Comments of Pacific Gas and Electric Company
Flexible Ramping Products: Incorporating FMM and EIM Straw Proposal

Submitted by		Company	Date Submitted
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Pacific Gas and Electric Company (PG&E) respectfully submits the following comments in the stakeholder process for the California Independent System Operator's (CAISO) Flexible Ramping Products (FRP) initiative June 2, 2014 Straw Proposal (Proposal).

Overview: PG&E supports the CAISO's efforts to identify through the FRP stakeholder process a market-based solution to the operational challenge of maintaining power balance in the Real-Time Dispatch (RTD) under increasing levels of variable energy resources (VERs). As these comments detail, however, key elements of the CAISO's proposed FRP market design changes remain unclear to PG&E and other stakeholders. In order to achieve broad stakeholder support for the FRP initiative, the CAISO must explain much more precisely the mechanics of FRP procurement and settlement. Furthermore, PG&E strongly encourages the CAISO to conduct robust market simulations as part of the FRP stakeholder process in order to demonstrate to stakeholders that the proposed market design changes are likely to yield reasonable market outcomes.

PG&E's comments fall into two categories: (i) substantive comments on the CAISO's proposed FRP market design changes; and (ii) clarifying comments on the language and intent of the June 2, 2014 Proposal. In summary, PG&E's comments are:

<u>Substantive comments:</u>

1. PG&E supports procurement of the Flexible Ramping Products in the Day-Ahead Market (DAM) in addition to procuring these products in the Fifteen-Minute Market (FMM) and the Real-Time Dispatch (RTD); however, PG&E does not support bidding in DAM for the Flexible Ramping Products;
2. The CAISO should consider allowing use-limited resources without Flexible Resource Adequacy obligations to opt out of providing Flexible Ramping capacity;

3. The CAISO should consider FRP deliverability so that procured ramping capacity is not stranded behind transmission constraints;
4. Alternative cost allocation models and other cost allocation issues should be considered in the next Proposal; and
5. The CAISO should develop a "sandbox" version of its market software so that it can thoroughly simulate the effects on market outcomes of proposed market design changes prior to their actual implementation.

Clarifying comments:

6. The CAISO should provide more detail regarding how it will set requirements for the Flexible Ramping Products in each of DAM, FMM, and RTD;
7. The CAISO should clarify whether, as part of the FRP stakeholder process, it plans to make changes to the methods by which it forecasts net system demand;
8. Important details about how the CAISO plans to construct the 95% confidence interval for net system demand changes in RTD require clarification; and
9. Further details are needed regarding how the CAISO will construct the demand curve linking the minimum and maximum requirements for each of the Flexible Ramping Products.

1. PG&E supports procurement of the Flexible Ramping Products in DAM; however, PG&E does not support bidding in DAM for these products

Procurement of the Flexible Ramping Up (FRU) and Flexible Ramping Down (FRD) products in the Day-Ahead Market (DAM) will allow the CAISO to better account for projected ramping requirements and the ramping capabilities of long-start units in making commitment and scheduling decisions. Furthermore, procurement of the Flexible Ramping Products in both DAM and the Real-Time Market (RTM) (i.e. both the Fifteen-Minute Market (FMM) and the 5-minute Real-Time Dispatch (RTD)) will maintain alignment between the CAISO's DAM and RTM processes.

Day-Ahead Flexible Ramping awards will explicitly compensate resources for opportunity costs associated with the provision of ramping capacity. This explicit pricing, reflective of a resource's bid-in Energy costs, should adequately compensate the resource. PG&E is not convinced that a resource will incur significant operating costs beyond those reflected in its Energy bid in order to provide Flexible Ramping capability, such that a separate bidding parameter is warranted. As a result, bidding for the Flexible Ramping Products would be inappropriate. Additional elements of PG&E's reasoning for this position are as follows:

i. **The willingness of market participants outside the CAISO to pay for in-CAISO Energy is captured through export bids.** Import or export bids from power marketers or other market participants submitted to CAISO allow the CAISO's market optimization to factor in the opportunity costs of foregone Energy sales to the CAISO's *and* external BAAs' loads. As PG&E understands it, this sufficiently addresses the unlikely case where a resource internal to the CAISO that could have sold Energy or related services outside of the CAISO is held inefficiently for FRP.

ii. **A resource's role in Resource Adequacy (RA) has no bearing on the need to bid for the Flexible Ramping Products.** The RA construct ensures that a sufficiently large, capable, and well-sited fleet of resources is available and participating in the CAISO markets such that the grid can operate reliably. FRP and the CAISO's spot markets, however, commit, position, and dispatch resources in a manner that balances supply and demand subject to grid constraints and conditions. Through the use of clearing prices and bid-in costs for Energy and Ancillary Services, a resource can recover its costs in accordance with competitive market conditions. The idea that resources with RA contracts have different marginal costs seems unreasonable.

iii. **The addition of bidding capability for the Flexible Ramping Products in DAM will create undue costs and complexities.** Bids for FRP would require market power mitigation, necessitating an additional set of market rules and complexities that might slow solution times and entail bid-insertion challenges. Most of these costs and challenges, however, are avoided through a structure that prohibits FRP bidding in DAM. In addition, this is consistent with the restriction proposed for FMM and RTD.

2. The CAISO should consider allowing use-limited resources without Flexible Resource Adequacy obligations to opt out of providing Flexible Ramping capacity

At the June 9, 2014 FRP stakeholder meeting, a number of parties voiced concern that FRP awards – especially in DAM – might complicate the management of use-limited resources. The CAISO ought to consider whether, in the absence of bidding for the Flexible Ramping Products (which PG&E supports), use-limited resources that do not have must-offer obligations under the Flexible Resource Adequacy program should be provided a means of signaling to the CAISO that they do not wish to be awarded FRP, without their having to submit Energy self-schedules and refrain from bidding a dispatchable range. It is important that the FRP design does not create new incentives for resources to self-schedule their Energy, thereby reducing overall system flexibility. An opt-out option for use-limited

resources is one way of ensuring this. PG&E notes that MISO will allow *any* resource to opt-out of providing its ramping capability products.[1]

3. The CAISO should consider FRP deliverability so that procured ramping capacity is not stranded behind transmission constraints

As PG&E understands it, the FRP's real ramp concept makes the deliverability of Flexible Ramping capacity highly relevant. Whereas today's Energy optimization considers Energy deliverability across multiple intervals, the proposed real ramp concept instead finds the most efficient ramping capability to meet real ramp targets for subsequent intervals. The deliverability of this capacity is crucial, particularly for the minimum procurement requirement, which is very likely to be dispatched in the subsequent interval. PG&E believes the CAISO should work to ensure to whatever degree possible that capacity procured for Flexible Ramping is not stranded behind transmission constraints in the event that the capacity is needed for Energy dispatch in a future RTD interval.

4. Alternative cost allocation models and other cost allocation issues should be considered in the next Proposal

The CAISO proposes an *ex-post* allocation of FRP procurement costs between load, supply, and fixed ramp (i.e. static intertie) resources. While PG&E appreciates the CAISO's efforts to allocate the costs of FRP procurement based on causation (in this case, movement by entities that necessitates changes in Real-Time dispatch of 5-minute dispatchable resources), PG&E believes the CAISO should consider the merits of alternative approaches to cost allocation in the next Proposal. For instance, the CAISO could consider an *ex-ante* approach to the allocation of FRP procurement costs, which could link to the CAISO's proposed methodologies for ramp procurement range. PG&E is happy to engage with the CAISO and other stakeholders in a discussion of alternative cost allocation models that are fair and guard against unreasonably high cost allocation to an entity.

5. The CAISO should develop a "sandbox" version of its market software so that it can thoroughly simulate the effects on market outcomes of proposed market design changes prior to their actual implementation

PG&E believes the CAISO should develop a "sandbox" (i.e. testing) software environment in which it can simulate the market outcomes likely to result under *any* proposed market design changes (including the Flexible Ramping Products). This capability would reduce uncertainty in the CAISO's stakeholder processes – in particular, it would help to address stakeholders' concerns with proposed market design changes *prior* to their actual implementation in the CAISO markets. Regular and robust sandbox testing would also

[1] MISO's Dec. 22, 2013 *Ramp Capability Product Design for MISO Markets* paper states: "Resource participation in the ramp products is voluntary" (page 20).

decrease the likelihood that serious problems with market design changes are not discovered until after the changes have been implemented.

6. The CAISO should provide more detail regarding how it will set requirements for the Flexible Ramping Products in each of DAM, FMM, and RTD

The CAISO should clarify some of the nuances of FRP procurement in DAM by detailing its proposed processes for developing real ramp needs and associated percentile ranges for ramp needs. PG&E requests that in the next Proposal the CAISO address the following questions:

i. In DAM, does the CAISO propose to estimate the 97.5 percentile and 2.5 percentile levels for change in net system demand *over an entire hour* in order to determine, respectively, the Flexible Ramping Up and Flexible Ramping Down requirements? If so, does the CAISO propose holding FRU and FRD to meet these 97.5 percentile and 2.5 percentile levels *uniformly* in each 5-minute period within the hour?

ii. Since the DAM does not clear based on CAISO forecasts of demand but instead clears based on participants' bids to purchase Energy, does the CAISO plan to procure Flexible Ramping Up and Flexible Ramping Down based on the ramp for net system demand cleared in one hour to the next in DAM plus the *uncertainty* in CAISO forecast of net system demand over the hour? Or does the CAISO plan to clear FRU and FRD based on its forecast of change in net system demand over the hour plus the uncertainty while ignoring the change in net system demand cleared in DAM between two hours?

iii. In DAM, holding uniform ramp capability over an hour (e.g. 5 MW in each of the twelve 5-minute intervals within the hour, as in the case of Resource B in the example on pages 11-12 of the Proposal) to meet the 97.5 percentile and 2.5 percentile levels for change in net system demand over the hour may not allow the CAISO to meet potentially significant shorter-term ramp requirements that could be needed to meet net system demand changes within the hour in Real-Time that CAISO could potentially estimate in the Day-Ahead timeframe. The CAISO's Day-Ahead estimates of the variability of net system demand changes in 5-minute periods in an hour in Real-Time may not be uniform; this could result in ramp requirements over a given 5-minute period within an hour being much greater than the average ramp needed to meet the 97.5 percentile level of ramp over the entire hour. For example, historical patterns may show that ramp requirements in the first part of an hour are much greater than ramp requirements in the latter part of an hour. Does the CAISO plan to address such differences between the requirements in its FRP design?

7. The CAISO should clarify whether, as part of the FRP stakeholder process, it plans to make changes to the methods by which it forecasts net system demand

Page 12 of the June 2, 2014 Proposal states that the CAISO is developing a "ramp forecasting tool to provide input to the market applications". At the June 9, 2014 FRP stakeholder meeting, the CAISO said it would provide more details about this ramp forecasting tool either in the next Proposal or at the next stakeholder meeting. PG&E requests that the CAISO clarify any plans to change the methods by which it forecasts the components of net system demand – namely, load, net scheduled interchange, and renewable generation – for purposes of procuring the Flexible Ramping Products. Specifically, in treating renewable generation as a random variable that it must forecast, how does the CAISO propose to handle *dispatchable* renewable generation – i.e. renewable generation that submits a Real-Time bid for dispatch by the RTD Security-Constrained Economic Dispatch (SCED) engine but for which the maximum output possible is a random variable? Moreover, how will the forecast of net system demand treat dispatchable output from renewable generation that is unknown until SCED dispatches the resource?

8. Important details about how the CAISO plans to construct the 95% confidence interval for net system demand changes in RTD require clarification

At least two aspects of how the CAISO will determine the 2.5 percentile and 97.5 percentile of the distribution of net system demand changes in RTD are unclear in the June 2, 2014 Proposal. First, it is unclear whether these percentiles – i.e. the maximum requirements for Flexible Ramping Down and Flexible Ramping Up capacity – can change from one 5-minute interval to the next (and, if so, how often they can change). On the one hand, page 12 of the Proposal states that "the ISO will <u>forecast</u> the 2.5% percentile and 97.5% percentile of the net system demand changes", which suggests the maximum requirements for FRU and FRD can indeed change between intervals. On the other hand, page 16 of the Proposal states that "the maximum requirement [for FRU] is independent of the expected upward net system movement"; likewise, figure 4 on page 17 states that "expected upward net system movement […] does not change the maximum requirement [for FRU]".

Second, it is unclear how the CAISO will construct the 95% confidence interval for net system demand changes for the advisory (i.e. non-binding) dispatch intervals in the RTD look-ahead optimization (e.g. intervals t+5 and t+10 in figure 6 on page 19 of the Proposal). Consider, for instance, the second advisory dispatch interval that occurs at time t+10. How are the 97.5 percentile and 2.5 percentile levels for the net system demand at time t+10 determined? Are they the 97.5 percentile and 2.5 percentile levels for change in net system demand in 10 minutes from the forecast expected net system demand in the binding interval at time t – that is, are they the 97.5 percentile and 2.5 percentile levels for the change in net system demand over 10 minutes between t and t+10 (call this Method 1)? Or,

are they the 97.5 percentile and 2.5 percentile levels for change in net system demand in 5 minutes from the forecast expected net system demand in the advisory interval at time *t*+5 – that is, are they the 97.5 percentile and 2.5 percentile levels for the change in net system demand over 5 minutes between *t*+5 and *t*+10 assuming that the forecast net system demand at *t*+5 comes to pass (call this Method 2)?

The above considerations could affect how the CAISO procures and settles Flexible Ramping Up and Flexible Ramping Down in the binding interval *t*. If Method 1 above were used, would CAISO procure FRU and FRD in the binding interval *t* to cover the changes between the forecast net system demand in the binding interval *t* and the 97.5 and 2.5 percentiles of net system demand in *all* later advisory intervals – i.e. *t*+5, *t*+10, *t*+15, etc.? Would CAISO make the FRU and FRD procured from *t* to *t*+5, *t*+10, *t*+15, etc. binding procurements of FRU and FRD at time *t* which must be settled?

Alternatively, if Method 2 above were used, would the CAISO procure FRU and FRD in the binding interval *t* to cover *only* the change between the forecast net system demand in the binding interval *t* and the 97.5 and 2.5 percentiles of net system demand in the first advisory interval, *t*+5, a binding procurement of FRU and FRD which must be settled? Would procurement of FRU and FRD in the SCED for later intervals be advisory only? That is, would SCED treat procurement of FRU and FRD from forecast net system demand at *t*+5 to the 97.5 and 2.5 percentiles of net system demand at *t*+10 assuming the forecast net system demand at *t*+5 is accurate, and from forecast net system demand at *t*+10 to the 97.5 and 2.5 percentiles of net system demand at *t*+15, etc., as advisory procurements of FRU and FRD only?

9. Further details are needed regarding how the CAISO will construct the demand curve linking the minimum and maximum requirements for each of the Flexible Ramping Products

PG&E has concerns that the direct coupling of the demand curve to the power balance violation penalty parameters used in the RTD SCED might overvalue the 5-minute ramping capability that resources can provide, thereby resulting in costly over-procurement of the Flexible Ramping Products on a regular basis.[2] Although PG&E broadly supports the use of a demand curve to capture the inherent tradeoff between using dispatchable capacity for Energy in the current interval and saving flexibility for future intervals, PG&E suggests that the CAISO consider MISO's simulation approach to identifying a reasonable demand curve for flexible ramping capability: MISO simulated its ramp capability products with demand curve prices of $5 and $10 (i.e. the value of the demand curve penalty is low compared to

[2] In addition, overvaluing the 5-minute ramping capability may become another source of transient price spikes in the Real-Time Market that do not reflect actual economic costs.

scarcity prices), and with only a single segment on the demand curve between the minimum and maximum requirements.

PG&E also requests further discussion of the approach for determining the frequency and severity of power balance violations. In the June 2, 2014 Proposal, the demand curves for the Flexible Ramping Products are constructed using: (i) data on the distribution of power balance violations in RTD over the period January 2011 – March 2011; and (ii) the penalty parameters for power balance violations used in the CAISO's RTD SCED. At the June 9, 2014 stakeholder meeting, PG&E asked whether the CAISO would actually construct the demand curves in this manner upon FRP implementation, noting that the distribution of power balance violations in RTD has likely changed since 2011 (because of increased solar generation and 15-minute scheduling at the interties, for instance). The CAISO answered that it preferred an approach based on historical data, yet acknowledged that it would likely refine its methodology and/or data sources. The CAISO should clarify and detail its exact approach for stakeholder review. If relevant data does not exist, we suggest the CAISO instead conduct studies to value an avoided short-run ramping shortage.[3]

[3] MISO used studies to inform its demand curve and values for ramping procurement in its spot markets.