

**FERC Technical Conference
Integrating Renewable Resources into the Wholesale Electric Grid
(AD09-4-000)**

**Examination of operational or dispatch provisions of wholesale tariffs and
market rules**

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**Remarks of Udi Helman
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Good afternoon Chairman Wellinghoff, Commissioners, and Commission staff. The California ISO (CAISO) appreciates the Commission's leadership in organizing this technical conference on renewable resource integration. Addressing renewable integration issues is vital to assist the transformation of the power sector, as it seeks to meet national and state environmental goals, promote technological innovation, and foster economic recovery and competitiveness.

The CAISO further appreciates the Commission's prior support of our efforts to accelerate renewable resource development, such as the location constrained resources initiative to support transmission expansion¹ and revisions to our generation interconnection rules, which have already improved the queue.²

Planning and Operational Assessments clarify Market and Tariff Needs

As the Commission considers what further tariff and market design changes may be necessary to support higher levels of renewable integration, the starting point is each ISO and RTO's (or region's) grid planning and operational assessments that define the system requirements associated with different renewable resource mixes.

In California, a round of integration studies conducted by the CAISO and other entities that focused on the State's current 20% RPS target by 2010, which is due to be achieved in 2012-13, is largely complete. The CAISO's assessment³ identified the need for additional load-following capability, especially in the morning and evening ramps when wind production tends to be inversely correlated with load ramps (see figure below). Also, Regulation capacity requirements are estimated to almost double in the upward direction and more than double in the

¹ 121 FERC 61,286 (Dec. 21, 2007).

² 124 FERC 61,292 (Sept. 26, 2008).

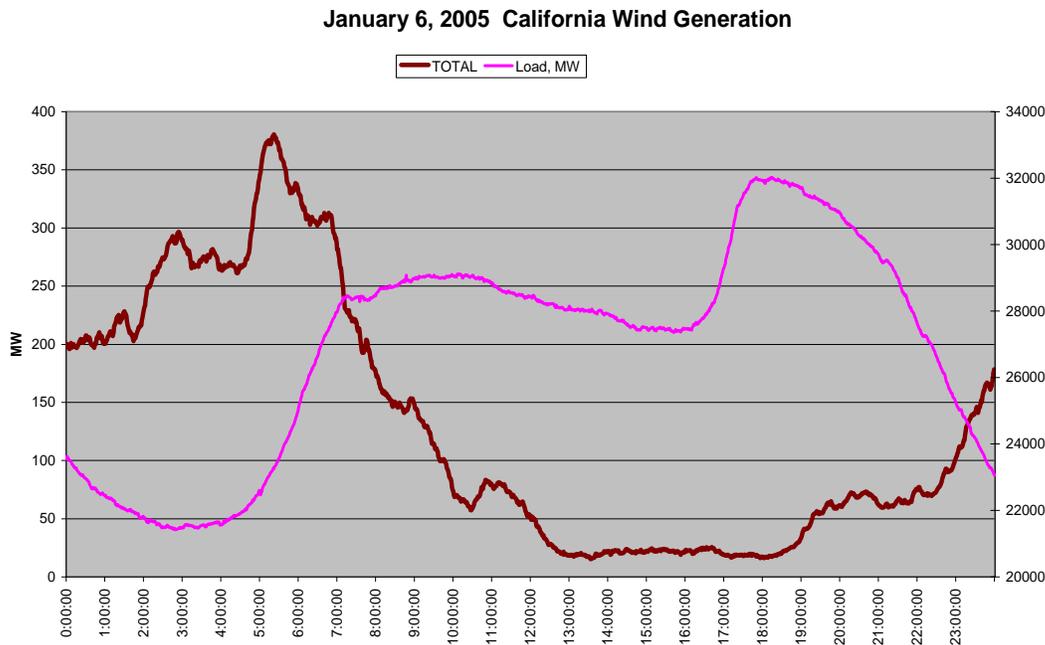
³ California ISO (CAISO), "Integration of Renewable Resources: transmission and operating issues and recommendations for integrating renewable resources on the California ISO-controlled grid," (November 2007). Available at www.caiso.com.

downward direction, depending on the season and time of day. Finally, the frequency and magnitude of overgeneration will increase, particularly during light load, high hydro periods. We are currently conducting unit commitment simulations to further verify the ability of the existing generation fleet to operate reliably under these various conditions. Our analyses haven't calculated integration costs, but have focused on operational needs.

The upshot of these analyses is that a 20% RPS, based largely on incremental wind additions in Tehachapi, appears to be feasible with the existing generation fleet, but does create operational challenges. The system will benefit from additional flexibility capabilities provided from generation and non-generation resources, such as demand response and storage. These would include

- fast ramping,
- quick start resources,
- increased operating ranges on generation,
- Regulation capability, and
- load shifting from peak to off-peak.

Facilitating the addition of resources that provide these capabilities is a current focus of the ISO.



Our planning and operational challenge now is moving beyond the 20% RPS to the 33% RPS by 2020 embodied in a recent Executive Order by Governor Schwarzenegger and reflected in other policy initiatives. Although alternative model resource portfolios for a 33% RPS are still being formulated, integration

requirements will change in a non-linear fashion from the 20% RPS. For example, while greater reliance on central station and distributed solar power may be useful in compensating for the typical wind drop-off in the daily afternoon peak hours (see Figure), the solar pick-up in the morning hours creates a potentially large quantity of surplus energy on the system. This highlights the need for standards and other mechanisms to encourage greater dispatchability from wind and solar resources as well as much greater storage and price-responsive demand response capacity.

Complicating the planning scenarios, there are several existing and pending regulations that will affect the capability of the existing generation fleet to provide integration services. These include the State's greenhouse gas targets, rules being developed for repowering or retirement of up to 22,000 MW of thermal plants that use once through cooling, many of which are in load pockets and which provide the ramp and Regulating capability, and limits on air emissions credits in Southern California. In any scenario, the California power system is on track to be changed dramatically by 2020.

CAISO Markets will Facilitate Renewable Integration

Turning to the role of wholesale markets in facilitating renewable integration, CAISO has laid out an agenda for the next couple of years that includes:

- Evaluating the effect of the MRTU market design and planned enhancements, such as scarcity pricing and virtual bidding, on renewable integration;
- Evaluating whether new market products and/or pricing rules are needed to stimulate needed capabilities;
- Pilot projects for non-generation resources to demonstrate operational capabilities and market value in ancillary services; and
- Coordination with other ISOs/RTOs to facilitate market design and development.

In general, we believe that the MRTU day-ahead to real-time sequence of markets and unit commitment procedures, along with improved spot market liquidity, provide the means to more efficiently utilize generation and non-generation resources needed for renewable integration.

CAISO, in cooperation with BPA, is also improving our hour-ahead and day-ahead wind and solar forecasting capability, and we are also close to testing a ramp forecasting tool, both of which can be introduced into various stages of the market and operational sequence to improve scheduling and reduce market unit commitment costs.

Under MRTU, locational marginal pricing (LMP) will provide price signals that will facilitate both demand response and investment in other needed capabilities, including storage. For example, in California, wind output tends to peak at night, reducing LMPs in those hours; moreover, during overgeneration periods, prices will likely be zero or negative, signaling the potential for load-shifting, storage or exports if possible. During a negative price, load or storage is effectively paid to consume, while supply pays to remain on. When coupled with carbon pricing, the peak to off-peak price spread may further increase. Hence, there are a number of storage projects of various sizes hoping to enter the California market for purposes of shifting energy from off-peak to peak as well as providing ancillary services, and we need other solutions as well.

CAISO currently has one specific pricing rule in place for wind resources, the Participating Intermittent Resource Program (PIRP), which was initiated in 2003 and allows any participating wind resource that provides specified meteorological and other forecast data to the ISO to be scheduled through a centralized hour-ahead wind forecast and in exchange pay a monthly averaged imbalance price for its net monthly imbalance MW. Participation in PIRP is now being extended to solar resources.

Turning to ancillary services, as mentioned, the ISO plans to procure additional Regulation capacity to support renewable integration, but now on a variable procurement basis by season and time of day. So we are interested in how to elicit such capability, including by non-generation resources. Under MRTU, Regulation Up prices will now be based on a co-optimization with Energy and the other market-based ancillary services, and will reflect the opportunity cost of not providing Energy, sending a price signal that is more attractive to, for example, storage devices. Other Regulation pricing features under consideration may also serve useful functions. For example, although not yet proposed to our Board, the CAISO has discussed with stakeholders a scarcity pricing design that would include a scarcity price for Regulation, similarly to ISO-New England. Hence, if the higher Regulation procurement targets driven by renewable integration were not being met, we would see a sharper price signal sent to the market to attract such capability.

Finally, as always, there will be opportunities to collaborate, share lessons and develop best practices in revising any tariff and market rules. To that end, the ISO/RTO Council is currently reviewing market design issues associated with wind integration among its members. This effort should be useful in discerning how differences in market designs affect integration capabilities.

That concludes my remarks. I look forward to answering any questions.