

Memorandum

To: ISO Board of Governors

From: Keith Casey, Vice President, Market & Infrastructure Development

Date: December 8, 2011

Re: **Decision on Renewable Integration – Market & Product Review Phase 1**

This memorandum requires Board action.

EXECUTIVE SUMMARY

This memo describes proposed changes to elements of the California Independent System Operator Corporation's current market design to facilitate the integration of renewable resources onto the grid. The proposed changes include:

- Reducing the energy bid floor from $-\$30/\text{MWh}$ to $-\$150/\text{MWh}$; and
- Changing the bid cost recovery netting methodology.

As part of the proposal for changing the bid cost recovery netting methodology, Management has been developing bid cost recovery measures with stakeholders to align incentives to follow ISO-issued dispatch instructions. Given the complexity of these new measures, additional development time is necessary to ensure that the new measures work as intended and to provide stakeholders with sufficient time to consider the impacts of these new measures. Thus, even though the complete suite of changes is not yet developed, Management believes it is beneficial to seek Board approval of the main elements of the proposal now to provide certainty on the policy for changing the bid cost recovery netting methodology and the reduction in the energy bid floor. This will allow the stakeholder process to focus on the additional bid cost recovery measures that are appropriate as a result of this new policy. Therefore, this proposal includes a commitment to the Board that, prior to filing the elements of this proposal with the Federal Energy Regulatory Commission, Management will first obtain Board approval for these additional bid cost recovery mitigation measures.

Management requests the ISO Board of Governor's approval to file tariff language to implement these changes and proposes the following motion:

Moved, that the ISO Board of Governors approves the proposed tariff change regarding the Renewable Integration – Market and Product Review Phase 1 as described in the memorandum dated December 8, 2011; and

Moved, that the ISO Board of Governors authorizes Management to make all necessary and appropriate filings with the Federal Energy Regulatory Commission to implement the proposed tariff change, following Board approval of the remaining bid cost recovery elements of the proposal.

DISCUSSION AND ANALYSIS

In July 2010 Management began the Renewable Integration Market and Product Review with the goal to “identify and develop potential changes to wholesale market design, including market products and procedures, needed to accommodate the expected substantial increase in production by variable energy resources over the next decade.”¹ This review evolved into two separate design efforts. Phase 1, which is the subject of this Board memo, identifies short term solutions for renewable integration, while the outcome of Phase 2 is the Renewable Integration – Market Vision and Roadmap, which was presented to the Board in October 2011 and provides a plan to address longer term solutions.

The scope of the Phase 1 market design effort was comprised of three elements:

- (1) re-evaluate the Participating Intermittent Resource Program (PIRP) for intermittent resources;
- (2) lower the energy bid floor to provide additional incentives for market participants, including intermittent to submit decremental bids; and
- (3) balance the effects of changing PIRP and the bid floor on generation suppliers by reconsidering the methodology that nets bid cost recovery over all settlement periods in a trade day.

The ISO conducted an extensive stakeholder process to develop each of these components and finalize Management’s proposal. Stakeholders provided invaluable feedback allowing Management to understand how these changes impact each segment of the ISO market and to craft a proposal that moves the ball forward in facilitating renewable integration.

Update the Participating Intermittent Resource Program

PIRP was designed and implemented well before there was a clear expectation of the enormous growth of variable renewable resources that is occurring under the state’s

¹ *Discussion Paper, Renewable Integration: Market and Product Review*, July 8, 2010, <http://www.caiso.com/Documents/DiscussionPaperonRenewableIntegrationMarketandProductReview08-Jul-2010.pdf>

Renewable Portfolio Standard requirements. The ISO's renewable integration studies have shown that the large influx of variable energy renewable resources will have significant market and operational impacts. This has resulted in the need to reassess the design of the PIRP in light of changes in state policy and advances in technology that provide new wind and solar resources with the ability to vary their output to help manage grid conditions.

In January 2002, the ISO filed the PIRP proposal with the Federal Energy Regulatory Commission to introduce provisions to facilitate the participation of eligible intermittent resources in the ISO market. At that time, before there was an RPS requirement, PIRP was designed to encourage investment in new wind and solar intermittent energy resources by mitigating the variability of the financial impact of imbalance energy costs that result when such resources inevitably go "off-schedule" (e.g., when wind patterns change). The RPS requirements are now the primary driver for renewable resource investment in California.

In addition, the original need for PIRP was based in part on technology that has now evolved to a point that draws into question the extent to which the original issues are still relevant. For example, when PIRP was implemented, the wind turbine technology generally used fixed blades that produced energy strictly based upon wind speed. The only ability to curtail wind generation in this scenario was to trip the unit thus reducing its output to zero. Today, wind turbine technology has evolved including blades that can be "feathered". In other words, their angle to the wind can be changed thus allowing the generator to continue to operate but at an output level below what could be produced with the blades in their optimal position. This now allows wind generators to respond to grid conditions through curtailing their output. This ability, in turn, helps to reduce the exposure to uplift faced by wind resources.

The same can be said for solar resources. Improvements in inverter technology allow these resources additional output flexibility not available in the past. Indeed, the ISO has been informed that many of the new purchase power agreements provide the purchaser with a limited number of hours in which the output of the resource can be curtailed. The combination of the technology, revised contractual arrangements, and the proposal contained herein, can provide for improvements in operational flexibility needed to reliably integrate large quantities of renewable resources.

To be eligible for PIRP settlement treatment, each hour a participating resource must schedule its output according to a forecast provided by the ISO. The resource's deviations from that forecast are netted across a calendar month and settled at a weighted average price, resulting in a payment, or charge, to the resource. A resource is not required to use the ISO forecast, however if it does not, it will not be considered for PIRP settlement treatment for that hour. The difference between this settlement and the settlement that would have occurred had their deviations been charged the 10 minute settlement price

results in an uplift cost.² Currently, PIRP uplift costs are allocated broadly to all market participants based on their deviations from scheduled levels. Under this approach, the majority of the PIRP uplift costs are spread to load. Historically, these costs have been relatively small. Between June 2010 and June 2011, PIRP uplift costs totaled approximately \$5.1 million.

Under Management's initial evaluation of how PIRP should be re-designed to accommodate the increasing need for dispatchability of these resources, several options for revising PIRP, including the eventual elimination of PIRP, were considered. Some stakeholders continue to have significant concerns over proposed modifications to PIRP. Management is therefore removing the proposed changes to PIRP from the renewable integration market and product review phase 1 proposal. In the second quarter of 2012, management will begin a new stakeholder process to consider revisions to PIRP. In particular, as outlined in the ISO's renewable integration market vision and roadmap, such revisions will be targeted at increasing the dispatchability of participating intermittent resources by enabling them to participate in PIRP and simultaneously submit decremental bids to indicate their willingness to curtail their output.

Lower the Energy Bid Floor

A supply resource uses its energy bids for two main purposes: first, to specify the minimum price at which it is willing to provide energy to the market; and second, to specify the maximum price it is willing to pay to "buy back" in real time energy it sold in the day-ahead market. Energy bids for the latter purpose are commonly called decremental bids because they are bids by a supplier to reduce or decrement its real-time output relative to its accepted energy schedule. The integration of large quantities of intermittent resources into the supply fleet creates an increased need for a liquid supply of such bids to manage real-time congestion and over-generation conditions.

There is currently a limited supply of decremental energy bids to enable the ISO market systems to economically reduce energy supply to balance demand when needed. This is especially critical during off-peak hours that are susceptible to much higher levels of over-generation as additional renewable energy production comes on-line. The shortage of decremental bids is due in part to an insufficiently low bid floor and also in part to contractual constraints on bidding for some plants. At the current -\$30/MWh level, the bid floor provides little incentive for renewable energy resources to provide decremental energy bids. These resources receive production tax credits and contractual energy payments significantly greater than \$30/MWh. Lowering the bid floor below the opportunity costs for providing energy will induce renewable and additional conventional resources to submit decremental energy bids that can be dispatched during low or negatively priced hours.

² The net impact can also be positive resulting in a net revenue.

In determining the level of the bid floor, Management reviewed the elements that comprised the potential revenues a wind resource could be getting outside of the ISO market. These include production tax credits that are valued at about \$37/MWh, the economic value of renewable energy credits which have a limit of \$50/MWh, and the Public Utilities Commission’s market price referent which is used to value the costs of RPS contracts and averages around \$100/MWh. Based on these values, Management believes that setting the bid floor at -\$150/MWh provides leeway for at least a portion of the wind community to participate in the market at any given time. Management believes that further lowering the bid floor to -\$300/MWh will likely provide additional benefits by incenting decremental bids from additional resources, including solar resource participation which has higher opportunity costs for providing energy and provide clear signals to incent investment in storage and demand response technologies that can respond quickly to over-generation conditions. Many stakeholders were uncomfortable automatically moving to levels lower than -\$150/MWh until the impact of the lower bid floor can be evaluated using actual market outcomes. Therefore, Management proposes to set the bid floor level at -\$150/MWh for one year and then evaluate the impact of this change. If there are no significant unanticipated negative effects, then Management will propose to lower the bid floor to -\$300/MWh.

As shown in Table 1, most other ISOs and RTOs in the United States have even lower bid floors than the level Management proposes for the ISO market. These low levels have not proven to be problematic in other markets.

Table 1 – Comparison of ISO/RTO energy bid floors

| ISO/RTO | Energy Bid Floor |
|---------|------------------|
| PJM | No Bid Floor |
| NYISO | -\$999.99/MWh |
| MISO | -\$500/MWh |
| ERCOT | -\$250/MWh |
| CAISO | -\$30/MWh |
| ISO-NE | \$0/MWh |

Changes to bid cost recovery

Bid cost recovery is the process by which the ISO ensures that scheduling coordinators are able to recover start up, minimum load and energy bid costs for supply resources. The bid cost recovery calculations compare bid costs and market revenues for each resource to ascertain whether or not there is a net revenue shortfall over the course of a day. If so, the resource receives an uplift payment for that shortfall. Currently, the ISO performs the calculation for bid cost recovery over the entire trade day and nets a resource’s costs and

revenues across the day-ahead, real-time, and residual unit commitment markets for that trade day.

Offsetting market outcomes can lower a resource's bid cost recovery, which may discourage economic bids in the real time market. Management's proposal to lower the bid floor has increased this concern for generation resources that may not be able to ramp down their output fast enough to avoid negative real-time prices. In this situation, such resources' day-ahead market revenues could be reduced. To mitigate this risk, Management proposes revising the rules for netting costs and revenues for performing its bid cost recovery calculation so that day-ahead costs and revenues are no longer netted against residual unit commitment and real-time costs and revenues. The recommended changes are designed to promote bidding, including decremental bids, in the real-time market. Specifically, separating the netting of the bid cost recovery calculations will make market participants' decisions about offering economic bids into the real-time market independent of the outcome of the day-ahead market. Without having to consider what real-time market conditions may do to offset day-ahead market outcomes, disincentives resources may have to submit economic bids into the real-time market are alleviated. In other words, by separating the bid cost recovery netting between day-ahead and real-time, a resource's day-ahead economic decisions do not hamper its real-time decision possibilities. Having a deep pool of economic bids in the real-time market will assist the ISO in managing the grid with increasing numbers of variable energy resources.

The separation of the netting of bid cost recovery calculations is consistent with practices at PJM Interconnection, the New York ISO, ISO-New England, the Midwest ISO, and the Electric Reliability Council of Texas.

Separating the calculation of bid cost recovery between the day-ahead and real-time markets will protect supply resources day-ahead market revenues from unexpectedly low real-time market prices. With these changes to the bid cost recovery rules, historical analyses show that total bid cost recovery uplift payments are expected to increase. Management believes that this increase is appropriate because it will provide cost recovery for shortfalls based on the independent optimization choices made by those markets. Providing that cost recovery is the mechanism by which proper incentives for resources to submit real-time economic bids will be created. A deeper pool of real-time energy bids provides the market optimization with the ability to reach a more efficient least-cost dispatch. Thus, any increase to overall bid cost recovery is likely to be offset by the countervailing decrease in the cost of dispatch.

To ensure that the separation of the bid cost recovery netting does not create logical inconsistencies or adverse incentives, Management proposes three changes to bid cost recovery rules:

- (1) Management recommends modifications to account for bid cost recovery by short start units dispatched in the real time market. For a short-start unit, the day-ahead optimization considers the resource's commitment costs when committed, and that commitment is financially (but not operationally) binding in the day-ahead market. The real-time market can again commit the short-start resource. These modifications will permit the ISO to separate the day-ahead and real time bid cost recovery calculations for short-start units that are committed in both the day ahead and real time markets when that commitment overlaps operating hours;
- (2) For multi stage generating resources with different day-ahead and real-time configurations, Management recommends that real-time minimum load costs be calculated as the incremental change in minimum load costs between day-ahead and real-time; and
- (3) Management recommends that negative minimum load costs be accounted for when a unit is completely de-committed to off-line in real time from its day-ahead schedule.

Even under the current design in which bid cost recovery calculations are netted across all markets, resources can garner greater bid cost recovery uplift payments by deviating from real-time ISO dispatch. Under the proposal to separate the netting of the day-ahead and real-time bid cost recovery calculations, this opportunity can be exacerbated. To mitigate this effect, Management recommends that the day-ahead metered energy adjustment factor be eliminated and replaced by bid cost recovery mitigation measures. Management has been developing bid cost recovery measures with stakeholders to align incentives to follow ISO-issued dispatch instructions. Given the complexity of these new measures, additional development time is necessary to ensure that the new measures work as intended and to provide stakeholders with additional time to consider the impacts of these new measures. Prior to filing the elements of this proposal with the Federal Energy Regulatory Commission, the ISO will bring the bid cost recovery mitigation measures to the Board for approval. We will then file both with FERC as a package.

POSITIONS OF THE PARTIES

Update the Participating Intermittent Resource Program

The load serving entities, the department of market monitoring and the Market Surveillance Committee believe that it is appropriate to suspend the program (with limited grandfathering provisions) after a reasonable amount of time.

Intermittent resource providers are generally supportive of the concept of maintaining the current program from a scheduling, bidding and pricing perspective, but disagree with changing from a pooled allocation to a resource specific allocation methodology.

Lowering the energy bid floor

Most stakeholders, including the department of market monitoring and the Market Surveillance Committee support lowering the bid floor from -\$30/MWh to -\$150/MWh and subsequently to -\$300/MWh if the analysis confirms this direction. A few stakeholders had other recommendations:

- Calpine recommended moving to -\$75/MWh initially, moving in a downward direction at a slower pace.
- Powerex advocated for a symmetrical bid cap and floor, setting the bid cap at -\$1000/MWh to avoid potential unintended consequences.
- SMUD does not believe the ISO should lower the bid floor until participating intermittent resources can submit economic curtailment bid curves.

Changes to bid cost recovery

Stakeholders expressed support for the separation of the netting of bid cost recovery calculations. For the most part, the changes recommended in support of the separation of netting were also supported.

Pacific Gas & Electric recommends an alternative minimum load cost accounting rule change for multi-stage generating resources with different ISO-committed configurations in the day-ahead and real-time markets. That proposal would result in all minimum load costs being reflected in the day-ahead bid cost recovery calculation which can create adverse market incentives, whereas Management's recommendation, while inclusive of a potential inefficiency, maintains the correct market incentives by preserving the alignment between the market of the minimum load energy and that of the minimum load costs.

Several stakeholders, including the department of market monitoring and the Market Surveillance Committee, recommended that the ISO and stakeholders further develop and the bid cost recovery measures designed to align incentives to follow ISO-issued dispatch instructions. In response to their concern that they have sufficient time and detail to understand and evaluate the impacts of these new measures, Management recommends that the measures be further vetted and refined through a stakeholder targeted for completion in March 2012.

The attached matrix of stakeholder comments provides further information.

MANAGEMENT RECOMMENDATION

Management recommends that the Board approve the policy to implement the elements of Renewable Integration Market and Product Review Phase 1 and modify tariff provisions as

outlined in this memorandum and conditionally authorize Management to make all necessary and appropriate filings with FERC to implement the proposed tariff change.