Flexible Ramping Product
Cost Allocation
Straw Proposal

March 15, 2012

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1 Introduction

The flexible ramping products being developed will help the system to maintain dispatchable flexibility in terms of ramping capability. The flexible ramping products specifically target the 5-minute real-time dispatch (RTD) imbalances due to variability and uncertainties. Variability may come from market granularity differences in load profile and supply. Variability may also arise due to unit startup/shut down profile, multi-stage generator transition profile, and inter-tie schedule inter-hour ramping profile. The uncertainties include deviations that have a random nature, such as load forecast error, variable energy resources' forecast error, and other uninstructed deviations. Scheduling coordinators (SCs) will be allowed to offer ramping capabilities into the market, and the ISO will optimize such offers to economically meet the anticipated 5-minute imbalances.

The ISO has applied the cost allocation guiding principles described in the draft final proposal that was posted on March 15th [1] in developing the cost allocation straw proposal for the flexible ramping product. The cost allocation guiding principles have seven elements: (1) Causation, (2) Comparable Treatment, (3) Accurate Price Signals, (4) Incentivize Behavior, (5) Manageable, (6) Synchronized, and (7) Rational.

The ISO proposes to allocate the costs for the flexible ramping product based upon deviations (gross positive deviations and gross negative deviations at the resource level) that are aligned with setting the procurement target. The expectation of potential deviations across all market participants causes the ISO to procure the flexible ramping product.

The ISO proposes to allow hourly profiles to be used for a resource's hourly schedules as needed. The hourly profiles will be used by market participants to shape their hourly schedules for the purposes of determining their flexible ramping product cost allocation. The hourly profiles will not be used for the settlement of imbalance energy. The purpose is to allow load and supply resources to establish a baseline that is aligned with the flexible ramping procurement decision. The hourly profile will provide a baseline that is more relevant to the impact on the flexible ramping product procurement requirement for the purpose of determining the cost allocation of the flexible ramping products.

2 Prior discussion on Flexible Ramping Product Cost Allocation

In the second revised straw proposal of the flexible ramping product, the ISO proposed using historical data to segment flexible ramping product costs based so that energy deviations as currently measured by the ISO could be used for allocating costs. This approach sought to allocate flexible ramping product costs based upon deviation type versus the type of resource. In reviewing the previous proposal against the cost allocation guiding principles, the ISO concluded that a more appropriate cost allocation approach would be to seek a comparable deviation measurement for load, conventional generation, variable generation, imports and exports. Since a comparable energy deviation metric does not currently exist, the ISO is proposing a new deviation baseline to be used to allocate flexible ramping costs.

[1] Additional information on the cost allocation guiding principles can be found at http://www.caiso.com/informed/Pages/StakeholderProcesses/CostAllocationGuidingPrinciples.aspx

3 Proposed Deviation Baseline for Flexible Ramping Product

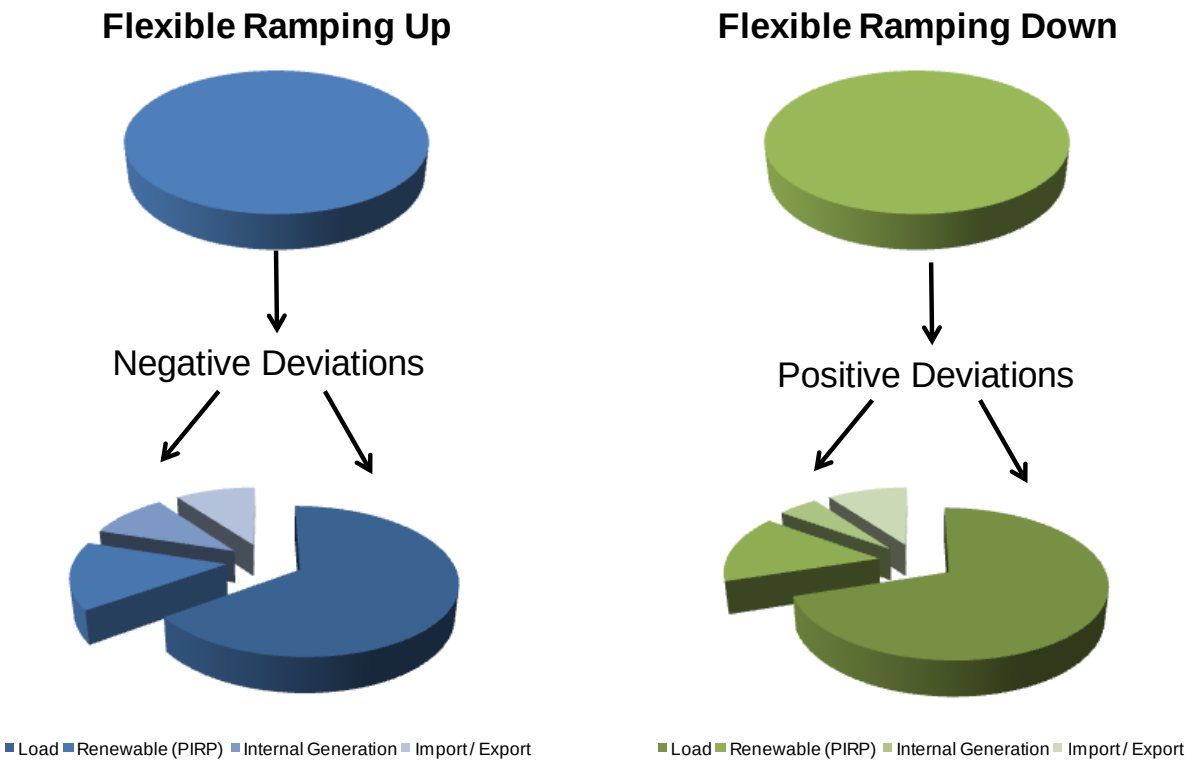
The ISO proposes to allocate the costs for the flexible ramping product based upon deviations that are aligned with setting the procurement target. The expectation of potential deviations across all market participants results in the procurement of the flexible ramping product. The totally system variability and uncertainty between RTPD and RTD is the driver of the procurement target. There may be instances where on average two market participants offset the other's deviations which decreases the overall system requirement. This offsetting impact decreases the quantity of the flexible ramping product the ISO must procure and is reflected in a lower system procurement target. Consistent with the Accurate Price Signals guiding principle the ISO has proposed a measurement of the billing determinant that reflects the expectation of a resource's impact on the flexible ramping product procurement.

The flexible ramping cost is the product of the procurement target and the market clearing price paid to suppliers of the flexible ramping product. The flexible ramping product costs are represented by the blue (Up) and green (Green) pies in Figure 1.

In order to allocate the costs to scheduling coordinators, the ISO plans to develop a comparable method to calculate deviations across supply and demand resources. The upward flexible ramping product is procured to address variability and uncertainty that is observed as negative deviations to system conditions assumed in RTPD. The downward flexible ramping product is procured to address variability and uncertainty that is observed as positive deviations to system conditions assumed in RTPD. The gross measurement of both positive and negative deviations at a resource level is then used to calculate the share of the total costs a resource receives, as illustrated by the pie slices in Figure 1.

The determination of the procurement target at a system level and the allocation based upon gross deviations is consistent with the cost causation and comparable treatment cost allocation guiding principles.

Figure 1 - Flexible Ramping Product Cost Allocation



3.1 New Baseline to Measure Deviations

In order to be consistent with the Comparable Treatment guiding principle, a similar baseline from which to measure deviations for the purposes of allocating the flexible ramping costs is being proposed. The ISO proposes to allow hourly profiles to be used for resources. The hourly profiles will be used by market participants to set a baseline for the purposes of determining their flexible ramping product cost allocation. The hourly profiles will not be used for the settlement of imbalance in energy. The hourly profile is aligned with the flexible ramping procurement decision. The hourly profile will provide a baseline that is more relevant to the impact on the flexible ramping product procurement requirement for the purpose of determining the cost allocation of the flexible ramping products.

Those resources that require an hourly profile will submit (or in case of Load calculate) the profile 37.5 minutes prior to the start of "binding" RTPD interval where units are committed to provide the flexible ramping product. The scheduling coordinator (ISO for Load) will provide a two hour profile; however, only the first 15 minute interval will set the baseline for measuring deviations subject to the flexible ramping cost allocation and be "binding" for determining the flexible ramping product cost allocation. The scheduling coordinator is allowed to provide an updated two hour profile every 15 minutes. For example, assume it is 08:22:30 AM, the scheduling coordinator submits the resource's hourly profile for 9:00 to 10:00 as follows: 9:00-9:15 = 10 MWh, 9:15-9:30 = 20 MWh, 9:30-9:45 = 30 MWh, 9:45-10:00 = 40 MWh, 10:00-11:00 = 50 MWh. The baseline for determining deviations from the baseline in the 9:00-9:15 interval would be 10 MWh and the other intervals will be advisory. Then at 08:37:30 AM, the scheduling coordinator submits the hourly profile for 9:15 to 10:15 as follows: 9:15-9:30 = 15 MWh, 9:30-9:45 = 25 MWh, 9:45-10:00 = 40 MWh, 10:00-10:15 = 50 MWh, 10:15-11:15 = 55 MWh. The

baseline for determining deviations in the 9:15-9:30 interval would be 15 MWh even though in the hourly profile previously submitted the advisory amount for the second interval was 20 MWh.

The deviations will be calculated for each 10 minute settlement interval based upon the rolling 15 minute forecasts. The 15 minute baselines will be converted to 10 minute intervals to align with the metering of internal generation. For example, assume two RTPD intervals. Interval 1 the forecast is 15 MWh and interval 2 the forecast is 30 MWh. The baseline for the 10 minute settlement interval 1 is 10 MWh, settlement interval 2 is 15 MWh, and settlement interval 3 is 20 MWh.

Table 1 below summarizes by resources type how the hourly profile, baseline, actual output and deviation will be measured for allocating flexible ramping product costs. Additional discussion on each of the elements is discussed in Sections 3.1.1 to 3.1.4. The hourly profile is in 15 minute intervals in order to align with unit commitment within RTPD and is then converted to 10 minutes in order to align with metering and settlement intervals.

Table 1 - Summary of Deviation Calculations UPDATE

	Hourly Profile	Baseline	Actual	Deviation
Load	ISO 15 Minute Forecast	Convert Profile to 10 Min	ISO 10 Minute Observed Demand	Baseline - Actual
Renewables (PIRP)	Resource's 15 Minute Forecast	Convert Profile to 10 Min	10 Minute Meter	Baseline - Actual
Internal Generation	N/A	Dispatch	10 Minute Meter	UIE1 + UIE2
Interties Static	Flat	HASP Schedule divided by 4	Deemed Delivered	Baseline - Actual
Interties Operational Adjustments	N/A	N/A	Deemed Delivered	OA1 + OA2

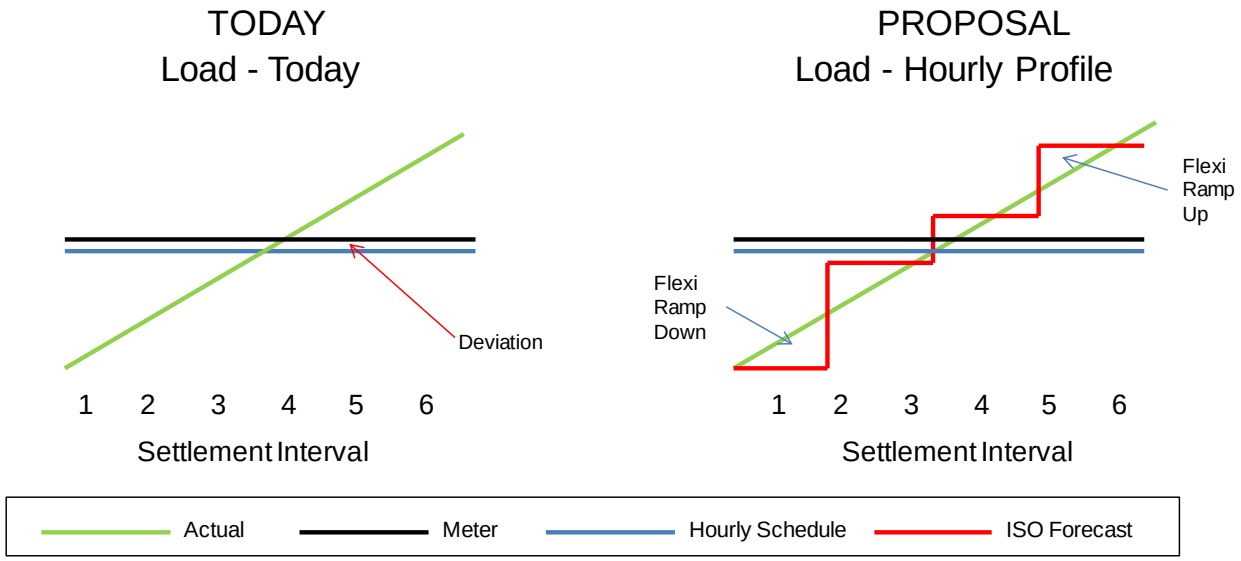
3.1.1 Hourly Profile for Load

In the real-time market, Load does not submit economic bids or schedules. The ISO commits resources in RTPD to meet the CAISO forecast of CAISO demand (CFCD). The real-time forecast of demand used for RTPD has 15 minute granularity. While metering of Load for energy settlement purposes is done on an hourly basis, the ISO can measure system demand with more granularly based upon actual observations. The ISO proposes to use the ISO RTPD demand forecast as the hourly profile to calculate the baseline for measuring Load deviations. The ISO updates the Load forecast for RTPD every 15 minutes. The ISO will use the forecast for the "binding" RTPD interval to compare to observed demand to calculate the system wide positive and negative deviations that will be used to allocated flexible ramping costs attributable to Load.

Figure 2 below illustrates why the RTPD forecast of load is a more accurate calculation of deviations to be used for allocation of flexible ramping product costs. Using current deviation

metrics, the comparison of the hourly meter value to the hourly schedule does not reflect the actual dispatch capability necessary to manage the variability and uncertainty observed. However, the hourly profile more accurately measures the uncertainty and variability that resulted between the RTPD load forecast and actual load.

Figure 2 - Comparison of Baseline to Calculate Deviations



Since the ISO is not requiring more granular metering of load by load serving entities, the deviations will be used to determine the share of flexible ramping costs attributable to load. The costs will then be allocated based upon load ratio share on a daily basis. In order to allocate costs more precisely, load serving entities would need to provide metering at 10 minute granularity to align with internal generation metering. If a load serving entity had 10 minute metering, then the load serving entity could submit its own load profile and its cost allocation would be calculated similar to section 4.1.2.

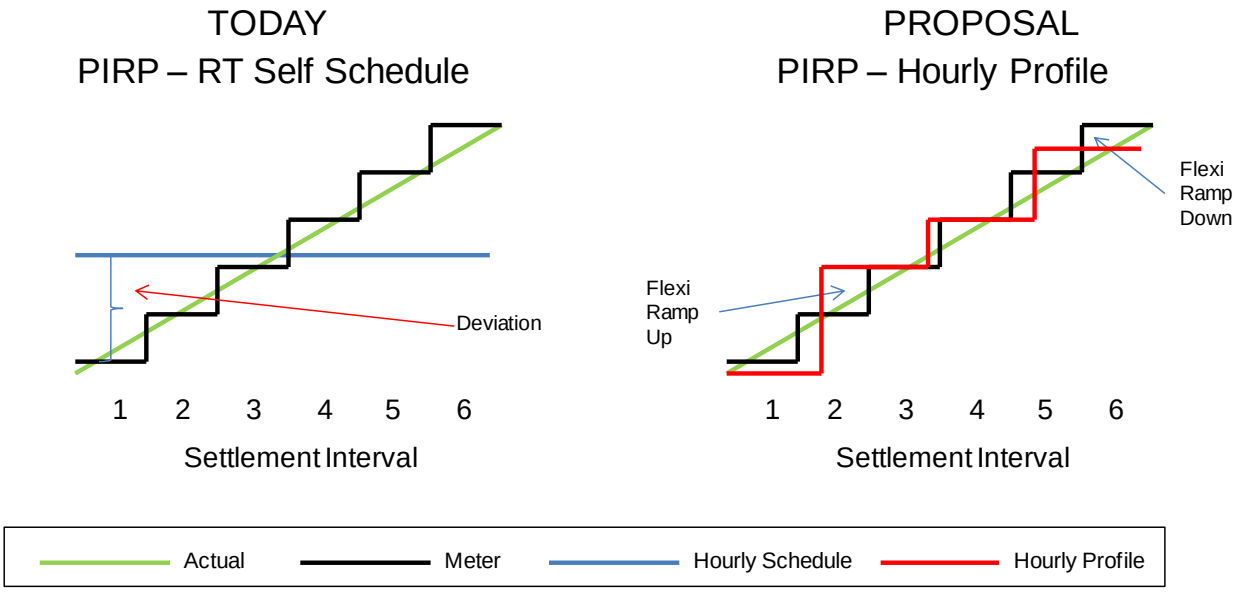
3.1.2 Hourly Profile for PIRP Real-Time Self Schedule

Currently the participating intermittent resource program (PIRP) requires resources to submit the ISO provided hourly forecast as a real-time self schedule in order to be eligible for monthly netting of imbalance energy. The ISO proposes to allow the scheduling coordinator of PIRP resources to submit an hourly profile of their output. The hourly profile is submitted 37.5 minutes prior to the "binding" RTPD interval. Every 15 minutes, the resource can submit an updated hourly profile which will be used as the baseline for the next "binding" RTPD interval.

As Figure 3 below illustrates, under the current measurement of uninstructed deviations the beginning and ending energy settlement intervals overstate the deviations that drive procurement of the flexible ramping product in RTPD. However, with the hourly profile, the 15 minute granularity aligns measurement of deviations with the RTPD timeframe of the flexible ramping procurement decision. Since the hourly profile submitted is better aligned with actual output and the 10 minute settlement interval, the resource would be allocated a more accurate portion of flexible ramping product costs. Scheduling coordinators for PIRP resources will be incentivized to improve the resource's hourly profile in order to reduce the flexible ramping

product cost allocation, consistent with the Incentivizing Behavior cost allocation guiding principle. Allowing updates every 15 minutes of the hourly profiles results in comparable treatment between renewable resources with real-time self schedules and conventional generation.

Figure 3 - Comparison of Baseline to Calculate Deviations



The ISO is considering leveraging functionality that is being implemented within the Dynamic Transfers initiative. In the Dynamic Transfers initiative, renewable resources can submit updates using 5 minute granularity for their future output profile. If a scheduling coordinator provides 5 minute granularity for a resource, the ISO is considering using the simple average of the three relevant 5 minute intervals to create the 15 minute hourly profile used to calculate flexible ramping product cost allocation deviations.

Over time, the ISO will utilize the hourly profiles submitted by renewable resources to refine the procurement target for flexible ramping up and flexible ramping down. This is consistent with the Cost Causation, Incentivizing Behavior and Manageable guiding principles.

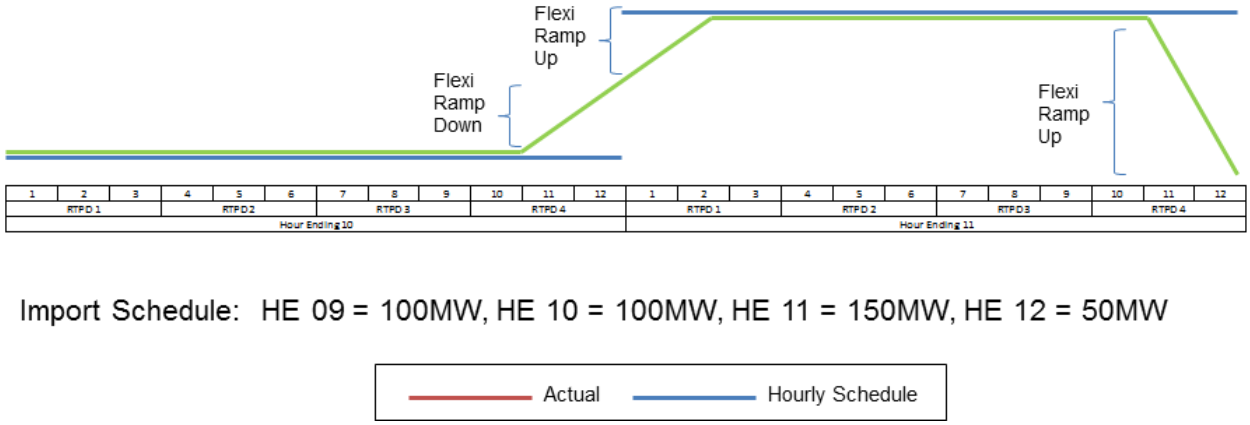
3.1.3 Internal Generation Hourly Profile

The ISO models conventional internal generation's ramp (or hourly profile) between hourly day-ahead schedules to determine uninstructed imbalance energy; therefore, the hourly profile for flexible ramping cost allocation does not need to be submitted by the resource. The ISO has two types of uninstructed imbalance energy. Uninstructed imbalance energy 1 (UIE1) measures a resource's deviations up to its five minute dispatch over the 10 minute settlement interval. If a resource deviates greater than the 5 minute dispatch, the remaining deviation is measured as uninstructed imbalance energy 2 (UIE2). The flexible ramping products are procured for generation which has deviated from both its hourly schedule and ISO dispatch. If a resource deviates from the ISO dispatch, the subsequent RTD interval will dispatch other internal generation to make up the shortfall. As a result, UIE1 and UIE2 will be counted towards the allocation of flexible ramping costs because other resources will have to be dispatched to address those deviations.

3.1.4 Import and Export Hourly Profile

Static hourly schedules for Imports and Exports allow a twenty minute ramp for hourly schedule changes. As shown in Figure 4, when a static hourly import schedule increases, the ISO must have sufficient downward ramping capability for the final two RTD intervals from internal generation to respond to downward dispatches to allow the import schedule increase. Then in the subsequent hour, the ISO must have sufficient upward ramping capability for the first two RTD intervals from internal generation able to respond to upward dispatches while the import reaches its hourly schedule. Since a scheduling coordinator can have both imports and exports in a given hour, the calculation of the MWh subject to flexible ramping cost allocation will be calculated based upon the scheduling coordinators net import and export position between hours.

Figure 4 - Example for Hourly Intertie Ramp



In addition, if an intertie schedule does not e-tag its hourly schedule from the HASP, any difference gives rise to deviations that are captured as operational adjustments (OA1 and OA2). Operational adjustments are similar to deviations from internal generation hourly schedules (UIE1 and UIE2) which results in the need for additional flexible ramping procurement.

4 Monthly Re-Settlement

Since the flexible ramping products are procured based upon forecasted variability and uncertainties, when a resource deviates in a specific settlement interval, it cannot be concluded that the resource's actual deviation caused the flexible ramping product to be procured for that settlement interval. Consistent with the Synchronization guiding principle, the ISO proposes to re-settle costs based upon the monthly rate per deviation. The monthly rate will be determined by the total costs incurred during the month divided by the sum of positive (or negative for flexible ramping product up) deviations across all resources. On a daily basis, scheduling coordinators will be allocated flexible ramping product costs as a share of their resources deviations. At the end of the month, these daily charges will be reversed, and the resource will be charge the monthly rate for each of its deviations.

5 Assignment of Flexible Ramping Cost Allocation

The flexible ramping costs will be allocated to scheduling coordinators. In order to facilitate implementation of bilateral contracts, the ISO will implement functionality to allow assigning of the flexible ramping product cost allocation at the resource level.

6 Next Steps

Item	Date
Post Guiding Principles Draft Final Proposal and Flexible Ramping Product Cost Allocation Straw Proposal	March 15, 2012
Stakeholder Meeting	March 19, 2012
Stakeholder Comments Due	March 29, 2012
Post Flexible Ramping Product Cost Allocation Draft Final Proposal	April 2, 2012
Stakeholder Meeting	April 9, 2012
Stakeholder Comments Due	April 16, 2012
Board Meeting	May 16, 2012

The ISO plans to discuss this draft final proposal with stakeholders at a meeting on March 19. The ISO requests comments from stakeholders on the proposed guiding principles. Stakeholders should submit written comments by March 29 to FRP@caiso.com.