SCE Comments on the Further Renewable Resource Integration Needs Analysis
to be Conducted in the LTPP Proceeding

Despite Valid Concerns about Interpretation of the Analysis Results, SCE Supports the Overall Approach Used in the CAISO's Analysis

The LTPP proceeding analyzed a series of resource planning scenarios for 2020 that varied by the amount of load, the quantity of renewable energy production, and the mix of solar and wind renewable energy production. For each scenario, the regulation , load/generation following and spin/non-spin reserves required to manage intra-hour intermittent renewable energy production were identified (Step 1 requirements) and then the ability of the California grid to accommodate this intra-hour variability was tested using the Plexos production simulation model (Step 2 analysis). Additional combustion turbine resources were added to clear instances where operational constraint violations occurred (insufficient regulation, upward load/generation following capability or spin/non-spin reserves). The amount of additional resources determined to be needed in the Step 2 analyses is identified as the integration need for the scenario.

The Step 2 scenario analyses were based on deterministic load patterns, a single outage "draw" for conventional resource availability, and a single set of hourly renewable energy resource "shapes". Except for one scenario that simulated a one-in-ten load pattern, all the scenarios were based on normally expected patterns of load and resource availability.

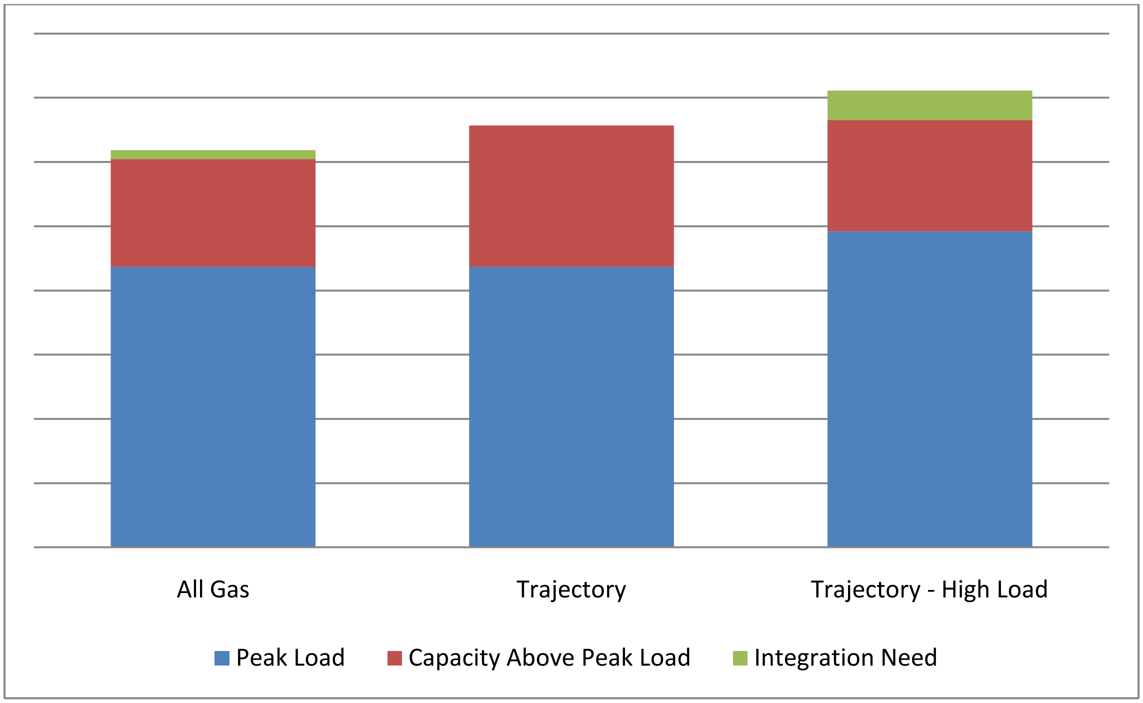
It is standard practice to procure additional capacity resources beyond the forecasted needs under normal conditions in order to have sufficient margin (the planning reserve margin or PRM) to accommodate more extreme "stress" conditions such as high loads or an unexpectedly large shortfall in generation resource availability. Since the Step 2 analyses are based on normally expected conditions, there is a surplus of capacity resources in the existing system that can be relied upon to meet intra-hour renewable resource and load variability. Indeed, since California IOUs are currently resourced above the desired 15-17% PRM, there are considerable resources available to meet these Step 1 requirements.[1] Figure 1 (next page) illustrates this phenomenon. Because the Step 2 analyses makes an "as forecast" assumption regarding resource availability in 2020, the amount of resource surplus available to meet Step 1 requirements (i.e., the ramping, load/generation following and spin/non-spin reserves for each scenario) is not consistent across the scenarios.

It is important to recognize that relationship between variables tested in the scenarios and the resulting integration needs is indirect and does not infer causality. For instance, in the scenarios with higher loads, integration needs are observed to be higher. This is because with higher loads, the available surplus of generation resources is smaller, so the potential for an operational constraint violation increases. Similarly, photovoltaic solar has a characteristic pattern that is somewhat correlated with load peaks (solar output actually peaks several hours prior to load and is beginning to drop rapidly when

[1] The magnitude of this excess is uncertain, since the calculation of reserve margin in the modeling is based in part on the presumed availability of out-of-state resources that can be relied upon during stress periods even though they are not under contract to supply resource adequacy capacity.

load peaks in mid-afternoon), so scenarios involving high solar will tend to have greater resource surplus than scenarios with an equivalent amount of wind energy. Because of this effect, differences between high solar and high wind scenarios cannot be directly used to assess the relative contributions of these technologies to integration needs.

Figure 1. Illustration of Surplus Generation Available to Meet Intermittency Requirements



Since the primary objective in the LTPP proceeding is to assess whether there are sufficient resources expected to be available in 2020 to operate the grid reliably, SCE supports the approach taken by the CAISO in framing the analysis, despite the difficulty of using the LTPP results to identify integration need causality.

SCE Believes that Additional Analysis is Necessary to Determine Integration Needs

Because the Step 2 scenario analysis is mostly based on expected conditions, the model allows reserve margin resources intended for use in stress periods to be used to meet Step 1 requirements. . This has a tendency to underestimate the amount of integration needs. SCE's most recent PRM analysis, which did not consider intra-hourly variability, determined a 16% reserve margin was needed to assure a notional one-outage-in-ten-years (one-in-ten) reliability. [2] This analysis took into account stochastic uncertainty of loads, stochastic uncertainty in availability of "conventional" generation, hourly stochastic

[2] Planning reserve margin studies are based on limited assumptions regarding the range of options available to a grid operator to manage reliability during periods of extreme stress. In all likelihood, during a one-in-ten event, voluntary appeals for conservation, emergency sharing of operating reserves among balancing authorities and other such actions would be sufficient to manage reliability.

uncertainty of wind generation, and hourly pattern variability of solar generation. [3] For example, in a high stress period where all available resources are needed to meet a notional one-in-ten event, there would be no resources available to manage intra-hour renewable resource and load intermittency, and system reliability would be lower than the one-in-ten criterion taking into consideration the joint need to meet hourly capacity requirements and intra-hour integration needs.

One of the scenarios run by the IOUs investigates integration needs during a one-in-ten load case.[4] In this instance, integration needs are particularly high because there is little available surplus generation to supply these integration needs. However, this may overstate a reasonable level of additional resources because the Step 1 requirements are based on the monthly 95th percentile distribution of cumulative ramping, load/generation following and spin/non-spin reserves requirements and the joint probability of simultaneous one-in-ten load and 95th percentile intermittency events is smaller than would be cost effective to mitigate.

SCE would like to see the CAISO further investigate Step 1 analysis as part of the additional work being undertaken to understand better the renewable resource intermittency requirements. In particular, we would like to have a better understanding of how renewable resource intermittency requirements vary at points on the probability distribution, such as 50th percentile, 80th percentile, 90th percentile and 95th percentile to better understand the duration of such requirements. Once this information is available, it may be useful to run “paired” analyses – such as one-in-two loads and resource availabilities paired with extreme renewable resource integration requirements, and one-in-ten loads paired with average renewable resource integration requirements, in order to gain a better understanding of the joint probability distribution of hourly and intra-hour needs. SCE would also like a better understanding of whether there is any overlap between the Step 1 requirements for upward following and the block hourly dispatch of energy resources in the Step 2 analysis.

As part of this investigation, the CAISO should address the results associated with the so-called “all gas” scenario, which stopped growth in renewable energy resource expansion at recent levels (around 12% statewide) in order to have a baseline to measure the costs and GHG emissions reductions associated with the 33% RPS scenarios. In this scenario, there were additional integration needs despite maintaining the current portfolio of renewable resources. It appears that the explanation is that there is sufficient load growth by 2020 to erode the availability of surplus generation to meet integration needs. However, it is unclear to SCE whether the Step 1 requirements in this scenario are consistent with what the CAISO is currently procuring for grid operations, and whether the stringency of the 95th percentile assumption is appropriate.

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[3] At the time of this analysis, SCE did not have variability data associated with photovoltaic and thermal solar, since SCE’s existing portfolio of solar thermal generators have substantial natural gas assist capability and exhibit very little intermittency. Thus, only wind intermittency was investigated. The study took into consideration the negative correlation between wind output and high load conditions.

[4] Note that this is not the same as a one-in-ten reliability event, which involves both extreme load and lower-than-expected generation availability.

An associated issue is whether there is any correlation between high load conditions and intra-hour resource variability. It is not obvious to SCE whether there is such correlation, but if it exists, is would suggest greater or lower integration needs depending on the sign of the correlation.

SCE Does Not Support Performing PRM Reliability Modeling in the Current LTPP

As the amount of solar renewable energy production increases, the net load (load net of must take renewable resources) peaks later in the day, well after solar output has reached its daily maximum and begun to decline. This reduces the contribution that solar renewable energy production contributes to meeting reliability needs. SCE believes that any analysis of this phenomenon should be addressed in separate studies (i.e., not part of the CAISO's renewable integration analysis), with the results incorporated into the LTPP modeling. Specifically, SCE would support adjusting the qualifying capacity value of solar resources downward to reflect the anticipated solar build-out, for the purpose of reporting reserve margin statistics.

The implications of having solar renewable energy production shift the reliability peak to later in the day are far reaching and important. However, it appears that the CAISO currently has sufficient generation resources available to meet PRM needs, so diminished capacity contributions from solar resources (and potential indirect impacts that a shift in the reliability peak to later in the afternoon has on some demand response programs) is not as critical an analysis as addressing integration needs.

SCE Supports the CAISO's Proposal for Limited Assessment of Energy Storage Technologies

One of the important potential values from energy storage technologies in today's environment is the ability of storage to utilize off peak power that would otherwise be wasted through curtailing the output of renewable generators. However, relatively limited attention has been paid to the modeling of off-peak model behavior (such as the time of use delivery characteristics of combined heat and power systems) in the 2010 LTPP proceeding, so it would be premature to use the current modeling effort to comprehensively understand the economics of energy storage.

SCE does support testing a selected set of energy storage technologies to assess whether their performance characteristics differ significantly from the use of conventional fossil-fired resources in addressing renewable intermittency.

Conclusion

SCE supports the analysis structure employed by the CAISO in recent studies (Step 1 and Step 2) to assess renewable resource integration needs. We would like to see the following work activities included in the studies contemplated in the recent LTPP settlement:

- Further analysis/investigation into the distribution of intra-hour renewable intermittency requirements developed in the Step 1 analysis to understand the duration and chronology of these values.
- A "drill down" into the "all gas" scenario to understand better why it shows integration needs.

- Selection and analysis of scenarios that explore varying levels of “stress” conditions (e.g., high loads and average renewable intermittency needs) to better understand the joint risk of reliability events considering both capacity and integration needs.
- Selection and analysis of scenarios that test generic energy storage technologies as an alternative to using combustion turbines to clear operational constraint violations.

In addition, as part of their LTPP testimony the Joint IOUs identified a number of areas in which further analysis should be undertaken. These areas are import limits, unit operational characteristics, and maintenance schedules.

SCE, October 5, 2011