



Bidding Rules Enhancements
Correct Inefficient Accounting of Minimum Load
Costs after Pmin Re-rate

Draft Final Proposal

January 8, 2016

Table of Contents

- 1. Executive Summary 3
- 2. Changes to Revised Straw Proposal 4
- 3. Stakeholder Comments..... 4
- 4. Plan for Stakeholder Engagement..... 4
- 5. Background..... 5
 - 5.1. Problem Statement..... 5
 - 5.2. Discussion of ISO guidance on Pmin re-rates..... 6
 - 5.3. Operational Considerations of MSG Resources 7
- 6. Draft Final Proposal 8
- 7. Next Steps 9
- Appendix A: Stakeholder Comments Summary.....10

1. Executive Summary

The *Bidding Rules Enhancements* stakeholder process combines consideration of energy and commitment cost bidding rules to refine and improve alignment between these rules. Through this process, the ISO and stakeholders have been reviewing the rules for energy and commitment cost bidding flexibility and resource characteristics definitions.

A portion of the *Bidding Rules Enhancements* stakeholder process explored the ISO's bidding flexibility rules for both energy and commitment cost bids. Section 7.2.1 of the *Bidding Rules Enhancements Revised Straw Proposal* addressed an inefficient accounting of minimum load costs when the minimum output of a generating unit or multi-stage generator (MSG) configuration is temporarily increased (*i.e.*, Pmin "re-rate").¹

The ISO's Revised Straw Proposal proposed to resolve the inefficient accounting of minimum load costs after a Pmin re-rate by calculating the actual commitment costs based on the Default Energy Bid (DEB) associated with the capacity range between the Master File (MF) Pmin and the re-rated Pmin where the incremental DEB costs associated with the actual cost of the re-rated Pmin level are added to the bid-in minimum load costs. The ISO proposes this option rather than the alternative of scaling the bid-in minimum load costs for two reasons:

- The DEB most accurately reflects the cost of incremental energy above minimum load which can vary substantially from minimum load costs.
- The 25% headroom provided for bidding minimum load costs is not appropriate to provide for incremental energy above the registered Pmin due to a re-rated Pmin because the costs for this incremental energy do not include the uncertainty associated with risk management costs, major maintenance costs and other hourly fixed costs that the 25% headroom accommodates.

The purpose of this proposal is to ensure efficient market generators are adequately modelled and therefore compensated for their minimum load costs when there are environmental or physical circumstances that change the operating conditions of the facility due to mechanical or physical attributes or limitations. Therefore, the ISO reiterates its expectation that any re-rate of the Pmin should be for operational or physical considerations and not for purposes of expanding uplift payments or avoiding appropriate economic consequences of their energy bidding practices.

¹ http://www.caiso.com/Documents/RevisedStrawProposal_BiddingRulesEnhancements.pdf

2. Changes to Revised Straw Proposal

Section 3 summarizes stakeholder positions on the ISO's Revised Straw Proposal to correct the inefficient accounting of minimum load costs (MLC) after a Pmin re-rate. This section also contains ISO responses to stakeholder comments regarding the ISO's proposal.

Section 4 shows the plan for the *Bidding Rules Enhancements* initiative stakeholder engagement portion related to the inefficient accounting of minimum load costs after Pmin re-rate. The ISO's proposal will go to the February 2016 Board of Governors meeting.

Section 5 provides background material related to this Draft Final Proposal. Found in Section 5.1, the ISO revised its example of its minimum load cost accounting after a Pmin re-rate to reflect the principle that DEB costs above the Pmin usually have a lower \$/MWh cost than the minimum load costs expressed in \$/MWh. Under Section 5.2, the ISO adds to its proposal a tariff revision to define the acceptable uses for submitting Pmin re-rates through the ISO's outage management system. Additionally, the ISO adds to the dialogue a discussion of the operational considerations of MSG resources (Section 5.3).

Section 6 provides the ISO's proposal to resolve the inefficient accounting of minimum load costs after a Pmin re-rate by calculating the actual commitment costs based on the DEB associated with the capacity range between the MF Pmin and the re-rated Pmin where the incremental DEB costs are added to the bid-in minimum load costs at the re-rated Pmin level.

3. Stakeholder Comments

Appendix A contains a summary of the stakeholder comments received on Section 7.2.1 of the Revised Straw Proposal.

4. Plan for Stakeholder Engagement

The schedule for this initiative is shown below.

| Date | Event |
|-------------------|-------------------------------|
| December 3, 2014 | Issue paper posted |
| December 10, 2014 | Stakeholder call |
| December 30, 2014 | Stakeholder comments due |
| April 22, 2015 | Straw proposal posted |
| April 29, 2015 | Stakeholder meeting |
| May 13, 2015 | Stakeholder comments due |
| November 23, 2015 | Revised straw proposal posted |
| December 03, 2015 | Stakeholder meeting |
| December 17, 2015 | Stakeholder comments due |

| | |
|-------------------|----------------------------|
| January 08, 2016 | Draft final proposal |
| January 14, 2016 | Stakeholder call |
| January 20, 2016 | Comments due |
| February 03, 2016 | Board of Governors Meeting |
| February 04, 2016 | |

5. Background

5.1. Problem Statement

The ISO market treats the minimum load cost as a fixed dollar amount representing the bid cost under the minimum load (Pmin). An inefficiency arises if the Pmin of a resource or the Pmin of an MSG configuration is re-rated to a higher MW level than registered in the Master File. The ISO market systems consider the energy cost under the re-rated Pmin the fixed bid-in minimum load cost and does not recognize the costs of rerated minimum load energy. This can lead to an unintended change in the economics of the resource and inefficient market outcome because the market does not optimize the resource based on the increased cost of the re-rated Pmin energy.

An example is provided below in Table 1. Resource A and B are the same resource except that Resource B has higher energy bid costs of \$50/MWh versus \$30/MWh (shown in row [E]). Resource B increases its Pmin from 100 MW to 185 MW. Under the ISO's current process, the minimum load cost per MWh (shown in row [F]) decreases from \$70/MWh to only ~\$38/MWh for Resource B. There is a market inefficiency since the total cost of Resource B with a re-rated Pmin seen by the market is now \$12,750 which is below its actual total cost of \$17,000 (shown in row [I]) and could displace Resource A since it falsely appears to be more economic.

The ISO explored two alternatives to correct for this inefficiency:

- Scale the MLC based on the original MLC per original Pmin MW as calculated in Table 1.
- Calculate the actual commitment costs based on the DEB associated with the capacity range between the Master File Pmin and the re-rated Pmin where the incremental DEB costs are added to the bid-in MLC at the re-rated Pmin level.

Table 1 illustrates the impact on total cost for the resource with the Pmin re-rate, Resource B, after applying the two proposed approaches. The approach scaling the MLC is shown in the column titled 'Scale MLC' where a \$70/MWh minimum cost (row [F]) is applied to the new re-rated Pmin of 185 MW (row [A]) to produce a new minimum load cost of \$12,950 per hour (row [D]). The approach integrating the DEB cost is shown in the column titled 'Use DEB' where the DEB costs associated with the re-rated energy is applied in the manner in Table 1 to produce a new minimum load cost of \$11,250 per hour (row [D]).

Table 1: Illustration of Pmin re-rate and minimum load cost

In this example, we assume the energy bid curve is the same as the default energy bid curve.

| Data | Units | Formula | Resource A | Resource B | Resource B w/ Pmin rerate | | |
|---------------------------|----------|------------------|------------|------------|---------------------------|-----------|----------|
| | | | | | Current | Scale MLC | Use DEB |
| [A] Pmin | MW | | 100 | 100 | 185 | 185 | 185 |
| [B] Pmax | MW | | 300 | 300 | 300 | 300 | 300 |
| [C] Capacity above Pmin | MW | $[B] - [A]$ | 200 | 200 | 115 | 115 | 115 |
| [D] Min load cost | per hour | | \$7,000 | \$7,000 | \$7,000 | \$12,950 | \$11,250 |
| [E] Bid cost | per MWh | | \$30 | \$50 | \$50 | \$50 | \$50 |
| [F] Min load cost / MWh | per MWh | $[D] / [A]$ | \$70 | \$70 | \$37.84 | \$70 | \$60.81 |
| [G] Min load cost / hour | | | \$7,000 | \$7,000 | \$7,000 | \$12,950 | \$11,250 |
| [H] Total bid cost / hour | | $[C] \times [E]$ | \$6,000 | \$10,000 | \$5,750 | \$5,750 | \$5,750 |
| [I] Total cost | | $[G] + [H]$ | \$13,000 | \$17,000 | \$12,750 | \$18,700 | \$17,000 |

5.2. Discussion of ISO guidance on Pmin re-rates

In coordination with the implementation of these market changes the ISO will provide further definition in the tariff for the acceptable uses for submitting Pmin rerates through the ISO’s outage management system. These will include:

- Changes due to ambient temperature
- Outages of mechanical equipment
- Managing of environmental limitations

Furthermore, the ISO tariff defines Pmin as the minimum operating capability of a generator. The ISO requires resources to register its characteristics in the Resource Data Template (RDT) which is contained in the resource’s Master File for the ISO’s optimization. According to Section 4.6.4 of the tariff, Pmin values as are all values contained in the Master File, should be based on physical characteristics and not other factors such as a resource’s economic interests². The ISO notes this Draft Final Proposal changes none of the Tariff guidance on re-rates to reflect changes due to physical or operational problems and not changes for economic reasons. The ISO tariff also specifies in Appendix A in the definition of the scheduling and logging system that the ISO makes that system available for the purpose of allowing market participants to notify the ISO when a generating unit’s properties change due to physical problems. This continues to be a necessary principle in the ISO market and the ISO will clarify this in the main part of its tariff by clarifying in section 4 or 9 that information reported in the ISO’s outage management system in addition to that provided in the ISO’s master file. Consequently, a Pmin re-rate submitted through the outage management system must be operationally based.

² Proposed changes to the language in Section 4.6.4 regarding these values is still being discussed under the Resource Characteristics issue under the *Bidding Rules Enhancements* initiative.

5.3. Operational Considerations of MSG Resources

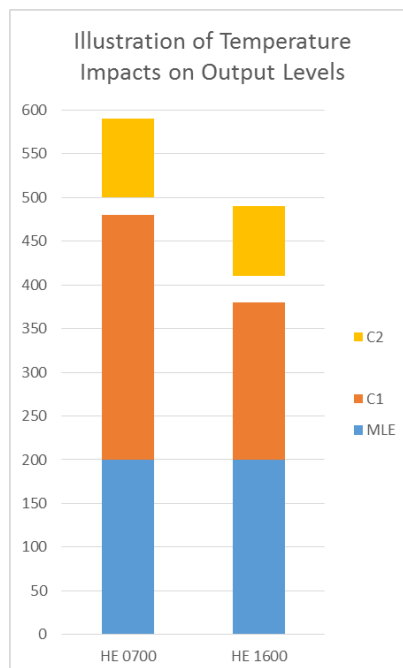
While the Pmin of a combustion turbine MSG resource remains fairly constant, its Pmax is highly influenced by the inlet temperature of the combustion air to the turbine. Through conversations with stakeholders, the ISO understands some of the factors influencing the output level of a MSG resource:

- Air quality or emissions control
- Changes in ambient temperature
- Failure of inlet cooling system, if applicable
- Steam leaks in the Heat Recovery Steam Generator (HRSG)
- Vacuum leaks in the condenser
- Sense low revolutions per minute

The ISO’s understanding is that the first two factors have the highest impact on plant output levels. Environmental compliance such as managing air quality or emissions concerns can be a main factor to a generator submitting a Pmin rerate for its combustion turbine. The re-rate would manage the minimum load level since a higher output would reach a more efficient combustion which can help manage air quality or emissions requirements placed on the plant.

As the temperature variation between hours within a 24 hour period increases, changes in ambient temperature exacerbate the impact to the Pmax level. In the desert southwest it is not unexpected for the temperate to vary by 40 degrees within a single 24 hour period which could reduce Pmax by 15% or more at the higher temperature points of the day. Figure 1 below illustrates how the lower configuration’s (C1) Pmax level fluctuates based on temperature and shows the simultaneous changes to higher configuration’s (C2) Pmin and Pmax levels.

Figure 1: Illustration of Temperature Impacts on Output Levels



The ISO requires a resource to register a single value for the maximum and minimum MW output levels in the Master File. Given this practice, MSG resources registered Pmin and Pmax values for a configuration represent the lowest minimum output level and highest maximum output level over the highest and lowest ambient temperature condition ranges for a plant. There is an expectation that daily OMS outage cards with hourly changes to Pmin and Pmax values would be the tool used to reflect actual operating conditions for a hour based on temperature forecasts.

6. Draft Final Proposal

The ISO proposes implementing the market solution modifying the MLC based on DEB costs because this approach will resolve the current market inefficiency as shown by the total cost of Resource B with Pmin re-rate and without a Pmin re-rate both being \$11,000 (shown in row [I]). By adjusting the MLC to reflect the cost of commitment under the re-rated Pmin level, the market can use the actual cost of commitment when solving for the most efficient commitment solution possible while ensuring market participants will recover the incremental costs associated with the rerated Pmin energy through ISO market revenue and bid cost recovery settlement.

The ISO’s goal is to calculate the most efficient operating point to resolve the ISO’s concern for inefficient market commitments. Because the ISO unit commitment process optimizes MSG resources by evaluating characteristics of each configuration, the ISO must use the DEB associated with the actual cost of re-rating a configuration’s Pmin with a Pmin re-rate in order to accurately model the MSG resource’s re-rated configuration. Figure 2 shows the formula used to calculate the MLC’ using the DEB integration method. The DEB costs used in this formula will be the costs associated with the change in actual costs of a resource or MSG configuration’s re-rated Pmin.

Figure 2: DEB Integration Formula

$$MLC' = MLC + \int_{P_{min}}^{P_{min'}} DEB(p)dp$$

- MLC'* Minimum load cost of the re-rated Pmin level
- MLC* Minimum load cost of the original bid-in minimum load cost
- DEB(p)* Default energy bid cost associated with the actual cost of re-rating a resource or MSG configuration’s Pmin
- dp* Change in energy

7. Next Steps

The ISO will discuss this Draft Final Proposal with stakeholders during a call on January 14, 2016. Stakeholders are asked to submit written comments by January 20, 2016 to InitiativeComments@caiso.com.

These comments will be reflected in the memo submitted as a part of the board memo for the February 2016 Board of Governors meeting.

Appendix A: Stakeholder Comments Summary

| Market Participant | Stakeholder Comments | ISO's Response |
|----------------------------------|--|---|
| Calpine Response | Supports | Section 6 discusses the ISO's proposal to integrate DEB costs into the minimum load costs of a resource. |
| Six Cities | Supports | |
| Pacific Gas & Electric | Supports and requests the ISO clarify calculation for decreased Pmin levels | The proposed DEB integration method would only apply to Pmin re-rates since the ISO does not support Pmin de-rates. |
| Southern California Edison | Supports and requests the ISO include an adjustment mechanism within the proposal to account for the additional start fuel required to attain the higher Pmin | The ISO does not see a reason a Pmin re-rate would result in additional costs to the minimum load costs than the incremental energy costs associated with the re-rated capacity. |
| Division of Market Monitoring | Supports and requests the ISO clarify Pmin re-rates can only be used for physical reasons | Section 5.2 adds to the ISO's proposal a proposed tariff revision to define the acceptable uses for submitting Pmin re-rates through the ISO's outage management system. |
| Western Power Trading Forum | Does not oppose but requests the ISO confirm implementation costs do not exceed benefits | The ISO does not anticipate excessive implementation costs and in combination with assuring improved modelling of resources with Pmin re-rates finds the benefits exceed implementation costs. |
| Northern California Power Agency | Opposes because the DEB is used to adjust generator's energy bid in event generator is deemed to have market power based on failing dynamic local market power mitigation test therefore inappropriate to use in absence of failing impact test and instead advocates to allow resource to | <p>The ISO proposes the DEB integration method rather than the alternative of scaling the bid-in minimum load costs for two reasons:</p> <ul style="list-style-type: none"> The DEB most accurately reflects the cost of incremental |

| | | |
|--------------------------|---|---|
| | rebid MLC based on re-rated capacity. | energy above minimum load or Pmin which can vary substantially from minimum load costs. |
| NRG Energy | <p>Opposes for the following reasons:</p> <ul style="list-style-type: none"> • It decreases the adjusted minimum load costs (MLC') headroom below the bid-in MLC headroom • It precludes submitting a lower MLC than the calculated MLC' when resource may want to bid below DEB <p>Instead advocates the ISO propose option 1 (scaling).</p> | <ul style="list-style-type: none"> • The 25% headroom provided for bidding minimum load costs is not appropriate to provide for incremental energy above the registered Pmin due to a rerated Pmin because the costs for this incremental energy do not include the uncertainty associated with risk management costs, major maintenance costs and various risks and do not include other hourly fixed costs that the 25% headroom accommodates. |
| San Diego Gas & Electric | No Comment | |