Scarcity Pricing

Draft Compliance Filing Language

CAISO Fourth Replacement Tariff

November 10, 2009
27.1.2 Ancillary Service Prices.

27.1.2.1 Ancillary Service Marginal Prices.

As provided in Section 8.3, Ancillary Services are procured and awarded through the IFM and the Real-Time Market. The IFM calculates hourly Day-Ahead Ancillary Service Awards and establishes Ancillary Service Marginal Prices (ASMPs) for the accepted Regulation Up, Regulation Down, Spinning Reserve and Non-Spinning Reserve Bids. The IFM co-optimizes Energy and Ancillary Services subject to resource, network and regional constraints. In the Real-Time Market, the RTUC process that is performed every fifteen (15) minutes establishes fifteen (15) minute Ancillary Service Schedules, Awards, and prices for the upcoming quarter of the given Trading Hour. ASMPs are determined by first calculating the Ancillary Services $s_{\text{Shadow}}$ $p$Prices for each Ancillary Service type and the applicable Ancillary Services Regions. The Ancillary Services $s_{\text{Shadow}}$ $p$Prices are produced as a result of the co-optimization of Energy and Ancillary Services for each Ancillary Service Region through the IFM and the Real-Time Market, subject to resource, network, and requirements constraints. The Ancillary Services $s_{\text{Shadow}}$ $p$Prices represent the cost sensitivity of the relevant binding regional $c_{\text{Constraint}}$ at the optimal solution, or the marginal reduction of the combined Energy and Ancillary Service procurement cost associated with a marginal relaxation of that $c_{\text{Constraint}}$. If the regional $c_{\text{Constraint}}$ is not binding for an Ancillary Services Region, then the corresponding Ancillary Services $s_{\text{Shadow}}$ $p$Price in the Ancillary Services Region is zero. The ASMP for a particular Ancillary Service type and Ancillary Services Region is then the sum of the Ancillary Services shadow prices for the specific type of Ancillary Service and all the other types of Ancillary Services for which the subject Ancillary Service can substitute, as described in Section 8.2.3.5, and for the given Ancillary Service Region and all the other Ancillary Service Regions that include that given Ancillary Service Region.

27.1.2.2 Opportunity Cost in Ancillary Services Marginal Prices.

The Ancillary Services $s_{\text{Shadow}}$ $p$Price, which as described above, is a result of the Energy and Ancillary Service co-optimization, includes the forgone opportunity cost of the marginal resource, if any, for not providing Energy or other types of Ancillary Services the marginal resource is capable of providing in the relevant market. The ASMPs determined by the IFM or RTUC optimization process for each resource
whose Ancillary Service Bid is accepted will be no lower than the sum of (i) the Ancillary Service capacity
Bid price submitted for that resource, and (ii) the foregone opportunity cost of Energy in the IFM or RTUC
for that resource. The foregone opportunity cost of Energy is measured as the positive difference
between the IFM or RTUC LMP at the resource’s Pricing Node and the resource’s Energy Bid price. If
the resource’s Energy Bid price is higher than the LMP, the opportunity cost is $0. If a resource has
submitted an Ancillary Service Bid but no Energy Bid and is under an obligation to offer Energy in the
DAM (e.g. a non-hydro Resource Adequacy Resource), its Default Energy Bid will be used, and its
opportunity cost will be calculated accordingly. If a resource has submitted an Ancillary Service Bid but
no Energy Bid and is not under an obligation to offer Energy in the DAM, its Energy opportunity cost is $0
since it cannot be dispatched for Energy.

27.1.2.3 Ancillary Services Pricing in the Event of a Supply Insufficiency.

In the event that there is not sufficient supply to meet an Ancillary Services procurement requirement in a
particular Ancillary Services Region in the IFM or RTM as required by Section 8.3, the applicable market
will relax the relevant Ancillary Service procurement requirement and will use the maximum Ancillary
Service Bid price permitted under Section 39.6.1.3 as the pricing parameter for determining the price of
the deficient Ancillary Service.

The CAISO will develop Scarcity Reserve Demand Curves as further described in an applicable Business
Practice Manual that will apply to both the Day-Ahead Market and the Real-Time Market during periods in
which there is insufficient supply to meet the minimum procurement requirements for Regulation Down,
Non-Spinning Reserve, Spinning Reserve and Regulation Up as required by Section 8.3. The CAISO
shall review the performance of the Scarcity Reserve Demand Curves and assess whether changes are
necessary every three (3) years or more frequently, if the CAISO determines more frequent reviews are
appropriate. When the CAISO identifies an insufficient supply, the Scarcity Demand Curve Values for the
affected Ancillary Services shall apply as set forth in this Section 27.1.2.3.

27.1.2.3.1 Regulation Down Pricing in the Event of a Supply Insufficiency.

When the shortage of supply to meet the Non-Spinning Reserve requirement in an Expanded System
Region is less than or equal to thirty-two (32) MW, the Scarcity Reserve Demand Curve Value for
Regulation Down shall be fifty (50) percent of the maximum Energy Bid price permitted under Section
39.6.1.1. When the shortage of supply to meet the Regulation Down requirement in an Expanded System Region is less than or equal to eighty-four (84) MW but greater than thirty-two (32) MW, the Scarcity Reserve Demand Curve Value for Regulation Down shall be sixty (60) percent of the maximum Energy Bid price permitted under Section 39.6.1.1. When the shortage of supply to meet the Regulation Down requirement in an Expanded System Region is greater than eighty-four (84) MW, the Scarcity Reserve Demand Curve Value for Regulation Down shall be seventy (70) percent of the maximum Energy Bid price permitted under Section 39.6.1.1.

27.1.2.3.2 Non-Spinning Reserve Pricing in the Event of a Supply Insufficiency.
When the shortage of supply to meet the Non-Spinning Reserve requirement in an Expanded System Region is less than or equal to seventy (70) MW, the Scarcity Reserve Demand Curve Value for Non-Spinning Reserve shall be fifty (50) percent of the maximum Energy Bid price permitted under Section 39.6.1.1. When the shortage of supply to meet the Non-Spinning Reserve requirement in an Expanded System Region is less than or equal to two hundred ten (210) MW but greater than seventy (70) MW, the Scarcity Reserve Demand Curve Value for Non-Spinning Reserve shall be sixty (60) percent of the maximum Energy Bid price permitted under Section 39.6.1.1. When the shortage of supply to meet the Non-Spinning Reserve requirement in an Expanded System Region is greater than two-hundred ten (210) MW, the Scarcity Reserve Demand Curve Value for Non-Spinning Reserve shall be seventy (70) percent of the maximum Energy Bid price permitted under Section 39.6.1.1. The Scarcity Reserve Demand Curve Value for Non-Spinning Reserve in an Ancillary Services Sub-Region (including an Ancillary Service System Region) shall be twenty-five (25) percent of the maximum Energy Bid price permitted under Section 39.6.1.1.

27.1.2.3.3 Spinning Reserve Pricing in the Event of a Supply Insufficiency.
The Scarcity Reserve Demand Curve Value for Spinning Reserve in an Ancillary Service Region shall be ten (10) percent of the maximum Energy Bid price permitted under Section 39.6.1.1. The Scarcity Reserve Demand Curve Value for Spinning Reserve in an Ancillary Service Sub-Region shall be ten (10) percent of the maximum Energy Bid price permitted under Section 39.6.1.1.

27.1.2.3.4 Regulation Up Pricing in the Event of a Supply Insufficiency.
The Scarcity Reserve Demand Curve Value for Regulation Up in an Ancillary Service Region shall be twenty (20) percent of the maximum Energy Bid price permitted under Section 39.6.1.1. The Scarcity Reserve Demand Curve Value for Regulation Up in an Ancillary Service Sub-Region shall be ten (10) percent of the maximum Energy Bid price permitted under Section 39.6.1.1.

27.1.2.3.5 Opportunity Cost in LMPs for Energy.

In the event that there is insufficient supply to meet an Ancillary Services procurement requirement in a particular Ancillary Service Region or Sub-Region, the Ancillary Services Shadow Prices will rise automatically to the Scarcity Reserve Demand Curve Values in that Ancillary Service Region or Sub-Region. LMPs for Energy will reflect the forgone opportunity cost of the marginal resource for not providing the scarce Ancillary Services consistent with the CAISO’s co-optimization design.

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CAISO Tariff Appendix A

Master Definitions Supplement

**Scarcity Reserve Demand Curve**  
A demand curve used to clear the Ancillary Services markets when there is insufficient supply in an Ancillary Service Region or Sub-Region to meet Ancillary Services minimum procurement requirements.

**Scarcity Reserve Demand Curve Values**  
Fixed percentages of the maximum Energy Bid price permitted under Section 39.6.1.1 reflected in the Scarcity Reserve Demand Curve that the CAISO uses to calculate Ancillary Service Shadow Prices for Regulation Up, Spinning Reserve, Non-Spinning Reserve and Regulation Down from which the CAISO determines Ancillary Service Marginal Prices when there is insufficient supply in an Ancillary Service Region or Sub-Region to meet an Ancillary Services minimum procurement requirement.