meaningfully assess the component costs of integration without first determining the optimized portfolio mix based on the relative marginal costs of alternative components. Factors such as those listed (partial load efficiency penalties, emission values, etc.) must be included for each alternative. While accuracy of estimation for each factor is significant, accuracy will be enhanced more by inclusion of all relevant factors than by increasing the precision with which each is modeled.

k. Other

Response: The RIM model results indicate a steep rise in fixed integration costs between the 20% and 27.5% scenarios, but almost no rise (and a substantial decrease measured in $/MWh) between the 27.55 and 33% scenarios, but there was no explanation of why this variation is not simply proportional or even escalating with increased integration, as would be expected. This requires explanation to ensure it is not a modeling error.

2. If you have concerns about <u>data inputs</u> used for any of the above topics, please answer the following specific questions:

a. What alternative data is currently publicly available?

The FIT Coalition has joined with numerous other parties in calling for the use of improved data and in recommending consideration of the recently released research results[1] on 'Advanced Modeling and Verification for High Penetration PV' by Thomas Hoff and Richard Perez of the Clean Power Institute, and related enhancement of Solar Anywhere irradiance data, as an examples of such improvements in both data sources and forecasting ability. We commend the responsiveness of both CAISO and the Energy Division to consideration of this work and appreciate the timely

b. Would using this alternative data have a material impact on the model's results? Please explain.

Yes. As noted in prior comments, the use of very limited data points in estimating generation variability substantially exaggerates these estimates. Likewise, the assumed forecasting predictability did not account well for strongly anticipated improvements. Recently developed data sets and forecasting software such as the one jointly presented will eliminate such exaggerations and associated integration costs. Improvements in the modeled forecast errors in RIM between the August 25th and October 22nd versions alone reduced the estimated operating flexibility resource requirements by 12%, or 1,000 MW. Since marginal costs are substantially higher per unit for higher levels of additional flexibility, overestimation of flexibility needs disproportionately increases the cost of integration. As expected, this more accurate data shows much lower variability from distributed generation than modeled using the current data sets, and more accurate forecasting. Each of these will avoid the procurement of the most expensive and unnecessary facilities for integration.

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[1] See: Thomas E. Hoff and Richard Perez, "Quantifying PV power Output Variability," Solar Energy 84:10, October 2010

See also: Andrew Mills and Ryan Wiser, "Implications of Wide-Area Geographic Diversity for Short-Term Variability of Solar Power", Lawrence Berkeley National Laboratory, LBNL 3884E, September 2010

III. Conclusion

While the current LTPP modeling efforts has high potential value for comparing integration requirements of alternative RPS scenarios, initial results clearly indicate the need to rely upon much more accurate information on dispersed and distributed generation profiles and forecasting, such as that recommended by multiple parties. Recent improvements in the RIM are commendable and serve to underscore the importance of further model data refinement, since these refinements alone reduced the estimated resource adequacy requirements by 1,000 MW.

Modifying certain operating protocols, and/or incorporating balancing and ramping resources such as short period electric storage capacity, may greatly help with the integration of variable resources at much lower cost than adding conventional generation capacity. Likewise, improved forecasting and management of operational flexibility is likely and far most cost-effective than adding dispatchable generation capacity. Incorporation of such alternatives into further model development will make it far more useful for evaluating needs under alternative integration scenarios.

Estimation of integration costs is not possible without first determining the relative marginal costs of alternative portfolio mix components. As the optimal integration portfolio will vary substantially based on the generation scenario, and costs will vary based on the integration portfolio, it is completely inappropriate to apply the placeholder use of gas generation as an actual basis of cost analysis.

Changes in the operation of existing resources, as mentioned above, are a critical factor in optimizing renewables integration to meet system needs for additional flexibility. Along these lines we reiterate our support for Vote Solar's recommendation that this proceeding should examine operating California's hydroelectric resources in a manner that promotes renewables integration in line with the conclusions of the Western Wind

Study[2] cited previously. We will provide additional comments on cost estimation at a later stage in this proceeding.

The understanding of the operational challenges and system flexibility requirements necessary to successfully integrate different renewable technologies is evolving significantly. Furthermore, the supporting technologies that promise to provide additional control and balancing capability to offset the type of variability associated with renewable resources are also rapidly evolving. As such, we continue to recommend that the Commission exercise a very cautious approach toward applying results of any modeling toward authorization of additional facilities in the IOU long-term procurement plans solely for the purpose of meeting uncertain system needs.

In the interim, integration assessment should strive to ensure that integration costs associated with each generation source are treated equally. From a technical perspective, this should include full consideration of costs, benefits and locational significance associated with all generation including increased distributed generation, transmission, congestion, localized balancing and short duration storage options. Beyond this, the varying impacts of different scenarios on State and local emissions and air quality goals, economic development, employment, and public revenues should be made apparent for consideration in procurement policy selection.

Respectfully submitted,

Kenneth Sahm White

/s/
FIT Coalition
16 Palm Ct
Menlo Park, CA 94025
(805) 705-1352

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[2] Western Wind and Solar Integration Study (WWSIS), NREL 2010
http://www.nrel.gov/wind/systemsintegration/pdfs/2010/wwsis_final_report.pdf

CERTIFICATE OF SERVICE

I hereby certify that I have served by electronic service a copy of the foregoing **FIT COALITION REPLY COMMENTS ON RENEWABLES INTEGRATION MODELING** on all known interested parties of record in R.10-05-006 included on the service list appended to the original document filed with this Commission. Service by first class U.S. mail has also been provided to those who have not provided an email address.

Dated at Santa Barbara, California, this 22nd day of November, 2010.

Tamlyn Hunt

Appearance List for R.10-05-006

b.buchynsky@dgc-us.com
douglass@energyattorney.com
deana.ng@sce.com
smartinez@nrdc.org
ssmyers@att.net
kristin@consciousventuresgroup.com
mrw@mrwassoc.com
amber.wyatt@sce.com
case.admin@sce.com
GBass@SempraSolutions.com
liddell@energyattorney.com
WKeilani@SempraUtilities.com
sue.mara@rtoadvisors.com
nlong@nrdc.org
AxL3@pge.com
AGL9@pge.com
GxZ5@pge.com
filings@a-klaw.com
MWZ1@pge.com
nes@a-klaw.com
tjl@a-klaw.com
will.mitchell@cpv.com
Diane.Fellman@nrgenergy.com
cem@newsdata.com
RegRelCPUCCases@pge.com
achang@efficiencycouncil.org
dwang@nrdc.org
mnelson@mccarthylaw.com
martinhomec@gmail.com
Danielle@ceert.org
blaising@braunlegal.com
eddyconsulting@gmail.com
atrowbridge@daycartermurphy.com
dsanchez@daycartermurphy.com
clu@cpuc.ca.gov
dbp@cpuc.ca.gov
jws@cpuc.ca.gov
kpp@cpuc.ca.gov
kd1@cpuc.ca.gov
wtr@cpuc.ca.gov
svn@cpuc.ca.gov
vsk@cpuc.ca.gov
claufenb@energy.state.ca.us
mjaske@energy.state.ca.us