



Day-Ahead Market Enhancements Phase 2 Initiative

Submitted by	Organization	Date Submitted
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This template has been created for submission of stakeholder comments on the issue paper and straw proposal that was published on February 28, 2019. The paper/proposal, Stakeholder meeting presentation, and other information related to this initiative may be found on the initiative webpage at:

<http://www.caiso.com/informed/Pages/StakeholderProcesses/Day-AheadMarketEnhancements.aspx>

Upon completion of this template, please submit it to initiativecomments@caiso.com. Submissions are requested by close of business on April 4, 2019.

Please provide your organization’s comments on the following issues and questions.

PG&E appreciates that CAISO has separated the Day Ahead Market Enhancement (DAME) initiative into two phases. However, given the significant level of issues outlined by stakeholders in the comments associated with Phase 1, PG&E reiterates its previous recommendation that CAISO pause work on Phase 2 in order to focus on the Phase 1. PG&E cannot support continuing work on Phase 2 at this moment considering the level of work necessary in Phase 1. Consideration of the scope and objective of Phase 2 should be re-evaluated after the completion of Phase 1. PG&E provides the following comments to illustrate just a few of our concerns with the current Phase 2 proposal.

PG&E would also like to echo its proposal as outlined in our comments to the DAME Phase 1 Third Revised Straw Proposal. If the technical feasibility remains an issue for 15-minute granularity, considering a Day-Ahead Flexible Ramping Product that is procured for intra-hour ramping needs might be a more feasible solution and provide many of the benefits outlined in both Phases of DAME without the level of implementation and computational changes.

1. Proposed Day-Ahead Market Structure

Please provide your organization’s feedback on the proposed day-ahead market structure topic as described in section 3 of the proposal. Please explain your rationale and include examples if applicable.

The use of Flexible Ramping Product (FRP) to procure capacity needed to meet the CAISO Net Load Forecast previously procured by the Reliability Unit Commitment (RUC) Process has problems. Also, the method used to set the requirement for Day-Ahead Flexible Ramping Product and the proposed market approach to procure it have not been adequately developed.

The Proposed DA Market Structure is Flawed

The Phase 2 proposal mentions issues from the 2018 stakeholder discussion that resulted from combining IFM and RUC in a single optimization problem and using the resulting prices:

“The potential structural changes included combining the integrated forward market (IFM) and residual unit commitment process (RUC). However, the re-optimization resulted in unintended price formation concerns caused by the introduction of the CAISO net load forecast into the clearing of day-ahead energy schedules.”

It is unclear to PG&E the nature of the unintended price formation problem mentioned above. PG&E can think of two possibilities to which the CAISO may be referring:

1. The market mechanism could determine a price for energy at a location for a physical resource that differs from the price for energy for a virtual resource at the same location.
2. Requiring that the Day-Ahead Market procure sufficient capacity to be able to meet the CAISO reliability demand forecast can affect commitment in the Day-Ahead market which can affect energy dispatch and energy prices.

We will first discuss the potential for energy price for physical resources to differ from energy prices from virtual resources.

During the discussions in 2018, CAISO noted that combining IFM and RUC in a single SCUC optimization could produce one LMP for energy scheduled from a physical resource at a node and a different LMP for energy scheduled from a virtual resource at the same node. In reality, a physical resource can provide two products: energy to meet bid demand cleared in the IFM and capacity that could be deployed to meet the CAISO's forecast of demand in RUC. A virtual resource can only provide a single product: energy to meet bid demand cleared in the IFM; it cannot provide capacity that could be deployed to meet the CAISO's forecast of demand in RUC. As such, it is appropriate that a physical resource be paid for both products that it provides while a virtual resource would be paid for only the single product that it provides. This is the source of the perceived pricing problem that CAISO noted in 2018.

It is possible to reformulate the combined IFM/RUC so that it would produce the same market schedule as produced by the 2018 formulation while producing an energy LMP at each node that would be used to settle all energy schedules at a node, whether physical or virtual, and producing a Market Clearing Price (MCP) at each node that would be paid to the physical capacity procured by RUC at a node. All energy

procured at a node whether physical or virtual would be paid the same energy LMP while physical capacity procured by RUC would be paid the MCP.

The IFM/RUC formulation considered last year produces energy prices that on the surface appear to be different for physical and virtual resources at a location. However, energy procured on a physical resource also provides capacity that could be used in RUC to meet CAISO forecast demand. The formulation from 2018 combined the shadow prices of constraints that constrain the clearing of energy supplies to meet the cleared bid demand in IFM and the shadow prices of some constraints that constrain the clearing of capacity to meet the CAISO forecast of demand in RUC to produce a price that would be paid to energy scheduled on a physical resource. It is possible to decompose this into an energy LMP and a capacity MCP so that physical and virtual resources see the same energy LMP. This should address the concerns regarding different prices for physical and virtual resources at the same location that CAISO raised last year.

If this is the pricing problem mentioned above, PG&E recommends revisiting combining IFM and RUC into a single optimization problem when it starts working on Phase 2 after completing Phase 1 given the difficulties encountered to date in trying to replace RUC with other processes, such as FRU and FRD procurement.

We next discuss procuring sufficient capacity in the Day Ahead Market to meet the CAISO reliability demand forecast affecting commitment decisions in the Day-Ahead market thereby affecting energy dispatch and energy prices. CAISO may find it problematic to have the CAISO forecast of reliability demand potentially influence energy market outcomes.

If this is the nature of the pricing problem mentioned above, then eliminating the integration of RUC and IFM and instead requiring the Day Ahead Market to procure sufficient FRU and FRD to meet a CAISO determined Flexible Ramp requirement only changes the nature of the problem. It does not eliminate it.

The Phase 2 proposal would have CAISO set an FRU requirement based on a CAISO estimate of the 97.5 percentile confidence level of difference between IFM cleared physical supply and FMM demand forecast. It would also have CAISO set an FRD requirement based on a CAISO estimate of the 2.5 percentile confidence level of difference between IFM cleared physical supply and FMM demand forecast. The IFM would procure sufficient FRU and FRD to meet these requirements. This would likely affect commitment in the IFM thereby affecting energy dispatch and energy prices in the IFM. The problem of a CAISO forecast of requirements affecting commitment decisions, energy dispatch and energy prices has not been eliminated, only transformed.

If this is the pricing problem mentioned above, PG&E believes that fundamental questions regarding whether the DA Market should commit resources to enable it to procure FRU and FRD requirements estimated by CAISO should be addressed.

In either case, development of Phase 2 market formulations should be delayed until such questions are thoroughly investigated after completing Phase 1.

The FRP Up and Down Requirements Are Not Correctly Defined

The Phase 2 proposal considers whether FRP Up and Down requirements should be set based on the distribution of Forecasted Net Load Error or the distribution of Market Net Load Error. The Forecasted Net Load Error in a period is defined as:

FMM Net Load Forecast – CAISO RUC Net Load Forecast.

The Market Net Load Error in a period is poorly defined in the Phase 2 Issue Paper. PG&E referred to the Technical Appendix for clarification, and it appears to use:

FMM Net Load Forecast – IFM Cleared Physical Supply.

The IFM Cleared Physical Supply may not be equal to the IFM Cleared Net Load since the load cleared in the IFM may be served by virtual supply. Some of the IFM cleared virtual supply may have been bid by parties with VERs that they did not bid into the Day-Ahead Market as physical VERs but that the parties plan to replace by energy from their physical VERs in FMM. However, the proposal does not adequately explain how the CAISO would determine which virtual supply would be replaced by actual VER energy in FMM that were not scheduled in IFM. In the following, we assume that CAISO plans to use IFM Cleared Physical Supply.

CAISO indicates that either definition (FMM Net Load Forecast – CAISO RUC Net Load Forecast or FMM Net Load Forecast – IFM Cleared Physical Supply) would yield similar results for range of uncertainty used to set FRP requirements. CAISO plotted one year of hourly data for each and concluded that "...the range of forecast errors was similar between market cleared net load uncertainty and CAISO forecast net load uncertainty. Therefore, the amount of day-ahead flexible ramping product needed relative to integrated day-ahead net load is not materially different than the amount ... needed relative to CAISO net load ..." CAISO proposes using the difference relative to IFM Net Load. PG&E believes that the analysis performed was seriously deficient to draw this conclusion. The analysis presented only consisted of two graphs, Figure 1 and Figure 2. They clearly show that the two distributions have substantial differences, so it is hard to draw CAISO's conclusion from them.

Please provide your organization's position on the proposed day-ahead market structure topic as described in section 3 of the proposal. (Please indicate Support, Support with caveats, Oppose, or Oppose with caveats)

Oppose (please note above).

2. Day-Ahead Flexible Ramping Product

Please provide your organization's feedback on the Day-Ahead Flexible Ramping Product as described in section 4 of the proposal. Please explain your rationale and include examples if applicable.

CAISO states that it will commit capacity so that it can procure FRU and FRD to meet a 95% confidence interval and so a demand curve will not be needed. It is unclear why the 95% confidence interval is the optimal level of FRU and FRD to procure. This could result in committing resources with very expensive commitment costs to obtain expected incremental benefits that are less valuable than the commitment costs incurred.

PG&E requests that CAISO provide an economic analysis to justify the rationale of requiring FRU and FRD be procured to meet a 95% confidence interval. PG&E is concerned that the cost of committing resources and procuring the FRU and FRD to meet that confidence interval may be greater than the resulting economic benefit. For example, if meeting the 95% confidence interval costs much more than the expected value of any avoided lost load, there is no way to avoid the uneconomic procurement. Also, if the CAISO is short of FRU and FRD in the real-time market, it may seek to commit fast start resources or make emergency purchases. CAISO indicates that using a 95% confidence interval will limit such out of market actions. While these actions may be costly, they may be economic compared to committing sufficient resources in DAM to prevent CAISO being forced to take such actions in the real-time markets. The cost of such actions should be weighted by the probability of their occurrence.

In the Real-Time Markets, a 95% confidence interval was set to allow the market to evaluate whether or not it would be cost effective to procure FRU and FRD cover variability within this wide range. A demand curve was used to determine whether meeting a given level of FRU or FRD would be cost effective. PG&E requests that CAISO conduct an analysis to show that meeting FRU and FRD everywhere within the confidence interval will be cost effective.

Please provide your organization's position on the Day-Ahead Flexible Ramping Product as described in section 4 of the proposal. (Please indicate Support, Support with caveats, Oppose, or Oppose with caveats)

Oppose (see note above).

3. Re-Optimization of Ancillary Services

Please provide your organization's feedback on the re-optimization of ancillary services as described in section 5 of the proposal. Please explain your rationale and include examples if applicable.

PG&E sees the potential for value in re-optimization of Ancillary Services between the day-ahead and real-time markets as described in the proposal, provided there are sufficient safeguards against strategic bidding of Ancillary Services in the day-ahead market from market participants with no intention of honoring these awards in real-time.

Mitigation in the form of performance penalties, increased certification requirements, and close monitoring of successive buy backs and pricing outcomes are essential to prevent market manipulation in the Ancillary Service market.

Please provide your organization's position on the re-optimization of ancillary services as described in section 5 of the proposal. (Please indicate Support, Support with caveats, Oppose, or Oppose with caveats)

Support with caveats.

4. Energy Imbalance Market Governing Body Classification

Please provide your organization's feedback on the EIM Governing Body classification as described in section 6 of the proposal. Please explain your rationale and include examples if applicable.

PG&E has no comment on this issue at this time.

Please provide your organization's position on the EIM Governing Body classification as described in section 6 of the proposal. (Please indicate Support, Support with caveats, Oppose, or Oppose with caveats)

APPENDIX C: DRAFT TECHNICAL DESCRIPTION

5. Assumptions and Mathematical Formulations

Please provide your organization's feedback on the assumptions and mathematical formulations included in Appendix C. Please explain your rationale and include examples if applicable.

PG&E recalls that CAISO mentioned that there's an updated version of the mathematical formulations document during the stakeholder meeting on March 7th,

2019. PG&E would appreciate the opportunity to review the updated document. For the posted version, PG&E provides the following comments.

Regional Transfer Capability Constraints

In Appendix C, CAISO states that it will enforce transfer capability limits into and out of regions.

For region r, CAISO will enforce the export limit of

$$\max\left(0, \left[\sum_{i \in S_r} (EN_{i,t} - L_{i,t}) + \sum_{j \in S_r} (EN_{j,t} - L_{j,t}) - Loss_{r,t}\right]\right) + \max\left(0, \sum_{i \in S_r} ASU_{i,t} - ASUR_{r,t}\right) + \max\left(0, \sum_{i \in S_r} FRU_{i,t} - FRUR_{r,t}\right) + \max\left(0, FRDR_{r,t} - \sum_{i \in S_r} FRD_{i,t}\right) \leq NEL_{r,t}$$

For region r, CAISO will enforce the import limit of

$$\max\left(0, \left[\sum_{i \in S_r} (L_{i,t} - EN_{i,t}) + \sum_{j \in S_r} (L_{j,t} - EN_{j,t}) + Loss_{r,t}\right]\right) + \max\left(0, \sum_{i \in S_r} RD_{i,t} - RDR_{r,t}\right) + \max\left(0, \sum_{i \in S_r} FRD_{i,t} - FRDR_{r,t}\right) + \max\left(0, FRUR_{r,t} - \sum_{i \in S_r} FRU_{i,t}\right) \leq NIL_{r,t}$$

These constraints are designed to limit the transfers across the regional interface if conditions arise in which the CAISO must deploy ramp up or ramp down. Let's consider the first constraint. Suppose that the CAISO determines that it has a requirement for flexible ramp up in the region of 500 MW and that it procures 600 MW of FRU in the region. Also suppose that the CAISO determines that it has a requirement for flexible ramp down in the region of 700 MW and that it procures 500 MW of FRD in the region. For simplicity, we will assume that the energy dispatch in the region meets the load in the region and that the Ancillary Services procured in the region are equal to the requirement in the region. The first constraint states that the CAISO must be able to export the amount by which FRU exceeds Flexible Ramp Up Requirement in the region plus the amount by which the flexible Ramp Down Requirement in the region exceeds the FRD in the region. That is, it assumes that the CAISO must be able to export

$$\max(0, 600 - 500) + \max(0, 700 - 500) \text{ or } 300 \text{ MW.}$$

This assumes that the CAISO will simultaneously experience the need to deploy FRU to meet 500 MW of FRU requirements while also deploying FRD to meet 700 MW of

FRD requirements in the region. It does not seem credible that conditions in the FMM would require the simultaneous deployment of FRU and FRD in the region.

It seems much more credible that the CAISO would either need to deploy FRU to meet the max FRUR in the region and not have to deploy FRD to meet a downward need in the region or that the CAISO would need to deploy FRD to meet the max FRDR in the region and not have to deploy FRU in the region to meet an upward need. This would have the first constraint split into two:

$$\max\left(0, \left[\sum_{i \in S_r} (EN_{i,t} - L_{i,t}) + \sum_{j \in S_r} (EN_{j,t} - L_{j,t}) - Loss_{r,t}\right]\right) + \max\left(0, \sum_{i \in S_r} ASU_{i,t} - ASUR_{r,t}\right) \\ + \max\left(0, \sum_{i \in S_r} FRU_{i,t} - FRUR_{r,t}\right) \leq NEL_{r,t}$$

$$\max\left(0, \left[\sum_{i \in S_r} (EN_{i,t} - L_{i,t}) + \sum_{j \in S_r} (EN_{j,t} - L_{j,t}) - Loss_{r,t}\right]\right) + \max\left(0, \sum_{i \in S_r} ASU_{i,t} - ASUR_{r,t}\right) \\ + \max\left(0, FRDR_{r,t} - \sum_{i \in S_r} FRD_{i,t}\right) \leq NEL_{r,t}$$

Returning to the simple example above, the CAISO must be able to export

max (0, 600 – 500) or 100 MW if it must deploy FRU to the max level
or
max (0, 700 – 500) or 200 MW if it must deploy FRD to the max level.

The second constraint has similar issues.

Please provide your organization’s position on the assumptions and mathematical formulations included in Appendix C. (Please indicate Support, Support with caveats, Oppose, or Oppose with caveats)

Oppose with caveats (please see above).

Additional Comments

Please offer any other feedback your organization would like to provide on the Day-Ahead Market Enhancements Phase 1 initiative third revised straw proposal.