BEFORE THE PUBLIC UTILITIES COMMISSION
OF THE STATE OF CALIFORNIA

Application of Pacific Gas and Electric Company for Approval of Agreements Related to the Novation of the California Department of Water Resources Agreement with GWF Energy LLC, Power Purchase Agreement with GWF Energy II LLC, and Associated Cost Recovery. (U 39 E)	)	Application 09-10-022 (Filed October 16, 2009)
Application of Pacific Gas and Electric Company for Approval of Novation of the California Department of Water Resources Agreement Related to the Calpine Transaction, and Associated Cost Recovery. (U 39 E)	)	Application 09-10-034 (Filed October 30, 2009)

NOTICE OF EX PARTE COMMUNICATION

In accordance with Rule 8.3 of the California Public Utilities Commission's Rules of Practice and Procedure, the California Independent System Operator Corporation (ISO) hereby gives notice of the *ex parte* communication described below. On April 27, 2010, Karen Edson, Vice President of Policy and Client Services for the ISO, and Phil Pettingill, Director of State Regulatory Affairs for the ISO, attended a meeting with the Carol Brown, Andrew Schwartz and Karl Meeusen, Advisors to President Michael Peevey; Sepideh Khosrowjah, Advisor to CPUC Commissioner Nancy Ryan; Michael Wheeler and Matthew Tisdale, Advisors to Commissioner Dian Grueneich; Karen Shea, Advisor to Commissioner Timothy Simon; and Robert Kinosian, Advisor to Commissioner John Bohn. The meeting occurred at 10:30 a.m. at the Commission's offices, 505 Van Ness Avenue, San Francisco, California. The meeting lasted 30 minutes.

At the meeting, the ISO described the various characteristics of conventional generation resources that would assist the ISO integrate the large quantity of renewable resources needed to meet California's 33 percent Renewables Portfolio Standard. The ISO provided an overview of various technical terms and the purpose for certain generator characteristics. Additionally, the ISO provided a printed copy of its recent comments filed with the Federal Energy Regulatory Commission in response for comments regarding the

integration of variable energy resources. A copy of the ISO's comments is attached to this notice.

Finally, the ISO clarified its position regarding three Applications filed by PG&E requesting approval to procure conventional resources. In connection with Applications 09-10-022 and 09-10-034, the ISO had previously sent a letter identifying the fact that the characteristics of the resources PG&E proposed to procure would support the integration of renewable resources. In connection with Application 09-09-021, the ISO informed the Commissioners' advisors that the characteristics of the proposed Marsh Landing Generating Station and Contra Costa Generating Station also would support the integration of renewable resources. The ISO stated that it continues to take no position on whether the proposed projects under consideration provide additional ratepayer value.

To obtain a copy of this notice, please contact:

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Respectfully submitted,

/s/ Andrew Ulmer

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Attorney for the California Independent System Operator Corporation

Dated: April 30, 2010

ATTACHMENT

California Independent
System Operator Corporation

April 12, 2010

VIA ELECTRONIC FILING

The Hon. Kimberly D. Bose
Secretary
Federal Energy Regulatory Commission
888 First Street, NE
Washington, D.C. 20426

RE: Integration of Variable Energy Resources, Comments of the California Independent System Operator Corporation, Docket No. RM10-11

Dear Secretary Bose:

The California Independent System Operator Corporation respectfully submits its comments to the Federal Energy Regulatory Commission's Notice of Inquiry issued in the above referenced docket number.

Please contact the undersigned if you have any questions regarding this matter.

Respectfully submitted,

/s/ Anna A. McKenna

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Counsel for the California Independent
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UNITED STATES OF AMERICA
BEFORE THE
FEDERAL ENERGY REGULATORY COMMISSION

Integration of Variable Energy Resources	**)**	**Docket No. RM10-11-000**

COMMENTS OF THE CALIFORNIA INDEPENDENT SYSTEM OPERATOR CORPORATION

The California Independent System Operator Corporation (the CAISO) hereby submits these comments in response to the Notice of Inquiry (NOI) issued in the above captioned docket number by the the Federal Energy Regulatory Commission (Commission) seeking comments on the extent to which barriers exist that may impede the reliable and efficient integration of variable energy resources (VERs)[1] into the electric grid and whether reforms are needed to eliminate those barriers.[2] The Commission seeks to explore whether existing rules, regulations, tariffs, or industry practices within the Commission's jurisdiction may hinder the reliable and efficient integration of VERs, resulting in rates that are unjust and unreasonable and/or terms of service that unduly discriminate against certain types of resources.[3] Accordingly, the Commission seeks comment on how best to reform any such rules, regulations, tariffs, or industry practices.[4]

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[1] The Commission specifies that for purposes of this proceeding, the term variable energy resource refers to renewable energy resources that are characterized by variability in the fuel source that is beyond the control of the resource operator. This includes wind and solar generation facilities and certain hydroelectric resources. NOI at FN 1.

[2] *Id.* at P 1.

[3] *Id.* at P 4.

[4] *Id.* In this NOI, the Commission will not address issues related to transmission planning and cost allocation, as the Commission is considering those issues in a different proceeding (*Transmission Planning Processes Under Order No. 890*, Docket No. AD09-8-000 (Oct. 8, 2009) (notice of request for comments).

I. EXECUTIVE SUMMARY

Through aggressive renewable portfolio standards (RPS) and other policies that promote renewable energy, California is a leader in the effort to increase the amount of renewable energy utilities procure to serve load. The state currently has a 20% RPS target, implemented by the California Public Utilities Commission (CPUC) for its jurisdictional utilities and by the California Energy Commission (CEC) for municipal utilities. The state legislature is currently considering a substantial increase to its RPS to 33 % by 2020. The 33 % RPS was incorporated into the California Air Resource Board's (ARB) scoping plan for achieving the state's Assembly Bill 32 targets for greenhouse gas reductions, and was further advanced pursuant to a related executive order issued by Governor Arnold Schwarzenegger in November 2008 (Order S 14-08).

In the context of this significantly evolving policy landscape, the CAISO has continued to evaluate the impacts the integration of VERs will have on its operations and markets and to explore effective ways to accommodate increasing amounts of VER. At this time the CAISO recommends that the Commission not make any material changes to its policies because of the numerous important initiatives in progress, in California and elsewhere, that will yield much greater insight than we have today into the policy and operational issues raised by the expansion of VER capacity and the alternative ways to address them. The CAISO's own technical evaluation is not yet complete, and at the same time the CAISO along with the various state agencies is undertaking additional significant efforts to more fully evaluate alternative approaches to facilitate the integration of VERs. The CAISO has fully embraced the challenges raised

by the state's ambitious renewable energy goals and as such appreciates the need to insure full and efficient integration of VERs and supports the Commission's efforts in evaluating the nation's experiences thus far. Neverthless, given the facts that certain pending policy considerations may substantially alter the electricity industry's policy landscape, and that a wealth of promising new research on VER integration is still in progress, the CAISO recommends that any actions taken by the Commission after this NOI should provide System Operators sufficient flexibility in fashioning rules that meet their regional needs as identified by their studies.

To date, VER integration has largely been handled by the CAISO using its existing operational tools and market rules as well as, since 2004, additional forecast improvements and VER scheduling procedures under the PIRP. In concert with state agencies and policy-makers, California's electric power industry and the CAISO are similarly mobilizing to prepare for the substantial planning, operational, technological and market changes required for the integration of the anticipated higher levels of renewable resources. Most notable is the use of centralized wind forecasting in conjunction with an innovative participating intermittent resource program (PIRP) in which VERs are afforded financial settlement of intra-hour deviations from schedule on the basis of monthly averaging to smooth out the financial impact of such variances. The CAISO has also established an Integration of Renewable Resources Program (IRRP), with the objective to provide operational assessments, technology evaluation and standards, and other needed capabilities as VER integration into the CAISO's core functions is expanded.[5] Analysis of future renewable resource investment scenarios

[5] The Integration Renewable Resources Program (IRRP) materials are available at http://www.caiso.com/1c51/1c51c7946a480.html.

has become a central component of the CAISO's transmission planning process,[6] including its participation in the California Transmission Planning Group (CTPG).

Looking forward to the dramatically increasing penetration of VERs forecasted for California over the next 5-10 years, a primary goal for the CAISO is the integration of these resources through their participation in the CAISO's day-ahead and real-time markets, which the CAISO utilizes to allocate transmission service, manage congestion, enable spot energy trading and operate the CAISO controlled grid. Accordingly, the CAISO seeks to provide better incentives for VERs to become dispatchable through modifications to its PIRP[7] and to related energy market provisions. In addition, the CAISO is evaluating the need to procure additional ancillary services to support VER integration. The CAISO has also participated in the CPUC proceeding to determine how to count VER capacity for Resource Adequacy purposes in an effort to enable VERs to provide resource adequacy capacity in a manner that supports the needs of the CAISO's markets and system operations.

Key Issues in Renewable Integration for the CAISO

In April 2009, the CAISO implemented a new market structure, along with a range of software and technology upgrades. The investment in that design, along with forthcoming investments in additional control room technology, will greatly improve the CAISO's ability to achieve efficient and reliable integration of VER using both generation and non-generation resources to maintain system balance and reliability. The design of the CAISO wholesale market system – a two-settlement spot market based on

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[6] Renewable transmission planning materials are available at http://www.caiso.com/242a/242abe1517440.html. The CTPG study plans and reports are available at www.ctpg.us.

[7] *California Independent System Operator Corporation,* Docket No. ER10-319, Response to the January 29, 2010 Letter.

Locational Marginal Pricing and security constrained unit commitment – is an effective structure for integrating VER. Planned enhancements to the CAISO markets – particularly convergence bidding, scarcity pricing of ancillary services, and rules to facilitate ancillary service provision by non-generation resources – will provide additional benefits for VER integration and improve overall market performance as the amount of VER increases.

Equally important to the removal of barriers to the integration of VER are incentives for them to adopt the means to participate in the CAISO markets in a manner comparable to the participation of other resources. The intent of this principle is to ensure that VERs, like other resources, face price signals to schedule and operate in a manner that supports reliable grid operation – for example by being able to moderate their ramping speed – which is a fundamental objective of an LMP-based market. This will become increasingly important at higher levels of VERs integration.

A corollary to the previous principle is that by requiring VER to face appropriate price signals, and possibly also cost responsibilities based on cost causation, the CAISO will provide incentives for VER to find ways to mitigate the operational and market impacts of their variable production characteristics, for example by installing a storage device on the site of a solar installation to smooth its output and to increase its capability to respond to operating needs and provide some ancillary services. Such incentives should offer an additional benefit by encouraging VER developers, or entities contracting with them, to partner in innovative ways with emerging technologies to help facilitate their own integration into CAISO markets and grid operations. In addition, a VER that adopts such innovative measures can improve its contribution to supply

adequacy and thereby realize the additional financial benefit of qualifying for a higher amount of resource adequacy capacity.

With regard to the real-time market, VERs should be encouraged to submit economic bids (*i.e.,* bids with prices) to enable the CAISO to issue them economic decremental energy instructions to relieve congestion and to manage over-generation conditions. To improve incentives to submit bids, the CAISO will examine whether modifications are required to the PIRP rules, which do not allow VER that submit economic bids to be eligible for the PIRP financial settlement rules for the hours in which they submit the bids.

Another real-time operating challenge for the CAISO is the rapidity with which VERs can ramp up and down in response to changes in their primary energy source. Because these changes in VER output are particularly challenging for real-time operation of the system, the CAISO hs pending tariff revisions to enhance the forecasting and outage reporting data available from VERs.[8] In addition, to allow for some moderation of rapid ramping by VERs the CAISO is currently conducting a stakeholder process to develop new interconnection standards for VERs that will require them to install the equipment needed to enable them to receive and respond to CAISO dispatch and possibly even Automatic Generation Control (AGC) instructions. With such equipment a VER would be able to moderate its ramp-up and thereby reduce the burden on CAISO load following dispatch and regulation.

With regard to the day-ahead market, the CAISO believes that VERs should be allowed but not required to submit day-ahead market bids (economic bids or self-

[8] *California Independent System Operator Corp.,* ER10-319-000 (2010).

schedules). Because presently a key challenge facing the integration of VERs is the limited accuracy of day-ahead forecasting of their output, a requirement to bid into the day-ahead market could force them to take on excessive risk of exposure to real-time imbalance charges, which in turn would create a plea for special settlement provisions to reduce this risk at the expense of other market participants, while providing little or no benefit to the CAISO markets due to the limited predictive value of a day-ahead VER schedule. As discussed below, changes in the CAISO market design, notably the implementation of convergence bidding in 2011, could create a forward market that is sufficiently liquid to compensate for any lack of VER participation.

Regardless of whether VER participate in the day-ahead market, the CAISO will need to develop its own best estimate of next day VER energy for determining its procurement target for the residual unit commitment procedure. In addition, convergence bidders will have incentives to develop better day-ahead forecasts of VER energy in order to profit from any predictable day-ahead to real-time market price differentials as a result of the unexpected appearance of VER energy the real-time. Thus allowing VER the flexibility to decide whether or not to bid into the day-ahead market, and not offering them risk-mitigating subsidies to encourage day-ahead market participation, could provide incentives and opportunities for a broad array of market participants to invest in improved VER forecasting capabilities.

The CAISO expects ancillary services requirements to increase substantially as California moves from a 20% RPS to the 33% RPS. The costs for ancillary services in the CAISO's markets are currently very low at around 1% of market procurement costs. While these costs may increase, the energy market costs may be offset by the energy

supplied by VERs. In addition, if energy prices decline with additional VER production, the opportunity costs of providing ancillary services could also decline.

In conjunction with reducing barriers to VER participation, it is equally important to focus on the market design changes needed to ensure sufficient operational capabilities in the generation fleet to accommodate increasing quantities of VER. The CAISO will soon initiate a review of its ancillary services market structure. In consultation with its stakeholders the CAISO will consider whether further changes (in addition to those already underway) are needed to its ancillary service products and markets. The CAISO will seek to ensure that the services of conventional generation and any non-generation resources that could support VER integration receive appropriate compensation, in order to encourage investment in and support the continued viability of existing resources with these capabilities.

Through analysis of VER performance both internal to California[9] and in neighboring regions (such as the Bonneville Power Administration), the CAISO has empirical evidence demonstrating that geographic diversity of VER helps to mitigate the impacts of volatility in their output. Regional western cooperation in VER development and integration shows promise for reducing costs, primarily through reducing aggregate variability and taking advantage of regional integration capabilities, but will face near-term barriers due to the lack of a well developed regional market for procurement of integration services (regulation and balancing energy). The CAISO is currently exploring alternative approaches for enhancing regional scheduling and cost allocation approaches to help realize the benefits of such geographic diversity.

[9] CAISO, "Revised Analysis of June 2008 – June 2009 Forecast Service Provider RFB Performance," March 25, 2010, available at http://www.caiso.com/2765/2765e6ad327c0.pdf.

VER are not yet competitive with conventional resources in the energy markets in the absence of internalizing the costs of the environmental impacts of those resources. Moreover, as discussed in these comments, VER production will likely depress energy market prices over time, unless there is a countervailing carbon price imposed. Hence, from a commercial viability or revenue adequacy perspective, the CAISO spot markets represent only one potentially modest element of a VER's revenue stream, the others being resource adequacy capacity (which will typically be small relative to a VER's installed capacity), bilateral energy contracts that reflect the VER's above-market costs for energy (driven to a large extent by measures such as California's 20% and 33% RPS for load-serving entities), production tax credits and renewable energy credits.

Given the economic factors just described, the major drivers of VER development and integration at present are the California state agencies and regulatory programs including resource adequacy, RPS implementation, long-term procurement planning, and the AB 32 rules for greenhouse gas emissions reductions. Many of these programs are still being developed or are in the process of being modified, and the CAISO is actively collaborating with the agencies to help develop the most effective and efficient ways to achieve state environmental policy goals. Nevertheless the rules and regulations these agencies ultimately adopt -- for example, to require load serving entities to procure forward energy contracts that also provide certain capabilities needed for renewable integration -- may duplicate or dominate the impacts of CAISO market design changes. Thus, the success of these numerous initiatives all aimed at closely related goals will depend on a far greater degree of collaboration and coordination than

had been attempted before the emergence of the state's ambitious environmental policies.

A case in point, the pending legislation to adopt a California 33% RPS by 2020 could well be a "game-changer" in terms of impacts on operations and markets. CAISO simulation analyses currently underway and due for release later in 2010 will provide a preview of possible operational and market impacts, including potentially large reductions in spot market energy revenues as large volumes of price-taker renewable energy, whose economics are based on extremely low marginal production costs combined with revenues from renewable energy credits and production tax credits, displace conventional generation. The CAISO is just beginning to evaluate the possible near-term and longer-term implications of such potential price trends for spot market design.

Finally, VER integration should be examined in the context of the broader spectrum of environmental policy goals, such as GHG emissions reductions (under AB32 or federal legislation) and the retirement or repowering of once-through cooling facilities. As California moves to a 33% RPS by 2020, the GHG emissions reduction impact of VER may be less than anticipated if operational integration requirements drive the need to dispatch additional thermal generation for load following and regulation. Such linkages between different initiatives and their impacts underscore the urgency of developing whole-system analytical approaches for evaluating potential market and program design changes, rather than addressing individual problems one at a time as they arise.

II. COMMENTS

A. Data and Forecasting

The Commission correctly identifies the crucial role that improved data collection and forecasting of VER generation will play in efficient and reliable VER integration. Experience with the existing fleet of VERs in California and elsewhere has demonstrated the need for appropriate rules and incentives to compel and encourage continual improvements in data collection and accurate scheduling. The expected increase in VER capacity heightens the need for enhanced forecasting methodologies and tools, which will increase reliability and the economic efficiency of resource commitment and dispatch, by allowing for more accurate prediction of VER output and material ramping events. Accordingly, the Commission seeks comment on whether and, if so, how the Commission should modify existing operational data reporting requirements.

Current practices used to forecast generation from VERs

The CAISO has pioneered central independent system operator/regional transmission organization (ISO/RTO) forecasting for VERs as part of the PIRP and has gained important experiences on how to improve the quality of data provided by VERs and selection of forecast service providers. These experiences are foundational to the CAISO's efforts to integrate the expected significant increase in VERs over the next decade.

Currently, 1005 MW of approximately 2900 MW of wind capacity in the CAISO footprint is eligible to operate under the PIRP. The CAISO also has 421 MWs of solar

capacity interconnected at the transmission level, but at this time, no solar capacity participates in PIRP. If a PIRP qualified VER, whether wind or solar, chooses to participate in a particular hour, the PIRP program requires that the facility schedule into the real-time market using an hourly forecast developed by a centralized forecast service provider vendor. The forecast service provider develops the forecast using ensemble forecasts techniques, rapid update cycles, and statistical analyses. The forecast uses the following inputs: limited grid point output from regional-scale and global-scale numerical weather predictions models; measurement data from several meteorological sensors; high resolution geographical data; and meteorological and generation data from wind projects.

The CAISO requires at least 2 meteorological towers for each wind site along with designated turbine wind speed within the park. As illustrated in Table 1, telemetry is required on all PIRP units, with reporting of wind speed, wind direction, barometric pressure, ambient temperature, MW availability, real time production, meter data and selected turbine anemometry.[10]

The CAISO and its stakeholders recognized the need to accurately forecast solar energy for reliable integration into the grid. Working with stakeholders, the CAISO established that a solar photo voltaic or solar thermal central station, with a rated capacity of 1 MW or greater must provide from at least one meteorological station (2 stations for a 5 MW or larger plant).[11]

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[10] See CAISO tariff Appendix Q, Eligible Intermittent Resource Protocol, Section 4 (revisions to which are currently pending in *California Independent System Operator Corp.,* ER10-319-000 (2010)) and technical requirements posted on the CAISO's website at the following internet address: http://www.caiso.com/2403/2403c1aa3e090.pdf.

[11] These requirements are currently set forth in technical requirements posted on the CAISO's website at the following internet address: http://www.caiso.com/2461/2461d28b6210.pdf. These requirements have been proposed to be refined and incorporated into the CAISO's Business Practice Manual for Market Operations, Appendix A,

Table 1: CAISO Requirements for PIRP Resources

Element	Device (s) Needed	Units	Accuracy
Global Irradiance Plane-of-Array Irradiance (GPOA)	Pyranometer or equivalent	W/m^2	$\pm 25 W/m^2$
Global Horizontal Irradiance (GHI)	Pyranometer or equivalent	W/m 2	±25W/m2
Global Diffused (GDIFF)	Pyranometer or equivalent	W/m^2	$\pm 25 W/m^2$
Diffused Irradiance Plane of Array (DPOA	Pyranometer or equivalent	W/m^2	$\pm 25 W/m^2$
Direct Irradiance (DNI)	Pyreheliometer or equivalent	W/m^2	$\pm 25 W/m^2$
Back panel temperature for PV type arrays at the array average height[12]	Temperature probe for back panel temperature	°C	± 1°
Ambient temperature at the array average height	Temperature probe & shield for ambient temp.	°C	± 1°
Barometer	Barometric pressure	Hecto Pascals HPa	± 60 Pa
Wind speed and direction at the average array height	Anemometer, wind vane and wind mast	m/s deg	±1 m/s ± 5°
Real-time Generation	Transducers -- Current and Potential Transformers	MWs	Per CAISO telemetry standards
Monthly Resource Generation		MWhs	+/-2%[13]

The CAISO makes available independent hourly forecasts of energy generation for each PIRP resource to the resource's scheduling coordinator. These forecasts are provided and published each hour, 105 minutes before the operating hour for each of the next seven operating hours. The scheduling coordinator representing the PIRP resource must use the hour-ahead forecast that is available 30 minutes prior to the deadline for submitting their bids in the single bid-submission process for the hour-

Section A.14 through proposed revision request 132 pending in the CAISO's BPM change management process, documentation regarding which can be found on the CAISO's website at the following internet address: https://bpm.caiso.com/bpm/prr/show/PRR000000000132.

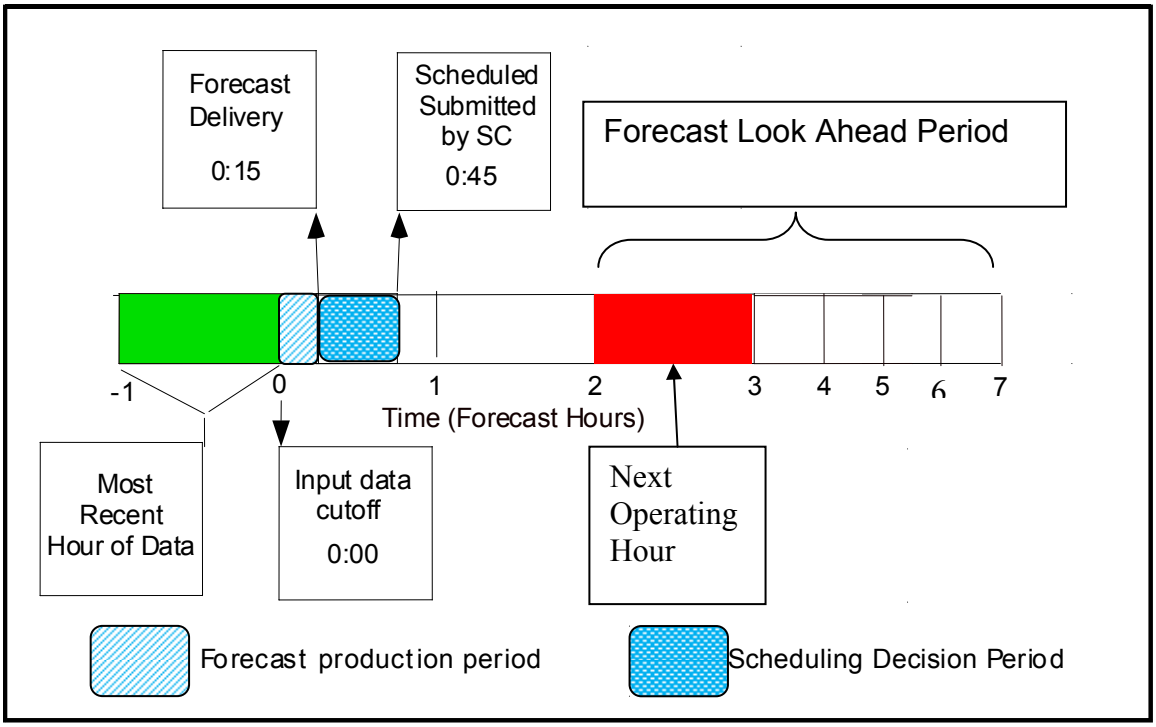
[12] Not required for concentrating type equipment.

[13] See, Monitoring and Communication Requirements for Generating Units Providing Only Energy and Supplemental Energy, Section 2.5 of the CAISO FERC Electric Tariff, Appendix Q.

ahead scheduling process and real-time market. If the CAISO fails to deliver the hour-ahead forecast to the scheduling coordinator prior to 15 minutes before the deadline for submitting hour-ahead scheduling process and real-time market bids, then the scheduling coordinator must use the most recent energy forecast provided by the CAISO to the scheduling coordinator for the operating hour for which bids are next due. Scheduling coordinators are required to submit hour-ahead scheduling process and real-time market bids (MWh) for PIRP resources in the aggregate, to the hour-ahead forecast published for that PIRP resource (MWh). PIRP resources that schedule consistent with this forecast are entitled to a monthly averaging of locational marginal prices (LMPs) associated with their uninstructed imbalance energy deviations netted over the month -- as opposed to settlement of actual deviations at the actual LMPs. This enables such resources to smooth out the financial impact of output deviations, which are otherwise settled at real-time five minute LMPs.

The schematic in Figure 1 demonstrates the scheduling process for resources that participate in the PIRP. The schematic shows that the real time telemetry is collected every four seconds from the wind plant via the CAISO PI data collection system. The data is delivered to the PIRP application at the CAISO where this data, combined with the MW availability data for the resource, is sent to the forecast service provider by the top of every hour.

Figure 1: Schematic of the Production, Delivery and Usage Time Line for PIRP Next Operating Hour Forecast.



While PIRP resources, like any other resource, are not required to schedule in the day-ahead market, the CAISO has also instituted an advisory day-ahead wind power forecast. The next day forecast consists of a forecast of energy (MWh) for each PIRP resource for each hour of the next calendar day, delivered by 5:30 AM. As described further below, this day-ahead forecast is also integrated into the residual unit commitment process.

In addition, the CAISO is developing an internal short term wind persistence forecast to better account for resource ramping trends. Unlike the PIRP hour-ahead scheduling process forecast, which is an average of the operating hour energy

production, this forecast is designed to look at the 5 to 15 minute intra-hour variations of wind supply especially in a weather event situation moving though the wind production areas. The CAISO intends to expand upon this initial effort to develop forecast-based short-term ramp event predictor more consistent with its commitment time-horizons that can form the basis of operational tools that ensure sufficient ramping capability is available to accommodate anticipated fluctuations in VERs output.

While the current forecast tools provide some ability to anticipate and incorporate expected output of wind resources, additional improvements in forecasting of wind production and substantial improvements in forecasting of solar photo voltaic production are necessary for both efficiency and reliability as the number of VERs increases. As VERs capacity on the integrated grid increases, even small percentage errors in forecasts per resource translates into large megawatt quantities of uncertain supply that would need to be covered through additional ancillary service commitments.

Under the CAISO tariff, the CAISO can assess a fee on PIRP resources of up to $0.10/MWh. The forecast fee is levied in order to pay the costs of the CAISO's forecasting service provider. The amount of the forecast fee is limited to the level necessary for the CAISO to recover its projected annual costs related to developing energy forecasting systems, generating forecasts, validating forecasts, and monitoring forecast performance. At present, the maximum fee is insufficient to cover costs such that the CAISO subsidizes the excess costs from its operating expenses. The CAISO recently proposed expanding application of the forecast fee to all Eligible Intermittent Resources in addition to those participating in PIRP.[14] The CAISO expanded the scope

[14] *California Independent System Operator Corp.,* ER10-319-000 (2010).

of those resources subjected to the forecasting fee in conjunction with its anticipated need to forecast the expected energy from all VERs within in its footprint for reliability and market operations, regardless of their election whether to obtain the settlement treatment offered by PIRP.

Transitioning to a state-of-the-art forecasting system

As discussed above, the CAISO already employs a state-of-the-art forecasting system for VERs. However, given the economic benefits of further improvements in forecasting, the CAISO is committed to continuous improvements as they become available by both public and commercial weather forecasting systems as well as innovative technology vendors (such as laser-based short-term wind forecast technologies). In this regard, during 2008-09, the CAISO undertook an evaluation of three commercial wind forecasters for purposes of improving both the day-ahead and hour-ahead forecasts. The results of that evaluation are available on the CAISO website.[15]

Some key findings from the report are worth discussing here, as they indicate the potential for forecast improvement:

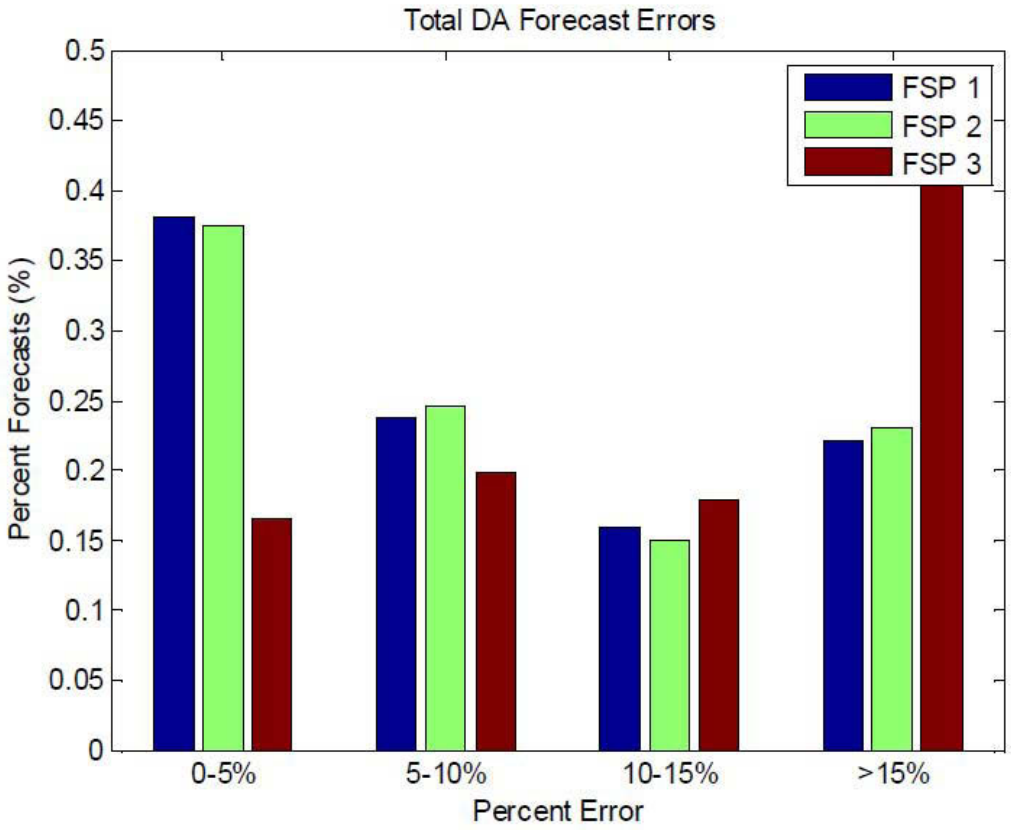
First, the CAISO sought, and the vendors delivered, an aggregate day-ahead forecast error that was reduced to less than 15%, calculated as the root mean square error (RMSE). This level of forecast error represents a substantial improvement over past CAISO experience with day-ahead forecasts.

Second, the results confirmed that for many hours of the day, the day-ahead forecast errors were below 15%: nearly 40% of the day-ahead forecasts have an

[15] CAISO, *Revised Analysis of June 2008 – June 2009 Forecast Service Provider RFB Performance,* March 25, 2010, available at http://www.caiso.com/2765/2765e6ad327c0.pdf.

absolute error of less than 5%; over 60% of all day-ahead forecasts demonstrate an absolute error of less than 10%; and over 75% of all day-ahead forecasts have an absolute error of less than 15%. The performance of the competing vendors, labeled as forecast service providers (FSP), is shown in 2.

Figure 2: Day-ahead Forecast Errors of Alternative Wind Forecast Vendors.

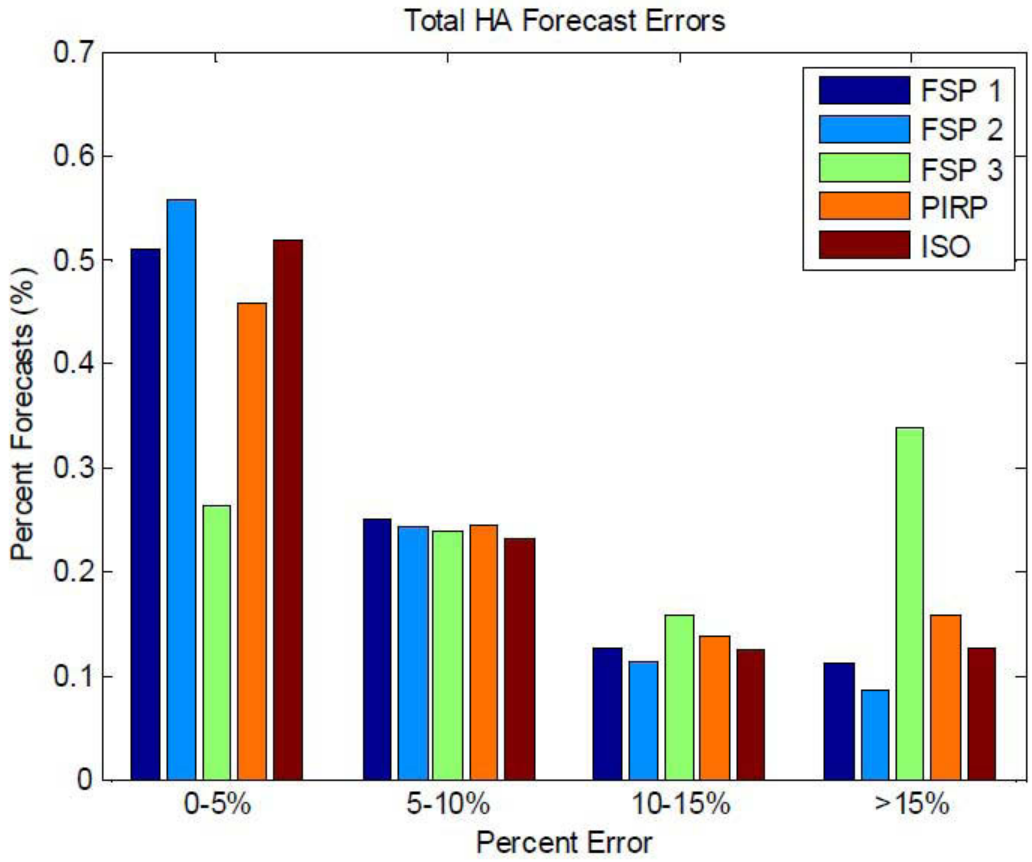


Third, aggregate hour-ahead forecast error is reduced to less than 10 percent root mean square error. This represents a 20% improvement in forecast accuracy over the current hour ahead forecast methodology used by the CAISO for PIRP.

Fourth, similar to the day-ahead forecasts, the majority of the hour-ahead forecasts had lower than 10% root mean square error: approximately 50% of the hour ahead forecasts have an absolute error of less than 5%; approximately 75% of hour

ahead forecasts demonstrate an absolute error of less than 10%; and nearly 90% of all hour ahead forecasts demonstrate an absolute error of less than 15%. The performance of the competing vendors, labeled as forecast service providers (FSP), is shown in Figure 3.

Figure 3: Hour-Ahead Forecast Errors of Alternative Wind Forecast Vendors.



Fifth, because the vendors were providing forecasts for wind resources at multiple locations, the results show that geographic diversity and aggregation of forecasts for individual wind facilities improve overall forecasting accuracy in both the day-ahead and hour-ahead time frames. For each forecast service provider, their

forecast error for each individual wind farm is greater than their forecast of the output from all farms combined. This indicates poor correlation among the direction of the forecast errors generated for each individual wind farm such that the errors have some tendency to offset each other. Sixth, another finding is that forecast performance is best at production levels greater than 80% of total capacity and, on the other hand, less than 20% of total capacity. This suggests that forecast accuracy will be higher during the relatively infrequent periods of high capacity utilization and the periods of low wind generation output. Low wind generation output generally coincides with the winter season and high ambient temperatures, which correlates to high demand. Production is most volatile in the wind facilities' mid-range of production.

The study results, as well as discussions with other balancing authorities seeking to improve forecasting, led to a number of recommendations intended to improve forecast quality. Some recommendations from the study are as follows:

- **Improve data quality** – Forecasts rely on high quality data made available in a timely manner to the forecast providers for use within their models. There were several instances throughout the test when data quality was an issue and forecast quality suffered as a result. Improving telemetry data from wind sites has been an ongoing focus of the CAISO to improve forecasting performance. In addition to the telemetry, the outage information of the site must be provided within a reasonable time after a forced outage or de-rate is detected. The outage data should also be provided at the maximum granularity, which the CAISO believes should be at the turbine level. Accordingly, scheduling of planned

outages and de-rates also needs improvement with respect to both the timing and capacity changes.[16]

- **Regional day-ahead forecasts** – The evaluation showed that significant advantages in forecast accuracy can be achieved when several wind plants are considered together. This advantage was particularly evident for the day-ahead forecasts, which would be used to inform the CAISO's day-ahead market in which most next-day unit commitment decisions must be made. Using a regional day-ahead forecast does not eliminate the need for more accurate sub-regional forecasting for congestion management purposes.
- **Change confidence levels** – The study specifications required 90% and 95% confidence levels. The 95% level in particular did not provide useful information because of the large interval size and the inability to achieve that performance target. Applying an 80% exceedance approach may result in a smaller and, therefore, more useful intervals if this confidence interval approach is desired. Switching to an exceedance[17] approach could potentially provide advantages over a confidence interval approach. For example, using this method would set a level in which forecast providers are 80 % confident that the production will exceed, rather than a band surrounding the forecast. ERCOT currently uses an exceedance based approach.[18] An advantage of the exceedance approach is

[16] Revisions to the CAISO tariff to implement these findings are currently pending in *California Independent System Operator Corp.,* ER10-319-000 (2010).

[17] Exceedence would be given as a minimum level that the resource is expected to exceed the specified production percent of time.

[18] http://nodal.ercot.com/docs/pd/ems/pd/wpforc/TN.EMS.61C01.WindPowForecastingReqSpec.doc

that it provides greater certainty that the forecast error will be in a particular direction.

- **Continual Evaluation of PIRP forecasts** – Though forecasts are used every day in operations, there is a tendency to ignore their performance other than with respect to their ramifications on settlements. A continual analysis of forecasts on an ongoing basis can ensure the CAISO is receiving the quality forecasts that it expects. The analysis can also be used to provide feedback to the forecast provider in an effort to improve forecasts. Continual forecast evaluations would naturally occur with a dedicated forecasting staff. In the past, errors have been reported using the mean absolute error percentage. The CAISO believes that this method "softens" the true error in forecasting. The CAISO is now using root mean square error method to evaluate performance. Root mean square error has advantages over a simple average in that the positive and negative forecast errors from different intervals do not cancel each other out, and, therefore does not mask the magnitude of the deviations over a large sample. Also, the root mean square error method gives higher weight values to bigger deviations than smaller deviations than smaller irrelevant deviations.
- **Alternative pay schemes for multiple forecast providers** – The CAISO could potentially lower costs and retain multiple forecast providers by proposing an alternative payment scheme. Forecasting service costs could be structured such that the CAISO pays each provider a smaller flat rate. The CAISO would then evaluate the quality of forecasts on an ongoing basis. The best trending forecasts for each time scale would be used for market and operational

purposes. Forecast providers would receive bonuses for having the best trending performance. This structure would allow the CAISO to benefit from having the additional reliability of multiple forecast providers, and would also structure the incentives to motivate providers to routinely improve the quality of their service. Implementing such strategy would require that the CAISO create a methodology to select the best prevailing forecasts.

- **Federal weather agencies should be required to improve forecasts** – The National Weather Service and National Oceanographic and Atmospheric Administration provide the numerical weather prediction models tuned to providing temperature and rain forecasts for the entire United States. These models are the baseline inputs to the forecasters' wind and solar predictions. The CAISO should actively coordinate with other balancing authorities impacted by intermittent renewable resources to advocate for improvements to these models.

Forecasting of VER ramp events

As noted by the Commission, forecasting significant VER ramping events is a crucial, but nascent, aspect of VER production forecasting. Both wind and solar resources can quickly reduce output under different meteorological conditions. For example, wind generators shut down when wind speeds exceed safe operating limits. As a result, a big storm front with high wind gusts can first result in a substantial spike in output, followed by the loss of hundreds of megawatts energy from wind generation over a short period of 10 to 20 minutes. Also, wind shear conditions at a wind facility may result in the units going from zero to full output within a few minutes when the wind

shear condition changes and the wind hits the turbines instead of passing above the units. The CAISO is working with the Bonneville Power Administration and forecasting companies to improve the tools for predicting these types of energy spikes and to make this information available to CAISO operators. Unlike the real-time forecast, which is an average of the operating hour energy production, this forecast is designed to look at the 5 to 15 minute intra-hour variations of wind or solar supply especially in a weather event situation moving though the wind production areas.

Definition of weather events, energy spike upward or downwards, is in the process of being defined. Factors of an energy spike not only include the magnitude and duration of the spike but also what effect it will have on the system. As an example, during the ERCOT event of February 2008 the ramp incurred by loss of wind over a three hour period combined with a climbing load and limited reserves led to a Stage 2 emergency.

Sharing of meteorological data across regions and between decentralized and centralized forecasts

The Commission is interested in opportunities to share of data and forecasts across regions and among entities conducting forecasting within a region. The CAISO agrees relevant meteorological data and reasonably aggregated forecasts of output and ramping events should be publicly shared. By increasing the availability of information from a broader network of observation points throughout the state(s) not only improves the predictability of weather phenomena for the energy industry but also provides societal forecast benefits. Similarly, making actual forecasts available provides better information to other resource providers regarding the value of making surplus capacity

available to the CAISO market and other balancing authority areas. However, the CAISO recognizes that forecasts of energy production from individual wind or solar parks should be confidential.

With respect to the encouragement of both centralized and decentralized forecasting, the CAISO is focused on continuing and refining its centralized forecasting mechanisms for central station VERs. Some of the load serving entities in the CAISO service territory are also making significant investments in VER forecasting. As noted above, to the maximum extent possible, sources of data feeding forecasts should be available to other entities performing forecasting activities. Moreover, the CAISO is evaluating whether different resource technologies, such as solar resources, are more amenable to decentralized forecasting.

ISO does not have a view on whether this type of decentralized forecasting should be mandatory for transmission providers or load serving entities, where the latter is the entity contracting with VERs. Some load serving entities with renewable resource contracts will be small and it may not be economically justifiable to require them to invest in forecasting capabilities rather than pay the fees for the CAISO to acquire the data from their resources via the PIRP.

Forecasting of distributed VERs

The Commission is interested in the impact on system operations of the lack of forecasting and data on operational status of distributed VERs. This is an issue that has not had much of an impact as of yet on CAISO system or market operations. However, under some technology forecasts, and perhaps also due to changes in State policy (*e.g.*, by provision of expanded feed-in tariffs), southern California could greatly

increase its distributed VER capacity. For example, the CPUC has studied a "high DG" scenario for 2020 that includes 15,000 MW of distributed solar photo voltaic.[19] The CAISO, along with its participating transmission owners, the CPUC, and other State agencies, is beginning to study the operational impact of large-scale distributed VERs. At present, there are no rules for such VERs to supply data for forecasting. These studies are intended to evaluate more closely what might be required to integrate such VERs.

B. Scheduling Flexibility and Scheduling Incentives

1. Scheduling Flexibility for VER Imports

As is the case in many other ISOs/RTOs, the CAISO conducts a day-ahead market with security constrained unit commitment using an hourly scheduling and market interval. During the operating day, the CAISO uses its real-time market to address imbalance energy needs, which utilize both intra-hour unit commitments on a rolling basis with various look-aheads, and then 5-minute security constrained economic dispatch of internal resources and dynamically scheduled external resources. This real-time market structure, supplemented by regulation reserve, affords the CAISO the ability to respond quickly and economically with internal resources to fluctuations in VERs supply. As discussed further later in these comments, there is no evidence that the CAISO's internal scheduling intervals require shortening for purposes of VERs integration.

[19] The CPUC report can be found at: http://www.cpuc.ca.gov/PUC/energy/Renewables/hot/33implementation.htm.

With regard to imports, however, as is true in most other ISOs/RTOs, most imports are from non-dynamic external resources[20] that are scheduled on the interties on an hourly basis during the operating day. This is largely due to the practices of surrounding balancing authority areas that do not employ similar real-time imbalance energy procurement and, instead schedule transmission service on an hourly basis. Such schedules can only be adjusted during the hour for emergency situations that threaten reliability.

The limited exceptions to the dominant hourly-scheduling practices consist of the CAISO's import and export arrangements known as "dynamic transfers," including dynamic scheduling and pseudo-ties. External resources that are dynamically scheduled into the CAISO are scheduled and dispatched on an intra-hour basis similar to internal generation and are not constrained by the inflexibility of hourly scheduling. The CAISO's existing provisions for dynamic scheduling were designed for conventional dispatchable resources, however, and therefore the amount of dynamically scheduled VERs the CAISO can accept will need to be increased gradually as the CAISO works with its neighboring balancing authority areas to design new dynamic scheduling provisions that enable the CAISO to ensure reliable operation with larger quantities of VER being scheduled dynamically. The other type of dynamic transfers, the pseudo-tie, allows the CAISO to have operational control over an external resource that is equivalent to that of an internal resource. To date pseudo-ties have been implemented only as pilot programs for conventional resources.

[20] "Non-dynamic" in this context refers to imports that are fixed over the hourly scheduling interval on the interties.

To advance the use of dynamic transfers for VERs, the CAISO is conducting a stakeholder process to determine how additional intra-hour scheduling flexibility can be achieved within the confines of the scheduling practices of its neighboring balancing authorities, *i.e.*, without moving more extensively to more granular inter-change scheduling.[21] This initiative includes consideration of changes to the CAISO tariff that may be needed to enable dynamic transfers from VERs outside the CAISO balancing authority area. The CAISO is reviewing the range of dynamic transfer-based services presently offered under the CAISO tariff and exploring the expansion of CAISO dynamic transfer scheduling policy to accommodate increased quantities of VERs imports.

The CAISO is also considering the extension of pseudo-tie service, which is currently a pilot program, to include VERs located outside of the CAISO balancing authority area. The pseudo-tie program is an arrangement whereby the CAISO operates an external resource in much the same way as if it were located in the CAISO balancing authority area. The CAISO is currently working with a VER to create the first pilot program for this type of resource. To inform these considerations of dynamic transfer policy, the CAISO is planning to conduct studies to analyze and quantify the impacts of dynamic transfers on CAISO grid operation to determing what if any quantity or other limitations should apply to dynamic transfers from VERs to maintain reliable operations. In the absence of changing the standard westwide practice of hourly schedules to adopt more granular sub-hourly schedules, these dynamic transfer approaches achieve sub-hourly scheduling for the participating resources through the CAISO's five-minute real-time market dispatch.

[21] Materials regarding this initiative can be found at: http://www.caiso.com/2476/24768d0a2efd0.html.

Besides dynamic transfers, the CAISO believes that increasing the temporal granularity of inter-balancing authority scheduling, perhaps to 15-minute interval scheduling, should be pursued as a way to facilitate imports of energy from out-of-state VERs into California. Under the existing non-dynamic hourly transmission scheduling practices on the interties, VERs outside of the CAISO that want to import energy into the CAISO must arrange for their host balancing authority to manage their intra-hour variability to support the delivery of a firm import for the hour. Thus the prevailing hourly scheduling requirement may prevent regional VER from utilizing the full flexibility of the real-time market structure of the CAISO. Shorter scheduling intervals on the interties would improve this situation by allowing the CAISO and other balancing authorities to more efficiently manage intra-hour VER variability as well as ramps and variations in demand. Moving to sub-hourly schedules could reduce integration requirements (*e.g.*, regulation) as long as the external VERs supply the CAISO with their forecasts. For dynamically scheduled VERs, the CAISO would prefer to establish a requirement for a 5-minute forecast from the resource, but that requirement is still under consideration in the stakeholder process.

Optimal intra-hour flexibility for VER imports

The CAISO is exploring how much flexibility is needed for within the hour scheduling to accommodate the VERs output, but has not yet concluded its evaluation and does not have a definitive answer. The CAISO believes that updates from VERs on their expected output every 5-minutes, structured in 5-minute intervals for a horizon up to 2 hours, would be optimal and most complementary to the CAISO's markets. It may also be more feasible to forecast on 15-minute intervals, an approach that would

complement the CAISO's 15-minute real-time unit commitment process through which the CAISO commits resources in the real-time. A very important benefit of having updated forecasts from dynamic external VERs is to enable the CAISO to re-allocate unused intertie transfer capacity from dynamic VER whose output drops to other dynamic resources that can utilize it.

It is important to consider that the NERC Reliability Standards and existing operating conditions will limit the amount of VER deviations the CAISO can accept without risking adverse operational impacts. One practical implication of this is that actual delivery from a dynamic transfer should not exceed its hour-ahead transmission reservation. This creates an issue because the CAISO must then determine how to allocate transmission based on maximum expected use of interties by dynamically scheduled VER, which may result in transmission being under-utilized if the maximum expected use is never achieved. Thus the ability of the CAISO to re-allocate transmission intra-hour stands as a fundamental operational need to be addressed in order to integrate larger quantities of VER dynamic imports.

The CAISO has contemplated incorporating intra-hour VER schedules by requiring the dynamic resource to inform the CAISO of its expected intra-hour adjustment ahead of time and then settling its deviations from the day-ahead hourly schedules at the real-time price. Using this approach hour-ahead allocation of Available Transmission capacity would be performed based on maximum expected use, and then the e-tag would be trued up after the end of the operating hour. Other issues that need to be addressed are whether there are limits on the amount of dynamic VER capacity that the CAISO can reliably accommodate on a specific tie or in aggregate across all

ties, and if there are limitations, how the capacity should be allocated. Lastly, the CAISO is considering requirements that include the ability to curtail a dynamic VER import so that in the case loading relief is necessary the CAISO has the necessary operational control to manage the actual flow limits while at the same time fairly allocating such curtailments among both static and dynamic transfers. Finally, the CAISO believes that increased coordination with other balancing authority areas is needed to develop practices for re-dispatching all interchange flows within the hour instead of maintaining the inflexible hourly scheduling practices currently predominant in the west. Such changes would, of course, need to be developed through collaborative efforts among western balancing authority areas.

2. Schedulin g Incentives

The Commission asks whether additional incentives are needed to encourage VERs to submit schedules informed by accurate forecasts and to submit those forecasts into the CAISO markets. The Commission asks whether penalties should be assigned for failure to submit accurate schedules and whether VERs should be assigned the same imbalance penalties as conventional resources. The CAISO has described above that under the PIRP, participating VERs are provided sufficient incentives to submit accurate schedules, although improvements in data quality are continually needed. As noted above (and unlike other ISOs/RTOs), the CAISO also provides a financial incentive to VERs under PIRP in that they are exposed to netted monthly real-time imbalances from their hourly schedule and a monthly average LMP. To the extent such resources schedule consistent with the external vendor's forecast, the PIRP resource is shielded from some degree of imbalance energy charges associated with deviations

from CAISO dispatches. However, this same approach makes the resources less sensitive to real-time price signals to curtail, because the real-time prices do not apply to their deviations.

C. Day-Ahead Market Participation and Reliability Commitments

1. Day-ahead Market Participation

The Commission has raised a number of questions related to the matter of increasing day-ahead market participation by VERs. Under the current market design VER, like all physical resources, can schedule voluntarily in the day-ahead market. However, although there is a day-ahead offer obligation for most resources that provide resource adequacy capacity, there is no comparable requirement for VERs.[22] In addition, there is no strong financial incentive for VERs to schedule or offer their power into the day-ahead market because, as discussed below, under the PIRP most VERs today bid or schedule only in the real-time market through the bid submission process that occurs hourly in advance of the operating hour. Consequently, the CAISO has observed some limited day-ahead scheduling of wind resources, but little compared to expected next-day output. As the CAISO sees additional VER generation at higher RPS levels, this lack of day-ahead scheduling may lead to increased day-ahead over-commitment of thermal generation (to minimize the risk of a supply shortfall) and a divergence of prices between the day-ahead and real-time market. It is crucial to understand, however, that the value to the CAISO of day-ahead VER schedules is directly proportional to the accuracy of the day-ahead generation forecasts on which

[22] Additional discussion of the resource adequacy offer obligation as it applies to VER is provided later in these comments in the section on resource adequacy capacity and capacity markets.

those schedules would presumably be based. Absent reliably accurate day-ahead forecasts, day-ahead VER schedules would be little better than speculative financial positions taken by the scheduling coordinators for these resources and as such would not relieve the CAISO of having to utilize the best forecast available to determine the need to commit additional thermal generation. As discussed in the section on Resource Adequacy Capacity later in these comments, this question of forecast accuracy is the main reason why at present there is no day-ahead offer obligation for VER that provide resource adequacy capacity. Hence, while there may in the future be a need to consider adopting changes in the incentives for VERs to schedule day-ahead market and perhaps apply a day-ahead offer obligation for VERs that provide resource adequacy capacity, it is important to consider the fact that a day-ahead schedule of a VER does not offer the same confidence as we have with a thermal generator that that schedule will actually be delivered. Morevoer, as discussed below, a certain degree of convergence between day-ahead and real-time market schedules and prices can be achieved through the participation in the day-ahead market of convergence bidders, who should be motivated to develop their own forecasts of VER energy in order to profit from day-ahead-to-real-time price differentials.

Given the considerations above, the CAISO has not arrived to any conclusions regarding what types of incentives should exist for day-ahead market participation by VERs, and intends to examine this entire question later this year as it commences its stakeholder process to evaluate PIRP reforms.

The above arguments notwithstanding, the CAISO emphasizes that the ultimate objective is to have VER participate in the day-ahead market based on highly reliable,

accurate forecasts of their next-day production in each hour. The lack of accurate VERs schedules in the day-ahead market could lead to increased out-of-market commitments, which are called exceptional dispatches at the CAISO, primarily for purposes of decommitment of conventional resources committed in the integrated forward market.

The core features of the day-ahead market and real-time market of the CAISO market design are intended to promote alignment between day-ahead market outcomes and real-time market outcomes. In addition, several forthcoming market design changes and changes to procurement practices will further improve the alignment of schedules and prices in the day-ahead market and real-time market. In particular the commencement of convergence bidding, which will allow virtual bidders to enter the integrated forward market and take positions not being taken by VERs will provide additional opportunities for market participants to submit bids in the day-ahead market that will tighten the spread between day-ahead and real-time prices. Convergence bidding was required by the Commission for the CAISO market and is scheduled for implementation February 1, 2011.

Several eastern ISOs and RTOs are reporting that convergence bidders (called virtual bidders elsewhere) are taking the day-ahead positions not currently being taken by VERs, which indicates that such bidders have sufficiently accurate forecasts to take the financial risks. Unfortunately, the CAISO will not have experience with both VERs and convergence bidders until 2011, and hence cannot comment on the impact of such bidders in voluntarily addressing the gap in day-ahead VER participation. However, as discussed above, convergence bidding is expected to substantially improve price

convergence between the two markets, thereby eliminating incentives to avoid scheduling in the day-ahead in anticipation of higher real-time prices for all resources generally.

In addition to the upcoming feature of the convergence bidding, as discussed further below in Section E, there are also some recently implemented and planned changes in the ancillary service markets that will help align day-ahead and real-time conditions as well as improve market efficiency. The CAISO's recent adoption in October 2009 of variable regulation procurement based on forecasts of real-time conditions will provide the basis for the CAISO to adapt its procurement to account for expected VER output.[23] The variable regulation feature provides the ability to calculate the amount of regulation required to handle the demand ramp by accurately forecasting the amount of demand ramp needed each hour. In addition, if implemented as proposed scarcity pricing will increase market clearing prices for market-based ancillary services and possibly energy[24] when ancillary services are in shortage. This will send better price signals to resource owners that are able to fulfill such requirements.

However, these measures alone may not suffice to tighten the divergence of prices between the day-ahead market and real-time market as higher levels of VERs and a higher degree of forecast error and variability penetrates the CAISO market. In its efforts to better evaluate the impact of greater VERs participation and necessary market design enhancements, the CAISO is undertaking an extensive and deeper analysis, the results of which it expects to make available later this year. This will

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[23] *See* http://www.caiso.com/2494/2494c16876b0.pdf and further discussion below in Section E.

[24] The energy price is increased administratively when ancillary services are short and energy production is also constrained.

include the recommended design changes, if any are deemed appropriate, to encourage greater participation by VERs in the day-ahead market.

The Commission asks explicitly whether day-ahead market designs place undue barriers to VER participation. As of these comments, and prior to receiving substantial stakeholder input on this issue, the CAISO does not believe that the current CAISO integrated forward market places undue barriers to participation by any resource, including VERs. Their participation in the integrated forward market is neither prohibited nor required. However, the current integrated forward market design does not provide the same protection from the financial consequences of realitime output variability as is currently available through the netting and averaging of imbalance charges for VER scheduling in the real-time market under the PIRP. These and any other enhancements will be considered in the CAISO's upcoming stakeholder process.

The Commission is interested in whether the timing of the day-ahead market could be modified to facilitate VERs participation. The CAISO day-ahead market, which consists of both the integrated forward market and residual unit commitment process, closes at 10:00 AM and results are posted by 1:00 PM.

While it may be feasible to extend the deadlines for the various components of the day-ahead market, *i.e.*, integrated forward market and residual unit committment, the CAISO has not evaluated the feasibility of implementing such staggered deadlines and the overall impacts such changes would have on the markets, nor is it clear what objectives such changes would accomplish. The CAISO and participants should consider the impact this would have on the opportunities afforded to resources that bid into the day-ahead market, but do not clear the market and the impact on units with

longer start-times. In addition, the CAISO understands that demand response will benefit from participating in the day-ahead market precisely due to the advance time available to prepare for such response in the operating day. These are all considerations that have to be considered carefully through a robust stakeholder process before such changes are adopted.

Improved day-ahead forecasts will substantially improve the ability of scheduling coordinators responsible for VERs to participate in the day-ahead market, by reducing uncertainty about next-day production. Improved day-ahead forecasts could also help convergence bidders with their day-ahead bidding decisions, whether the forecasts are directly contracted by the convergence bidders or received via a CAISO-mediated transfer of information.

The Commission must recognize, however, that the CAISO has not yet reached a conclusion on whether it is appropriate to implement mechanisms that reduce the financial risk of VERs' participating in the day-ahead market in recognition of their unique characteristics. As noted below, the current PIRP program does explicitly include pricing measures, including netting imbalance deviations and averaging the LMPs for the netted deviations over the month, that reduce the risks VERs would otherwise face by having an hour-ahead schedule against which they are financially exposed for real-time deviations. At current levels of VER capacity, this rule has had the benefit of reducing VER financial exposure and facilitating investment while providing the CAISO with reasonably accurate hour-ahead VERs schedules. However, as VER capacity increases, this rule also will diminish the incentives for VERs to respond to real-time CAISO dispatch instructions by reducing the financial impact of the

actual price in each real-time interval. As a result, some load serving entities are beginning to develop contracts provisions that give the scheduling coordinator the right to curtail VERs in response to market prices.

Moreover, real-time deviations from hourly schedules are of a smaller scale than real-time deviations from day-ahead schedules. Hence, moving the PIRP rules into the integrated forward market would result over time in an ever larger proportion of the CAISO day-ahead energy market not being exposed to full real-time price signals. The CAISO recognizes that some wind resources in California would like the extension of the PIRP settlement rules to day-ahead schedules. As noted above, facilitating VERs participation through minimizing exposure to imbalance costs (*e.g.*, under PIRP) should be balanced against the value of market price signals to guide efficient system operations. The CAISO will be examining this trade-off – *i.e.*, financial risk management for VERs *versus* efficient pricing for dispatch -- later in 2010 when it begins its stakeholder process to address incentives for VERs to participate in the day-ahead market.

2. Reliability Commitments

The Commission considers whether the lack of more frequent post-day-ahead market reliability assessment and unit commitment processes may result in unjust and unreasonable rates by causing System Operators to make inefficient reliability commitment decisions, which may further cause unnecessary system uplift costs.

Similar to the market structure in other ISOs/RTOs, the CAISO day-ahead market includes a *reliability* unit commitment process referred to as the *residual* unit

commitment conducted after the integrated forward market is finalized.[25] The residual unit committment process is designed to ensure that sufficient generation will be available in the appropriate places to meet the CAISO's estimate of the next day's forecasted demand. The integrated forward market is cleared based on bid-in demand. The residual unit commitment process, on the other hand, is cleared based on the CAISO's forecast of the next day's demand. If the integrated forward market cleared resources are insufficient to meet that forecast of demand, the CAISO commits additional resources. After the CAISO conducts the residual unit committment process, there is no other formalized market process that is part of the day-ahead market that enables the CAISO to re-optimize the committed resources. The next market opportunity to make unit commitment decision is the short term unit commitment process then can commit resources as far as 270 minutes in advance. If necessary and under certain conditions specified in its tariff, the CAISO may issue an exceptional dispatch. However, such day-ahead reassessments of the next day's need have proven to be neither necessary nor advisable. The CAISO's experience under its current design over the past year has demonstrated that there is no need to re-optimize and decommitt or commit additional resources in the day-ahead given the flexibility of the fleet and the ability to re-optimize in the real-time.

The CAISO series of market processes in the real-time provide an opportunity for re-assessment and re-optimization of resources to meet demand forecast in the real-time. For example, intra-day procedures such as the short-term unit commitment process and real-time unit commitment processes enable the CAISO to prior day

[25] *See* Section 31 of the CAISO FERC Electric Tariff.

commitments to ensure optimal use of all resources in the real-time, given that the optimality of the solution may change closer to real-time as system conditions materialize and become known to the System Operator. The residual unit committment process in the day-ahead market provides a special feature that allows the CAISO to adjust the residual unit committment procurement target, which consists of the CAISO's forecast of CAISO demand for the the next day, to consider variations in the participation of VERs in the real-time the next day.[26] Scheduling coordinators for VERs may submit bids, including self-schedules, in the day-ahead market and the quantity ultimately scheduled from Eligible Intermittent Resources may differ from the CAISO forecasted deliveries from the Eligible Intermittent Resources. If so, the CAISO may adjust the forecasted demand either up or down for such differences by residual unit committment zone in which the Eligible Intermittent Resource resides. To the extent the scheduled quantity for an Eligible Intermittent Resource in the integrated forward market is less then the quantity forecasted by CAISO, the CAISO makes a supply-side adjustment in residual unit committment by using the CAISO forecasted quantity for the Eligible Intermittent Resource as the expected delivered quantity. To the extent the scheduled quantity for an Eligible Intermittent Resource in the integrated forward market is greater than the quantity forecasted by the CAISO, the CAISO makes a demand-side adjustment to the residual unit committment zone demand equal to the difference between the day-ahead schedule and the CAISO forecasted quantity.

In the real-time, the current CAISO market design also offers several opportunities for finer tuned commitments based on closer to real-time assessment of

[26] *See* CAISO FERC Electricity Tariff, Section 31.5.3.4 Eligible Intermittent Resource Adjustment.

system conditions. The real-time unit commitment process currently runs as much as almost four hours in advance of the operating hour, depending on the time of day. The hour-ahead scheduling process, a special run of the real-time unit commitment designed to procure energy and ancillary services from hourly-dispatchable external resources in the hour-ahead, permits participants of PIRP to schedule resources consistent with the vendor provided forecast. The real-time unit commitment process could be further adapted to facilitate efficient VER integration. For example, the CAISO could adopt a probabilistic approach to unit commitment that enables the real-time unit committment to consider the variations in output over time. The CAISO is studying such approaches, as are other markets and researchers, but believes that further research is needed before a definitive design change can be made.

The Commission is interested in the appropriateness of new markets with financial settlement on additional intra-day time-frames that would more closely track updated VER production forecasts. When redesigning the markets, the CAISO and stakeholders considered whether to establish a full hour-ahead market instead of the hour-ahead scheduling process.[27] After one year experience with its new market design, the CAISO does concluded that an additional market that coincides with the timing of an intra-day reliability commitment process is necessary and it is not clear that it would be beneficial in the forward scheduling of VERs.

The existing market design already incorporates centralized forecasting of VERs' output in the reliability assessment and commitment processes. Both the residual unit commitment conducted in the day-ahead market and the hour-ahead scheduling

[27] See *e.g.*, *California Indep. System Operator* Corp., 112 FERC ¶ 61, 310 at PP 28-33 (2005)

process can include adjustments based on the centralized forecasting of VERs output. As discussed above, the residual unit committment process can be tailored to commit additional resources based on the expected variability of VERs output in specific grid locations. Also, as discussed above, the hour-ahead scheduling process permits PIRP participants to submit schedules consistent with vendor provided forecast.

D. Balancing Authority Coordination

The Commission seeks to explore whether increased coordination among balancing authorities has the potential to enlarge the base of generation and demand available to customers, thereby making variability more manageable and ultimately reducing overall costs. Accordingly, the Commission seeks comments on ways to increase customer access to energy, capacity, and reserve products through the use of pseudo-ties, dynamic scheduling, and/or other tools and agreements.

The CAISO is the only balancing authority within its controlled transmission grid footprint. In the state of California, and closely integrated with the CAISO grid facilities, are there 12 other balancing authorities that the CAISO must coordinate and check out with regularly. With respect to the balancing authorities that the CAISO must interact with, the CAISO believes that smaller balancing authorities will have higher VER integration costs and that inter-balancing authority coordination and cooperation can reduce such integration costs. This is for two reasons: first, access to a broader pool of integration resources; and second, because geographical diversity can reduce aggregate variability of VER output.

The CAISO is pursuing this issue on three fronts: through joint arrangements with neighboring balancing authority areas (such as Boneville Power Administration),

through development of dynamic transfers and pseudo-tie arrangements that will allow CAISO to integrate external VERs into its system operations, and through active participation in WECC committees including the Seams Issues Subcommittee. The Commission should consider as part of this inquiry that differences in how VERs are charged for firming services in contiguous balancing authority areas could lead to distortions in scheduling practices between those areas. Commission action in encouraging balancing authority coordination for VER integration would be a useful step to overcome regional policy and market differences.

The CAISO is currently evaluating aspects of this question via its dynamic transfer initiative.[28] These issues involved in this initiative include those identified in Section II.B.1 of these comments.

The Commission is interested in the costs and benefits of small generation-only balancing authorities. The CAISO has no such balancing authorities within its balancing authority area, and the CAISO has not studied the costs and benefits of such balancing authorities; however, there are such balancing authoritys elsewhere in the WECC. As discussed in the recent CAISO straw proposal on dynamic transfers, among the requests for dynamic transfers into the CAISO (and throughout the western region) are requests from single generator balancing authority areas. Currently, single generators providing their own reserves and service are tagged and denoted as "unit-contingent" resources and transactions, which is a type of standard transaction that is recognized by the Western Systems Power Pool (WSPP). If a single resource trips off line, then backup reserves from that same unit are not available. To avoid unit-contingent status,

[28] See CAISO, Dynamic Transfer Straw Proposal, March 10, 2010, pp. 17-18, available at http://www.caiso.com/2755/2755e7b852d20.pdf.

a single generator would need to show adequate services from a separate resource capable of ensuring the required back up and diversity needed for reliable delivery. The challenges of dynamic transfers from these balancing authority areas include: (1) increased potential for increased requirements for the CAISO to firm, shape and load follow for a single resource, particularly an intermittent resource, (2) proper accounting and compensation for inadvertent flows, (3) whether aggregation as described above offers a better solution than participation as a generator-only balancing authority area, (4) whether NERC/WECC reliability is met, and (5) impacts pertaining to intermittency. To the extent that the single generator balancing authority area cannot self regulate, it imposes inadvertent interchange on the balance of the WECC.

These single generator balancing authority areas maintain that they self regulate with their EMS systems continually moving the unit to hold its schedule, and that they procure contingency reserves from reserve sharing pools that can be dispatched within 10-minutes to restore schedules. However, on a case-by-case basis, the CAISO will need to be assured of their responsiveness for four-second regulation in a unit contingency event, until such time that these reserves can be dispatched. On a case-by-case basis, the CAISO can evaluate whether a single generator balancing authority area has shown a history of high deliverability, and will expect that, at a minimum, the single generator balancing authority area should demonstrate adequate performance (management of inadvertent energy) and is coupled with acceptable control area services such as EMS and reserves (self-provided or procured from a third party), to avoid the imposition of greater costs on the CAISO than would occur with a dynamic transfer from a conventional balancing authority area that contains both generation and

load, and which has the ability to regulate using other generation within the balancing authority area as regulation reserves.

A generation-only balancing authority area with multiple independent units behind a meter or delivery point can be preferable to a single-generator balancing authority area, when, for instance, it has two or more independent thermal units, even if there is shared capacity to reach the top of its combined maximum range. With this configuration, if one unit has an outage, a second unit can still act as an independent generator, offering backup and reserves if necessary. However, in either case, it will be beneficial to enter into dynamic transfer arrangements on a case-by-case basis as a pilot project, to give such entities time to prove the reliability and deliverability of their projects.

E. Reserve Products and Ancillary Services

The Commission seeks to explore whether existing reserve products provide the CAISO with the most cost-effective means to maintain reliability with increased VERs on the system, and how other reforms, such as the possible changes to the timing of markets and reliability assessment procedures and improvements in forecasting discussed above might affect the need to procure additional reserves. The CAISO believes that many of the Commission's questions in this NOI will have interacting effects on market and operational requirements, including ancillary services. The overarching question in the CAISO's mind is which set of these reforms will provide the most efficient design to facilitate VER integration. The answer to that question will require further analysis, but some elements are discussed below.

The following types of Ancillary Services are currently traded in the CAISO market:

- Regulation up, must be synchronized and able to receive AGC signals.
- Regulation down, must be synchronized and able to receive AGC signals.
- Spinning reserve (must be synchronized, be available in 10 minutes, and be maintainable for two hours.[29] The CAISO's Boad of Govenrors has authorized the CAISO to request changes to these timing requirements to facilitate participation by non-generator resources in anciallry serives market. The CAISO intends to file propsed tariff changes in May 2010.
- Non-spinning reserve (must be able to deliver the ancillary services award within 10 minutes and be maintainable for two hours). The CAISO's Boad of Govenrors has authorized the CAISO to request changes to these timing requirements to facilitate participation by non-generator resources in anciallry serives market. The CAISO intends to file propsed tariff changes in May 2010.

A frequently cited policy concern at higher VER levels is that any additional ancillary services required for renewable integration should be procured so as to minimize market costs. This effort might require a mix of higher quality and lower quality ancillary services, including supplemental reserves. This concern is reflected in the NOI questions in this section. The CAISO has not yet identified the exact mix of ancillary services to minimize procurement costs while ensuring reliability. Assuming that the right mix of ancillary services is being procured to meet VERs operational requirements, the CAISO's market solution for ancillary services is designed both to co-optimize the procurement of energy and ancillary services and to allow higher quality ancillary services to substitute for lower quality ancillary services if this reduces the cost

[29] The two-hour requirement is specified in CAISO FERC Electric Tariff Section 8.4.3(a), Ancillary Service Capability Standards.

of procurement.[30] As such, the CAISO's market procures these services economically and efficiently using state-of-the-art solution algorithms. There are ongoing revisions to the market design for ancillary services, but these are likely to have minor effects on the efficiency of procurement.

One prospect at higher levels of VER production is that ancillary services could be in deficiency more often, and in unexpected hours (such as heavy morning and evening ramps), if they are procured increasingly to address VERs integration requirements. In this case, ancillary service prices should naturally increase to reflect the shortage of supply.[31]

The Commission is interested in how the CAISO could more fully utilize forecasting information and knowledge about existing system conditions to optimize reserve requirement levels. The response below addresses the Commission's question with respect to each existing category of current reserves individually. In addition, the CAISO discusses the status of participation by non-generation resources in the current ancillary service market as well as additional reserve products, such as a load following/VER following reserve.

Regulation

Under the CAISO FERC Electric Tariff, regulation is the service provided either by internal generating resources certified by the CAISO as equipped and capable of

[30] For numerical examples of ancillary service co-optimization, *see* California Independent System Corporation, California ISO, Reserve Scarcity Pricing Design, Revised Numerical Examples, and February 6, 2008. Available at http://www.caiso.com/1f65/1f65dabe49d90.pdf.

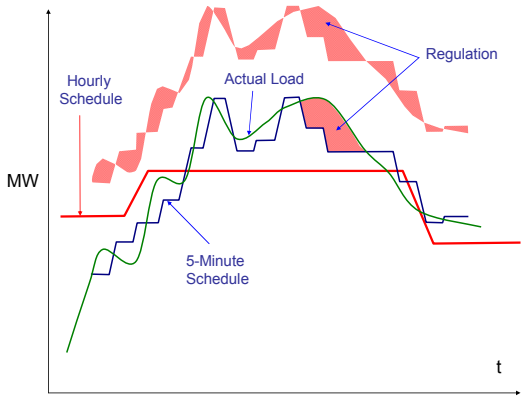
[31] The CAISO intends to implement an additional scarcity pricing design for reserves upon approval by the Commission. The CAISO's proposal is currently pending in FERC Docket No. ER10-500.

responding to the CAISO's direct digital control (*i.e.*, AGC) signals, or by external import resources that have been certified by the CAISO as capable of delivering such service to the CAISO balancing authority area, in an upward and downward direction to match, on a real-time basis, demand and supply resources, consistent with established NERC and WECC reliability standards, including any requirements of the Nuclear Regulatory Commission. The CAISO tariff further specifies that regulation is used to control the power output of electric generators within a prescribed area in response to a change in system frequency, tie line loading, or the relation of these to each other so as to maintain the target system frequency and/or the established Interchange with other Balancing Authority Areas within the predetermined regulation limits. Regulation includes both the increase of output by a resource (*i.e.*, regulation up) and the decrease in output by a resource (*i.e.*, regulation down). Regulation up and regulation down are distinct capacity products, with separate requirements, pricing and settlement. See Figure 4 below.

The CAISO is required under WECC and NERC reliability standards to procure sufficient regulation to meet its operating needs, which vary over time. The WECC does not specify a regulating margin based on load levels but requires adherence to NERC Control Performance Criteria. To meet the NERC criteria, the CAISO has historically procured ± 350 MW of regulating reserve (approximately 1 to 1.5% of load) on a given day. On days with high load demand, additional regulation is procured. Prior to October 3, 2009, the amount of upward and downward regulation procured in the integrated forward market varied from day to day between +/-375 and +/-500 MW as necessary to maintain compliance with NERC control performance standards, but

remained fixed for all 24 hours of the operating day. The CAISO has since adopted variable regulation procurement.

Figure 4: Regulation Requirement (Red Shaded Area).



Given the variable nature of the regulation requirement generally, and the expectation that hourly regulation procurement requirements could substantially increase regulation requirements in some hours, the CAISO has determined that setting an entire operating day's regulation requirements to a fixed amount creates potential market and operating inefficiencies. Accordingly, the CAISO implemented a regulation forecasting tool that varies the level of procurement on an hourly basis.[32]

This tool calculates the coincidental 10-minute peak requirement for regulation separately in the up and down direction for each hour based on changes in the demand forecast, generation self-schedule changes, and hourly intertie fluctuation. Incorporation of renewable resource variability offers an opportunity for future enhancement of the CAISO's current variable regulation procurement tool. Analysis of wind forecasting within the CAISO indicates that forecast error is likely to be greatest

[32] See fn 23 supra.

when wind is operating in the mid-range of its production. This suggests that day-ahead forecasts of wind production can help calibrate regulation requirements needed to compensate for errors in predicting wind output. The diurnal production of wind and, even more significantly, solar resources provide ramp patterns that also can be accounted for by variable regulation procurement.

The CAISO currently does not recalculate the variable regulation requirements in its real-time market. The CAISO is exploring functionalities to provide the operator the ability to recalculate the regulation requirement needs based on updates of the inputs to the regulation procurement decision. As part of this inquiry, the CAISO is including the possibility of incorporating a persistency forecast of renewable resources over several dispatch intervals into the real-time functionality. This is consistent with the fact that CAISO regulation requirements might vary for each 15 minute interval based on the real-time unit commitment process.

Looking ahead, preliminary CAISO estimates indicate that regulation up and regulation down requirements are likely to increase substantially in certain hours of the day under a 20% RPS, with further increases under a 33% RPS.[33] Figure 5 shows the results of the operational assessment that the CAISO undertook in 2007 of the regulation requirements for a 20% RPS achieved through incremental wind resources in the Tehachapi area. The figure shown is for the summer season (the other seasonal results are available in the 2007 CAISO IRR Report).[34] The CAISO may not face this

[33] See California Independent System Operator Corporation, Integration of Renewable Resources, 2007, available at http://www.caiso.com/1c51/1c51c7946a480.html. (CAISO IRR Report)

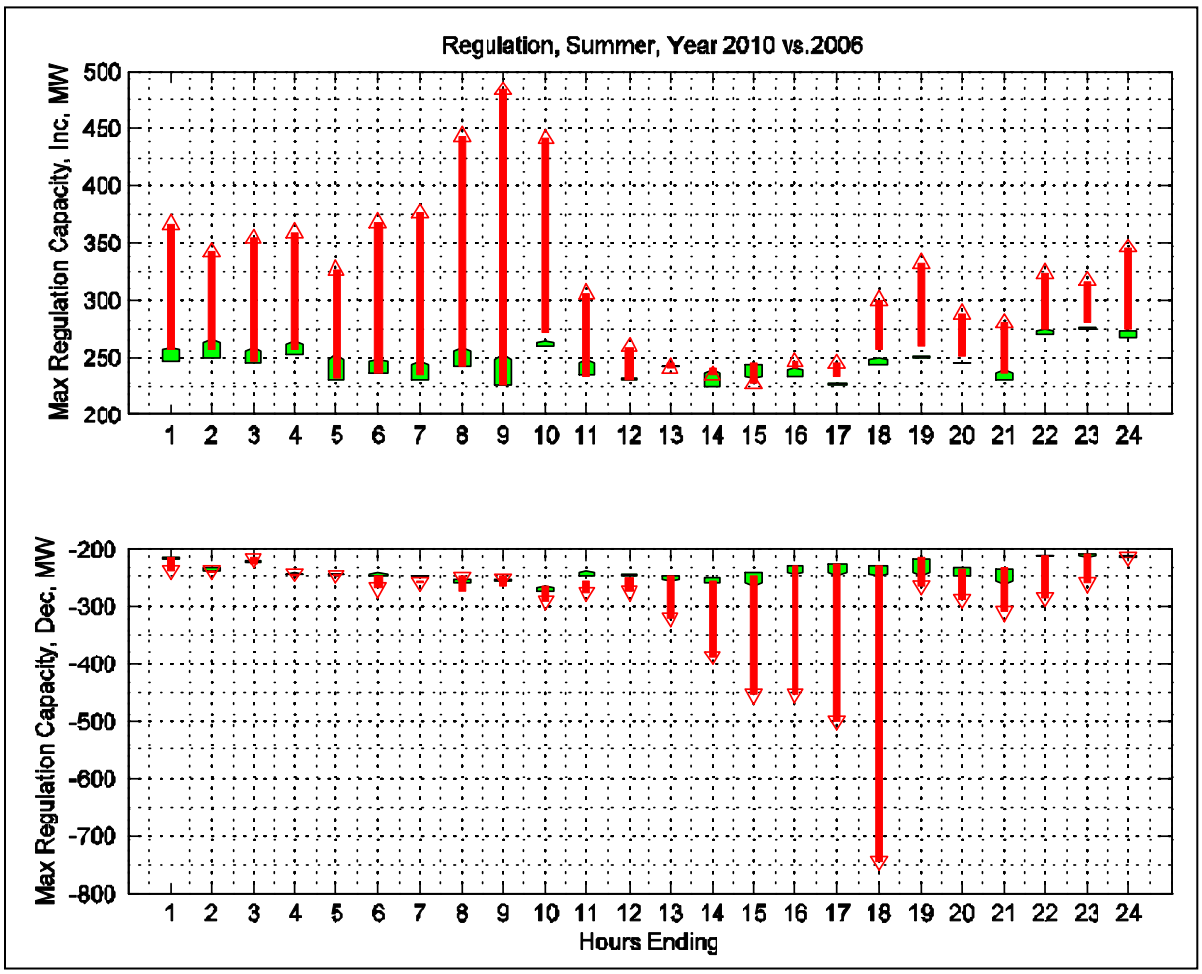
[34] The results are for the 95th percentile load following result for each hour of the season. That is, the Monte Carlo simulation does large numbers of draws for each hour in the summer months and this result is the highest load following result after the 5% highest results are eliminated.

additional regulation requirement in each hour, but needs to be prepared to do so in at least some hours. The green bars in the figure represent the hourly regulation requirement calculated just for load forecast error and variability. The red bars represent the hourly regulation requirement net of VER production; that is, with the additional variability created by VERs.

The CAISO is undergoing additional analysis to validate these assessments and to assess anticipated solar resources coming on line to satisfy the 20% RPS. Wind is anticipated to cause additional regulation procurement primarily in the high wind production and high wind ramp hours (morning and evening). Solar is expected to cause additional regulation procurement in the evening ramp down period. Increased overgeneration periods in light load, high wind conditions may also cause shortages in available regulation down capacity.

The CAISO notes that the figures in the 2007 study reflected below are forecasts because at the time of the study the CAISO had not yet experienced sufficient VER capacity in actual operations to adjust its regulation procurement. However, the statistical methodology used to model these longer-term changes on the system are being adapted by Pacific Northwest National Labs to provide a shorter-term, *e.g.*, daily or real-time, tool that could be used to inform the variable procurements in the CAISO markets. This is one way in which forecasting information will be utilized to optimize reserve procurements.

Figure 5: Estimated CAISO Seasonal and Hourly Variable Regulation Up and Down Requirements Under a 20% RPS



Source: CAISO IRR Report, available at http://www.caiso.com/1c51/1c51c7946a480.html.

Spinning and Non-Spinning Reserves

The CAISO procures two types of operating reserves: spinning and non-spinning reserves. Spinning reserves consist of the portion of unloaded *synchronized* generating capacity that is immediately responsive to system frequency and that is capable of being loaded in ten minutes and running for at least two hours. Non-spinning reserves

consist of the portion of generating capacity that *is capable of being synchronized* and ramping to a specified load in ten minutes (or load that is capable of being interrupted in ten minutes) and that is capable of running (or being interrupted). The CAISO's Board of Governors has authorized the CAISO to request FERC approval for changes to these timing requirements to facilitate participation by non-generator resources in ancillary services market.[35] The CAISO intends to file propsed tariff changes in May 2010.

The CAISO procures operating reserves through the integrated forward market in the day-ahead and the hour-ahead scheduling process and RTUC process during the operating day. The CAISO sets its operating reserves procurement target and maintains minimum contingency operating reserve made up of spinning reserve and non-spinning reserve in accordance with NERC and WECC reliability standards, including any requirements of the NRC. If necessary, the CAISO may, from time to time, determine to use more stringent criteria.[36]

Currently, based on these standards, CAISO procures Operating Reserves equal to the greater of:

1) Five percent of CAISO forecast of internal CAISO demand met by hydroelectric resources, plus seven percent of the CAISO forecast of internal CAISO Demand met by thermal resources plus firm exports minus firm purchases, (less net firm imports that are supplied with Operating Reserves), or

2) The single largest contingency.

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[35] *See* CAISO Management Memorandum to Board of Governors, Decision on Non-Generator Resources in ISO Ancillary Services Markets, March 25, 2010, *http://www.caiso.com/275d/275dab4648c62.pdf*

[36] See Section 8.2.3.2 of the CAISO FERC Electric Tariff.

In practice, the quantity of operating reserves based on percentage of CAISO demand reflected in (1) is greater in most hours and sets the requirements system-wide.

The CAISO may also procure operating reserves on a more granular basis, such as sub-ancillary services regions, in which case the CAISO would determine the regional requirements, taking into consideration: the CAISO forecast of CAISO Demand; the location of demand within the balancing authority area; information regarding network and resource operating constraints that affect the deliverability of ancillary services into or out of an ancillary service region; the locational mix of generating resources; generating resource outages; historical patterns of transmission and generating resource availability; regional transmission limitations and constraints; transmission outages; Available Transfer Capability; day-ahead schedules or hour-ahead scheduling process intertie schedules; whether any ancillary services provided from external system resources requiring a NERC tag fail to have a NERC tag; and other factors affecting system reliability.

Because the single largest contingency may affect these factors more in an ancillary services sub-region than in the CAISO balancing authority area as a whole, the latter criteria (*i.e.*, quantity of operating reserves based on the single largest contingency) could affect the procurement of operating reserves in one or more of the smaller regions.

In addition, under the current standards, at least 50% of the operating reserve requirement must be met by spinning reserves,[37] and no more than 50% of the operating reserve requirements may be met from imports of ancillary services.

The quantities of regulation up, regulation down, and operating reserves that CAISO targets for each hour of the operating day are published as part of the public market information by 1800 hours two days prior to the trade date. Total system ancillary services requirement is also posted to OASIS.

The CAISO's operational assessments have not yet identified the need for additional spinning or non-spinning reserves under a 20% RPS.[38] As discussed below, there is some preliminary indication that additional spinning or non-spinning reserves will be necessary before the system reaches 33% RPS.

Need for supplemental reserves for load/VER following

The Commission is interested in whether a load following or similar reserve product would facilitate lower cost VER integration, as well as the characteristics of such a product. In theory, a lower quality supplemental reserve (*e.g.*, a 20-30 minute operating reserve) that could effectively substitute for procurement of additional regulation or ten-minute reserves could result in lower costs of ancillary service procurement to address VER integration requirements.

CAISO 20% RPS operational studies (which only included estimates of wind resources) have identified an increase in the load/VER-following requirement, as shown in Figure 6 from the 2007 CAISO IRR Report. The figure shows the estimated load

[37] The CAISO posts a market notice in the event that the 50% Spinning Reserve requirement is to be changed.

[38] *See* CAISO IRR Report.

following up and load following down requirements by hour in the system under a 20% RPS. As with the regulation result discussed above, this result is based on the operational requirements associated with additional capacity of wind resources at Tehachapi. The CAISO is now conducting additional simulations, which are to reflect the current expected renewable mix with additional solar resources. The figure shown is for the summer season (the other seasonal results are available in the 2007 CAISO IRR Report).[39] As with the regulation result, the CAISO may not face this load following requirement in each hour, but needs to be prepared to do so in some hours. The green bars in the figure represent the hourly load following requirement calculated just for load forecast error and variability. The red bars represent the hourly load following requirement net of VER production; that is, with the additional variability created by VERs. Hence, the red bars are the system VER following requirements.

Whether the load following requirements shown in Figure 6 require additional procurement of existing reserves or of a new type of reserve product is a function of whether the system can provide this new requirement through economic dispatch alone. That is, if the system can follow load without any additional procurement of reserves or developing new ancillary services products. The CAISO has evaluated this question through production simulations. To date, the production simulations have not yet demonstrated that the dispatch market itself will be unable to provide that load/VER-following capability under a 20% RPS.[40]

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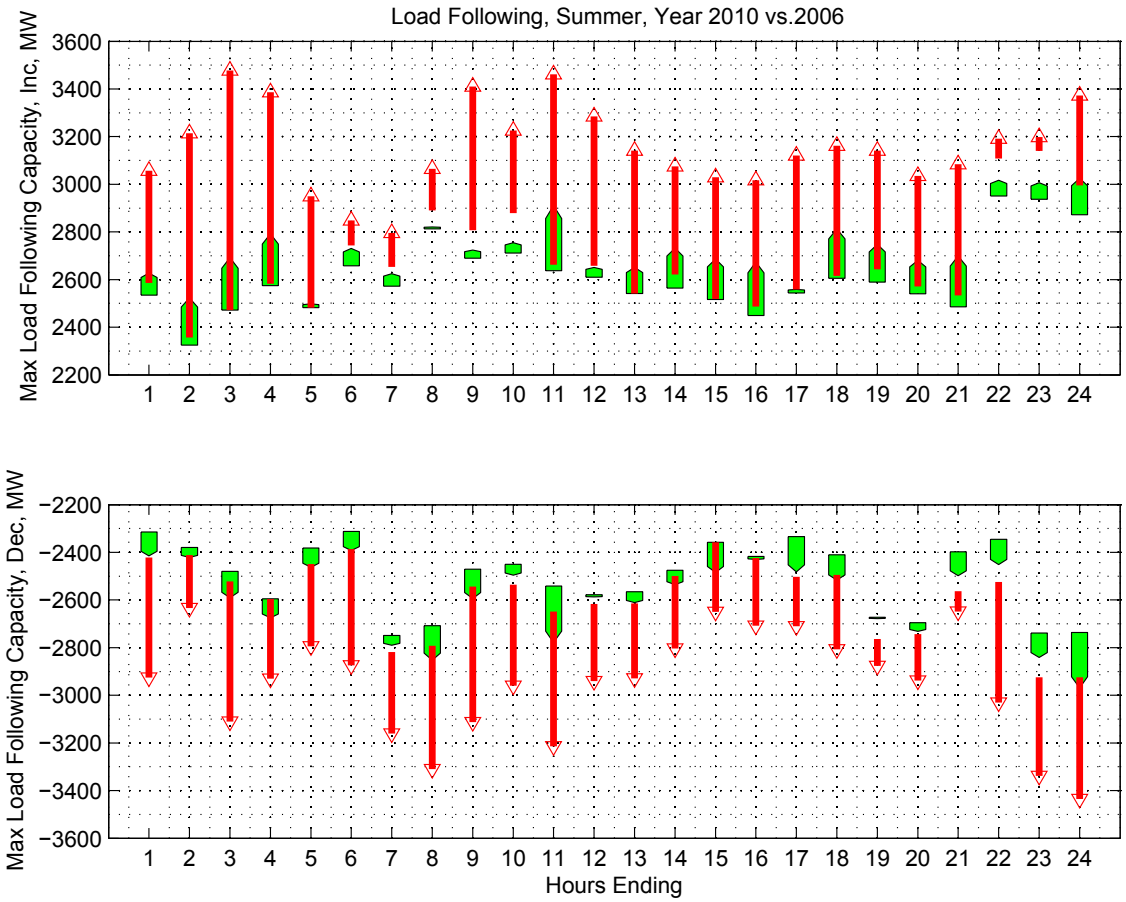
[39] The results are for the 95th percentile load following result for each hour of the season: the CAISO's Monte Carlo simulation assesses a large number of draws for each hour in the summer months and this result is the highest load following result after eliminating the 5 percent highest results.

[40] The work plan and initial results are found here: http://www.caiso.com/2449/2449ea32303a0.pdf. The CAISO intends to finalize results in 2010.

Figure 6: Example of CAISO Simulation of Load Following Requirements Under a 20% RPS



Source: California Independent System Operator Corporation, Integration of Renewable Resources, available at http://www.caiso.com/1c51/1c51c7946a480.html.

The CAISO 33% RPS operational studies that are currently in process have identified an even greater load-following need, and the production simulations, which are being conducted on an hourly time-step, had to assume a load-following reserve quantity to reflect intra-hour potential VER ramps. The provisional interpretation of the simulation results is that a load/VER-following reserve will be needed somewhere between a 20% RPS (expected in 2012) and a 33% RPS (expected in 2020); more refined simulations may change that result.

Moreover, while they can be very detailed, production simulations do not replicate all the physical constraints and market decisions (such as self-scheduling) that can further ramp-constrain the dispatch. Hence, the CAISO foresees that simulations will assist in preparing the market and system operators for future requirements while actual system conditions are monitored carefully to determine whether sufficient load/VER following capability is being made available to the market.

Whether or not it needs to procure an additional supplemental reserve product for least cost VER integration, CAISO is under a FERC mandate to evaluate such an operating reserve product to reduce reliance on exceptional dispatch.[41] Stakeholders have expressed support for a 30-minute ancillary services product in written comments to the CAISO for reasons such as increased participation by demand response resources in ancillary services markets, ability for the CAISO to better manage the grid with expected increase in VERs under increasing RPS targets, and enhanced ability of market participants to provide ancillary services services to the CAISO that meet their operational capabilities.[42]

Procuring reserves for extreme VER ramp events

As noted above, CAISO is still evaluating the need for, and timing of, an additional operating reserve product that could potentially serve as a load/VER-following reserve in addition to recovering from contingencies in 20-30 minutes.

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41 *California Indep.System Operator Corp.*, 126 FERC ¶ 61,150 at P 44 (2009).

42 This section draws on the CAISO Issues Paper on 30 Minute Ancillary Services, along with stakeholder comments, available at http://www.caiso.com/2078/2078be2d3790.html

Other mechanisms and resources to provide additional reserve capability

The Commission is interested in the expansion of reserve-sharing programs to expand the set of resources and lower the costs of reserves. Reserve sharing programs can be implemented by two or more balancing authorities that have Area Control Error (ACE) diversity. Reserve sharing allows the netting of the ACE differences among balancing authorities.[43] The benefit of reserve sharing is that it allows for a more relaxed control of generation and, therefore, reduces control burden on individual balancing authorities. The CAISO does not currently have a reserve sharing arrangement. However, the CAISO does procure reserves from entities in neighboring balancing authority areas. Also, the CAISO and Bonneville Power Administration have a research agenda to address VER integration.

The Commission is further interested in new sources and/or providers for reserve products -- such as inter-balancing authority pooling arrangements, demand response aggregators and/or storage devices -- that can be used to maintain reliability and lower reserve costs during VER ramping events. The Commission asks whether there are characteristics of these new sources of reserves that would positively or negatively impact their ability to match the reserve product needs presented by the variability of VERs.

[43] For example, assuming that Balancing Authority "A" has a positive ACE of +20 MW and Balancing Authority "B" has a negative ACE of -20 MW. Since these two Balancing Authorities have no ACE diversity (the two ACEs sum to zero), then no reserve sharing takes place. If there is diversity, then reserve sharing adjustments are calculated and communicated to each Balancing Authority who can then control its adjusted ACE.

The CAISO anticipates that at higher levels of VER penetration and with concurrent technological changes and the possible inclusion of a carbon price, market prices will encourage greater participation by non-generation resources.

Earlier in 2010, the CAISO completed an effort to develop a proposal to facilitate the provision of ancillary services by non-generator resources in CAISO's markets. In March 2010, the CAISO Board of Governors approved the proposed modifications which would apply to both generation and non-generation resources to participate in the CAISO's ancillary services markets. Based on its review and discussions with stakeholders, the CAISO intends to propose the following modifications to existing operating characteristics and technical requirements:

- Reduce the current ancillary services continuous energy requirement from two hours to the following:
    - Day-ahead regulation (up & down) is 60 minutes;
    - Real-time regulation (up & down) is 30 minutes;
    - Spinning reserve is 30 minutes;
    - Non-spinning reserve is 30 minutes.
- Clarify that the measurement of the continuous energy requirement will start from the point a resource reaches their award capacity rather than the existing measurement starting after the 10 minute ramp requirement.
- Reduce the minimum rated capacity requirement to 500KW from the existing 1MW requirement.

The CAISO hopes modifications to these requirements will increase the ability of resources and technologies to participate in the CAISO's anciallry services market to support the integration of VERs and deploy technological innovations surrounding smart grid.

VERs as providers of ancillary services and frequency response

VERs should be encouraged to supply the ancillary services for which they would be eligible. Currently, participation in the Participating Intermittent Resources Program (PIRP) specifically excludes wind generators from taking part in the ancillary services market.

F. Resource Adequacy Capacity (Capacity Markets)

In 2004, the State of California established a resource adequacy program to ensure that load-serving entities procure sufficient generation capacity to meet monthly peak loads plus a planning reserve margin. Most resources within the CAISO footprint that have a resource adequacy contract are obligated to make themselves available to the CAISO, whether through a self-schedule or an economic bid into the CAISO energy and ancillary services markets. The CAISO plays a role in the resource adequacy program by establishing local capacity requirements for local capacity areas, primarily urban areas, which have a limit on the amount of power that can be imported during peak hours. In essence, the local capacity requirements establish a minimum amount of capacity that must be available within each local area to reliably operate the grid.

The CAISO also has the authority to "backstop" the resource adequacy program by procuring capacity in the event that load-serving entities fail to meet their resource

adequacy procurement requirements and also when conditions on the grid change due to a "significant event" – *e.g.*, a significant transmission or generation outage – such that the CAISO needs to procure additional capacity in particular locations to ensure reliability.

Resources that qualify to provide resource adequacy capacity sell their capacity to load-serving entities through bilateral contracts, as there is no centralized capacity market either in California or elsewhere in the west. In response to broad demand among market participants the CAISO recently implemented "standard capacity product" provisions which standardize the tracking of forced outages and derates to resource adequacy resources and create financial incentives for resources to minimize such outages and derates. Market participants argued that standardizing such provisions within the CAISO tariff would facilitate the bilateral procurement and trading of resource adequacy capacity. The CAISO's initial filing of the standard capacity product deferred application of the provisions to VERs and other types of resources whose qualifying capacity for resource adequacy purposes is based on each resource's historical energy output during high load hours. The basis of this temporary deferral, which the Commission approved, was the fact that these resources already have a financial impact of forced outages and derates through the calculation of their qualifying capacity. Therefore, application of the standard capacity product provisions to them would require coordination with the CPUC, the agency that determines qualifying capacity for resources that provide resource adequacy capacity to its jurisdictional load serving entities, as well as potentially a different methodological approach that realistically reflects the impact of forced outages and derates on their ability to provide

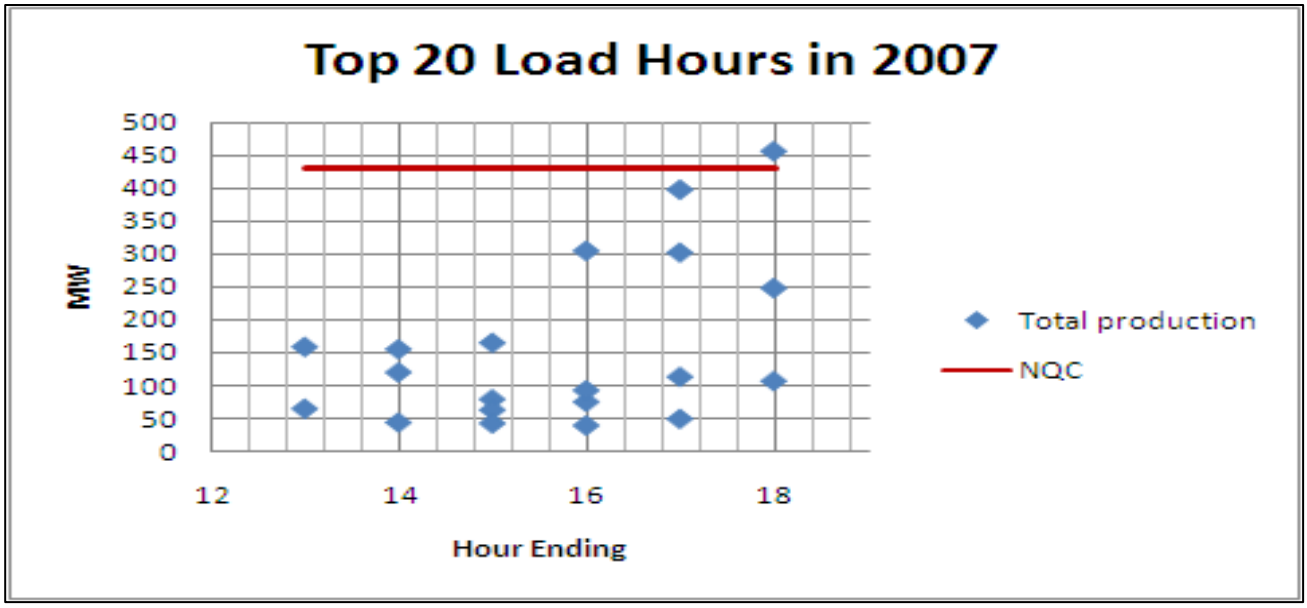
their committed resource adequacy capacity. The CAISO is currently engaged in a stakeholder process to address these issues.

The CPUC jurisdictional elements of the California resource adequacy program continue to be in a period of design transition. As of the date of these comments, the CPUC appears to be poised to adopt a decision that retains its current annual, one-year ahead resource adequacy framework rather than adopting the recommendations of the CAISO and most other stakeholders to transition to a multi-year forward procurement requirement facilitated by a centralized capacity market. The CAISO will shortly be initiating a stakeholder process withing this context to design a replacement for its existing backstop procurement mechanism, which was adopted as an interim approach and expires on March 31, 2011.

The Commission asks whether capacity rating rules as applied to VERs are unduly discriminatory and whether standard rules may be appropriate. The CAISO believes that a significant challenge under higher VER penetration – and a challenge on which California has made substantial progress as explained below – is to establish the capacity value of variable generation in a manner that preserves the fundamental objectives of the resource adequacy program and system reliability, namely, to ensure that sufficient capacity is available to meet load-serving and reserve requirements during peak load conditions. The particular concern is that the summer high load hours which are used as the basis for determining capacity requirements are also the hours when wind is typically operating at low output due to lack of fuel, *i.e.*, the wind. Thus, as explained below, the qualifying capacity rating of a wind resource is typically – and appropriately – just a fraction of its nameplate capacity.

The CAISO has provided input to the CPUC in its efforts to develop effective approaches for determining capacity values for resource adequacy for wind and solar resources. As a result the CPUC, with IOU and CAISO support, recently tightened its rules for determining the qualifying capacity values for VER. In the past, the CPUC had used three-year average output over six high-load hours to determine the qualifying capacity values for VERs, an approach similar to that being used by the eastern ISOs and RTOs. In California, however, as shown in Figure 7, that approach proved to overestimate actual VER production in 2007.

Figure 7: VER Peak Load Production in CAISO, 2007

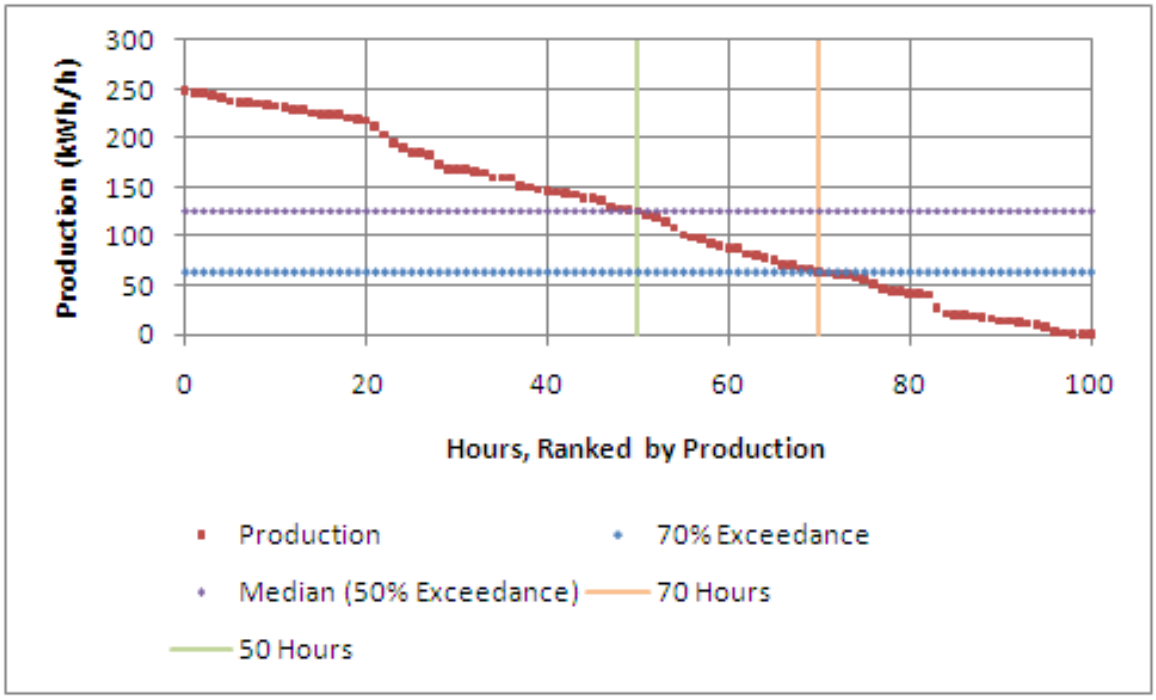


The CPUC recently moved to a new methodology for calculating the qualifying capacity values for wind and solar resources which became effective for the resource adequacy compliance year starting January 1, 2010. The new methodology uses an exceedance calculation to determine the qualifying capacity of wind and solar

resources.[44] The exceedance approach uses historical data to assess the MWh level of energy production that is met or exceeded by a resource in a specified percentage of the historical hours included in the assessment. This MWh level of energy production is then used as the qualifying capacity MW value, *i.e.*, the maximum amount of resource adequacy capacity the resource can offer. For example, the mathematical concept of "median" is a special case of the exceedance concept, with the exceedance level set to 50%. The exceedance level used to calculate the qualifying capacity of wind and solar resources under the CPUC's new methodology is 70%. In other words, the QC value (in MW) for such a resource is the amount of energy (in MWh) the resource produced or exceeded in 70% of the historical hours used in the calculation. The exceedance concept is depicted in Figure 8 for a hypothetical assessment period consisting of 100 historical hours and a hypothetical resource whose maximum energy production is at least 250 MWh (*i.e.*, the highest output observed during the assessment hours). Although the median is not used in the wind and solar qualifying capacity calculation, it is included in Figure 8 to provide context to the 70% exceedance. The 70% exceedance value is shown as a blue horizontal line (indicating roughly 125 MWh production level and hence 125 MW qualifying capacity value for this hypothetical resource) and the median is a purple horizontal line (indicating roughly 55 MW qualifying capacity value).

[44] Adopted in CPUC D.09-06-028, Appendix C.

Figure 8: Conceptual Illustration of the Exceedance Concept[45]



The five high system load hours included in the qualifying capacity assessment for the wind and solar qualifying capacity calculations are shown in Table 2. The included hours vary seasonally and are based on the time of system peak demand. The system coincident peak demand each day has been found to fall within the range of the five hours shown in Table 2.

Table 2: Included Hours for Qualifying Capacity Calculations

Jan–Mar, Nov and Dec:	HE17 - HE21[46] (4:00 p.m. - 9:00 p.m.)
Apr–Oct:	HE14 - HE18 (1:00 p.m. - 6:00 p.m.)

[45] The production profile in the exhibit is generated randomly and is not intended to represent any particular resource or classification of resources.

[46] HE indicates "hour ending", or the 60 minutes that end at the numbered hour, in 24 hour time. For example, HE17 indicates the 60 minutes beginning at 16:00 (i.e. 4:00 p.m.) and ending at 16:59.

Thirty-six months of production data (the three most recent years of complete settlement quality meter data from the CAISO) are used for the qualifying capacity calculation. The three years of data are then averaged within each month to result in 12 final monthly values, so that each resource has a distinct qualifying capacity value for each month of the year.

It is important to note that the methodology also considers the "diversity benefit" of wind and solar resources across the state, which provides an adder to the base calculation of qualifying capacity to recognize both geographic diversity and the fact that the output from wind and solar resources may complement each other. That is, although the wind may not be blowing in one geographic area of the state the wind may be blowing in another geographic area of the state, and while the output from wind generators may be declining during the middle of a hot summer day due to a decrease in wind speed the output of solar resources may be increasing during that period.

In the course of the CPUC proceeding where the new methodology was developed and adopted, representatives of the wind industry argued strenuously against using the exceedance calculation and applying it only to the wind energy production in certain high load hours. Instead, the wind industry advocated for the approach that qualifying capacity for VER be based on the concept of *expected load carrying capability*, which calculates qualifying capacity from a resource's energy output in all hours of all days. Wind industry representatives raised numerous arguments in support of their position, to which the CAISO and other parties provided effective rebuttal. The following were the key conclusions of that debate and fully supported the CPUC's adoption of the exceedance approach.

(1) The *expected load carrying capability* approach, based as it is on energy production in all hours, is not consistent with the fundamental purpose of resource adequacy, which is to ensure adequate supply resources to meet peak load conditions. The exceedance approach, in contrast, is designed specifically to address the resource adequacy objective.

(2) The *expected load carrying capability* approach is not an industry best practice, and is not even as widely used as its advocates in this proceeding claimed. In fact there is no single best practice in use. Rather, grid operators use methodologies that work best given the particular conditions they face (*e.g.*, the level of installed wind capacity, the correlation between wind production and load on their systems, and the level of wind variability and unpredictability on their systems), and the particular purpose of their analysis (*e.g.,* resource adequacy program requirements, planning, reporting, operations).

(3) The exceedance approach is consistent with capacity counting approaches used in other jurisdictions. ERCOT, for example, uses an 80 % exceedance formula to estimate next-day wind production for determining its day-ahead procurement target in its equivalent procedure to the CAISO's residual unit commitment procedure.

(4) The exceedance approach is particularly well suited to the conditions that exist in California. In particular, wind production in California is not positively correlated to load, is extremely variable, and is difficult to predict in advance of the hour-ahead timeframe. These conditions would lead to erroneous conclusions if an *expected load carrying capability* approach were used to determine the qualifying capacity value, as *expected load carrying capability* that relies on average energy production over both on-

peak and off-peak hours. Indeed, as noted above, the prior averaging methodology did lead to substantial over-estimation of wind peak-hour output during 2007.

The Commission asks whether obligations for capacity resources to offer into the day-ahead market unfairly discriminate against VERs. Currently, VERs are exempt from obligations to offer in the CAISO day-ahead market even if they are capacity resources. The CAISO believes that VER should be allowed but not required to submit day-ahead market bids (economic bids or self-schedules), even if they provide resource adequacy capacity. Although this policy would exempt VER from the day-ahead offer obligation that applies to other resource adequacy resources, the CAISO believes it is appropriate because a day-ahead offer obligation for VER would create additional costs to the market without offering comparable benefits. It would create a direct cost to the VER because, due to the limited accuracy of day-ahead forecasts of their output, a day-ahead schedule would become an exposure to real-time imbalance charges that is difficult to manage or hedge. This could easily become a cost to the market in general if VER exposure to real-time imbalances is viewed as excessive and gives rise to pleas for special settlement provisions to protect the VER by socializing some of the cost of imbalances among other market participants.

At the same time, a day-ahead offer obligation for VER would provide little or no benefit to the market, again due to the limited predictive value of a day-ahead VER schedule. Regardless of whether VER participate in the day-ahead market, the CAISO needs to develop its own best estimate of next-day VER energy in each hour for determining its procurement target for the residual unit committment procedure. For dispatchable resources scheduled in the day-ahead market, the CAISO can use their

day-ahead schedules as a reliable basis against which to determine how much residual unit committment capacity to procure. The CAISO cannot use day-ahead VER schedules for this purpose, however, but would instead defer to the best available forecast of next-day VER output for input to the residual unit committment procurement target.

Thus the question of day-ahead market participation for VER comes down to having sufficiently accurate day-ahead forecasting tools to enable VER to effectively manage their exposure to real-time imbalance charges. The CAISO believes that there already exist strong incentives in the marketplace to develop such tools and that a day-ahead offer obligation for VER would not accelerate that process. As noted above ISOs and RTOs have strong incentives to develop such tools for setting their day-ahead residual unit committment procurement targets. In addition, convergence bidders will have incentives to develop better day-ahead forecasts of VER energy in order to profit from any predictable day-ahead-to-real-time price differentials that may occur due to VER energy appearing in real-time. Thus allowing VER the flexibility to decide whether or not to bid into the day-ahead market, and refraining from offering them risk-mitigating subsidies to encourage day-ahead market participation, would provide incentives and opportunities for a broad array of market participants to invest in improved VER forecasting capabilities.

The Commission asks whether VERs as capacity resources will affect the compensation to other capacity resources and whether market reforms are needed. In general, it is expected that with higher presence of VER in the supply fleet, and given the incentives of the RPS, production tax credits and the economic value of renewable

energy credits, VER will have strong motivation to produce as much as possible at lower marginal cost than other resources. This in turn can be expected to generally drive down spot market energy prices and revenues, which would then require resource adequacy resources to recover a larger share of their costs through capacity payments. In the case of California the resource adequacy program is based on bilateral contracting between suppliers and load-serving entities and the contract capacity prices are not known to the CAISO. Therefore the CAISO cannot evaluate whether payments under the resource adequacy program will be sufficient to retain needed capacity for peak hours and integration needs, or will need to rise, and if the latter, by how much. In any event, the CAISO completely agrees with the Commission that forward ancillary services capacity markets could be a useful adjunct to resource adequacy requirements. The CAISO has previously raised, in the context of the CPUC's Long Term Resource Adequacy proceeding, the question of whether it is most effective to acquire specific needed resource performance capabilities through the resource adequacy capacity product or through spot or forward ancillary services markets. This question is especially important with regard to incentives for new investment in the resource types that can support VER integration. The CAISO has already planned to initiate a stakeholder process later this year to examine these questions in the context of a more comprehensive inquiry into the possible need to revise or expand its ancillary service product definitions and market structure in view of the changing composition of the supply fleet.

The Commission asks whether capacity markets should incorporate a goal of ensuring sufficient generation flexibility to accommodate ramping events in addition to

the goal of ensuring sufficient generation to meet peak demand. The CAISO agrees that having sufficient available ramping capacity is of critical importance for maintaining reliable operation with larger amounts of VER on the system, and that to address it properly we must consider both the operational time frame – creating incentives for resources to provide and mechanisms for the CAISO to procure ramping capacity in the spot markets – as well as the investment time frame – providing incentives and revenue streams that will stimulate investment in and ensure the viability of such resources. The CAISO is approaching this matter by considering several approaches, including the comprehensive review of ancillary service markets described above, as well as possible modifications to forward capacity procurement, and other market and regulatory approaches that could achieve the same objective (see further discussion below).

G. Real-time Adjustments

The Commission asks whether VERs may be curtailed too frequently in response to transmission congestion, minimum generation events, and ramping events, because of a lack of clarity in curtailment protocols. The Commission seeks to explore whether redispatch and curtailment practices and protocols, especially as they relate to VERs, are transparent, non-discriminatory and efficient.

The CAISO has not yet changed its current redispatch and curtailment practices for VERs pending both experience with the new market design and a stakeholder process to address any such needed changes, especially to the PIRP. With increased interconnection of VERs, CAISO has experienced more instances where redispatch of VER is necessary due to congestion. There also seems be an increase in real-time market price volatility that in some cases has been correlated to VER changes.

The CAISO does not believe that current practices discriminate against VERs, which are essentially, treated the same as conventional resources. However, VER generally have self-schedules and are not re-dispatched based on economic bid prices. Rather, self-schedules are only affected if all effective economic bids have been exhausted and the CAISO finds it necessary to still adjust effective resources regardless of whether they are conventional or VER.

The Commission asks whether all ISOs/RTOs should adopt redispatch of VERs on the basis of economic bids. The CAISO has reviewed the other ISOs/RTOs rules for economic dispatch of VERs. The CAISO will launch an initiative to develop additional bid-based dispatch of VERs in 2010. This will require reconsideration of the PIRP rules, which currently actually inhibit PIRP VERs from offering bids into the market (submitting an offer to redispatch makes a VER ineligible for the PIRP settlement rules for the intervals in which its offer is accepted). In addition, there are other market rules that will also need be evaluated during this process. With respect to conventional generation, the CAISO provides physical curtailment instructions or calculates negative prices to incent decrementing to minimum operating levels or decommitting. Currently, the decremental bid floor is at -$30/MWh. However, the current bid floor is not necessarily sufficient to incent VERs to decrement output economically, because the production tax credit is currently greater than -$30/MWh.

As noted in the 2007 CAISO IRR Report, over-generation occurs whenever there is still more generation than load and the operators cannot move generators to lower the level of production.[47] During such conditions, controllable generation and imports

[47] CAISO IRR Report at pp. 82.

are at their minimum levels or are shut down, exports are maximized and the total net generation production still exceeds the system load. The real-time energy prices typically go negative and the CAISO, at times, literally pays adjacent balancing authorities to take the excess energy.

In California, this condition is most likely to occur if the following circumstances are present:

- Light spring load conditions with loads around 22,000 MW or less;
- All the nuclear plants on-line and at maximum production;
- Hydro generation high production levels due to rapid snow melt in the mountains;
- Long start thermal units on-line and operating at their minimum levels because they are required for future operating hours;
- Other generation in a regulatory “must take” status or required for local reliability reasons; and
- Wind generation at high production levels.

As noted in its recent straw proposal on interconnection standards review, VER plants must be able to limit and control their ramp rates. When not controlled through dispatch, VER plants can have very steep ramp rates as compared to more gradual ramp rates for conventional fuel source resources. Per the NERC Integration of Variable Generation Task Force report, some VER generators can change output by +/- 70% in a time frame of two to ten minutes, many times per day.

It is currently envisioned, subject to further stakeholder consultations, that ramp-rate limits will be imposed when, consistent with the generator's economic bidding strategy or for specified operating conditions, accommodating the natural ramp rate of variable energy generators could threaten grid reliability. The CAISO does not envision that this functionality will be continuously used. It will be used only when needed to reliably accommodate the upward and downward ramps for variable energy resources. The interconnection customer should design the system such that the ramp rate control feature can be enabled, when needed, either by the plant operator or in response to an external command from the CAISO. This ability to enable or disable ramp rate limits is valuable to the grid. At the present time, the CAISO anticipates limiting ramps when a curtailment instruction is engaged or released. In addition, the ability to limit the rate of power change may be necessary during periods of insufficient aggregate ramping capability on the system, primarily during a significant upward ramp of wind or solar resources.

As a general matter, the CAISO does not foresee limiting downward ramps that occur because of the absence of fuel for a variable wind or solar generator. The CAISO recognizes that absent wind speed in excess of turbine cutout levels, downward wind ramps in the aggregate tend to be over a reasonably substantial period of time. Solar downward ramps due to the sun setting are likely to be more severe absent storage. But these types of solar down ramps can be addressed through active power control limits coupled with dispatch instructions to curtail prior to sunset. Any implementation of such a scheme must be supported by further analysis of system impacts and costs as well as consideration of appropriate market mechanisms and triggers.

The CAISO is not requiring any set limits for ramp up and down at this time. The CAISO notes that the Alberta ISO has adopted a 10% MW rated capacity/minute upward ramp rate limit. A report prepared for ISO New England identified a rate of 5% MW rated capacity/minute as the slowest such adopted rate. If during the stakeholder process, it is determined that specification of a ramp rate is necessary to define the equipment specifications.

H. Other California Regulatory Programs that Will Affect VER Integration

Renewable development and integration in California will also be heavily influenced by the actions and requirements of State agencies. In some cases, policies by those agencies and the California legislature (*e.g.*, 33% RPS eligibility and compliance rules; instituting a more expansive *feed-in tariff* for distributed or even larger renewable resources) will overlap with, and possibly reduce, the value of CAISO market prices to signal needed integration capabilities and VER responsiveness.

Among state agency programs, both the CPUC's Long-Term Procurement Planning for the jurisdictional investor-owned utilities could include explicit requirements for generator operating characteristics to support renewable integration; as could the CEC's generator permitting requirements. As discussed above, there is also an open question about whether the CPUC's resource adequacy program would include generator characteristics.

However, these State programs will not alter CAISO's efforts to improve renewable integration capabilities through market design and operational changes, as well as to provide incentives for development of more efficient renewable resource portfolios.

Once Through Cooling

Approximately 38% of California's in-state generation capacity (gas and nuclear power) uses coastal or esturine water for "once through" cooling. Under a draft policy recently issued by the California State Water Resources Control Board concenring the use of coastal or estuarine waters for power plant cooling, these units face requirement to reduce their impact on marine organisms. Depending on the provisions of the adopted policy, some plants may have to retire or repower in order to meet these new requirements.[48] The CAISO is currently working with representatives of the CPUC and CEC to develop a viable sequence for addressing once-through cooling requirements for particular units and local capacity areas. The CAISO anticipates that future transmission planning efforts will reflect the adoption of a water board policy and has commenced this analysis as part of the CAISO's 2011 transmission study plan. The CAISO also anticipates that the CPUC, as part of its Long-Term Procurement Plan proceeding will include measures to address any adopted water board policy to eliminate the impacts of once through cooling technology.

There are several linkages between the water board's once through cooling draft policy and renewable integration. First, and most importantly, some units using once through cooling provide essential local capacity. Second, units using once through cooling also provide ancillary services needed for renewable integration. Thus, complying with once-through cooling regulations is yet another factor to consider in preparing the power system for higher levels of renewable resources.

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[48] See http://www.swrcb.ca.gov/water_issues/programs/npdes/docs/cwa316/draft_otcpolicy.pdf.

V. Conclusion

The CAISO appreciates this opportunity to comment on the important questions posed by the Commission in this NOI.

Respectfully submitted,

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Dated: April 12, 2010

CERTIFICATE OF SERVICE

I hereby certify that I have served the foregoing document upon all of the parties listed on the official service lists for the above-referenced proceedings, in accordance with the requirements of Rule 2010 of the Commission's Rules of Practice and Procedure (18 C.F.R. § 385.2010).

Dated at Folsom, CA this 12th day of April, 2010.

/s/ Jane Ostapovich
Jane Ostapovich

CERTIFICATE OF SERVICE

I hereby certify that on April 30, 2010. I served, on the Service List for Proceedings A09-10-022, A09-10-034 by electronic mail, a copy of the foregoing

NOTICE OF EX PARTE COMMUNICATION. Notice of Ex Parte Communication was filed with the California Public Utilities Commission on April 30, 2010.

Executed on April 30, 2010 at Folsom, California.

/s/Jane Ostapovich//

Jane Ostapovich

An employee of the California Independent System Operator Corporation