Straw Proposal

Changes to Bidding and Mitigation of Commitment Costs

March 16, 2010

Changes to Bidding and Mitigation of Commitment Costs

1 Introduction

The new market launched by the California Independent System Operator (ISO) in April 2009 commits generating units based on their Start-Up (SU) and Minimum Load (ML) cost elections that must be in place for six months. Many market participants have stated that this has caused their resources to be committed more frequently than good utility practice would dictate, to be held at minimum operating levels and to be de-committed. Participants observe that this causes extra wear and tear on their generating units, uses up fixed numbers of unit starts and emissions allocations, and makes it difficult for unit owners to recoup their operating costs.[1]

In order to try to alleviate these issues, the ISO undertook a two-phased approach to changing SU and ML bidding restrictions. The first phase, which was implemented in July 2009, enabled generation owners to modify their SU and ML elections and to switch between the registered and proxy cost options for SU and ML more frequently. The second phase initially proposed to implement frequent SU and ML cost bidding, and a mechanism for resources to capture opportunity costs for units that face use limitations.

In September, 2009, the ISO proposed that the stakeholder process on this Phase 2 portion of the initiative be extended over a longer period of time than originally proposed. This reopening of the SU and ML stakeholder initiative re-evaluates the preliminary conclusions of the previous iteration of the *Straw Proposal*, and broadens the range of topics considered in light of the MSG designs. This initiative is renamed "Changes to Bidding and Mitigation of Commitment Costs" to reflect the fact that we will also addresses issues around the transition costs associated with MSG units. Starting with this *Straw Proposal*, the ISO will work with Stakeholders to reach a final policy design for consideration by the ISO's Board of Governors in May of 2010.

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1 There are instances in which additional cycling of resources may take place due to the fact that the ISO does not currently have multi-day unit commitment. Participants have expressed a need to manage and control their resources' frequency of cycling until the ISO has implemented this functionality. To this end, the ISO is considering a process enhancement that would allow a market participant to inform the ISO that it intends to self-commit its resource to bridge the resource across hour ending 24 (HE24) in cases it was not committed across HE24. With this information the ISO can flag the resource as being online for the next day-ahead market (DAM). This will avoid the situation in which the resource is cycled offline for minimum downtime in the case when it is economic to keep the resource online. The ISO anticipates that this enhancement will help address some of the observed cycling. This enhancement was discussed on March 16, 2010 in the Market Performance and Planning Forum. The presentation for that discussion is posted at the following link: http://www.caiso.com/2756/27569a323ba80.pdf. The relevant discussion begins on slide 18.

2 Criteria for Evaluating Potential Solutions

- Proposed changes should be mindful of the costs of implementation, both for stakeholders and for the ISO;
- The benefits and costs of market changes should be weighed along with other, competing enhancements to market systems; and
- The proposal for changing the way commitment costs are bid into the ISO markets, and how they are mitigated, should consider the need for flexibility along with the need for fair and reliable market function.

3 Background

3.1 Start-Up and Minimum Load

The new market design bases the decision to commit a unit on that unit's Start-Up and Minimum Load costs. Market participants bidding in generating resources submit their SU and ML costs to the ISO Master File where those values are static for 30 days. The Start-Up curve can be up to three segments, the dollar values of which correspond to hot, warm, and cold starts of the generating unit. Minimum Load is single dollar *per* MWh value that is incurred for hours in which the ISO dispatches the unit to its Pmin and the unit reaches that output level.

Market participants can specify one of two options for the SU and ML values they have in the ISO Master File: either the proxy cost option or the registered cost option, which are described further below.

Proxy Cost Option

The proxy cost option is comprised of two elements: an indexed value that changes daily depending on the natural gas price (or, for units for which that is not applicable, on the energy price), and an operations and maintenance (O&M) adder. The main advantage of this option is that it provides generation owners protection from fuel-price risk.

The O&M adder is a fixed $/MWh value that is added to the proxy cost value. That value is $4/MWh for combustion turbine or reciprocating engine technology, and $2/MWh for all others. There is also the option to negotiate a value up to $6/MWh with the Independent Entity.

Registered Cost Option

As an alternative to the proxy cost option, market participants can employ the registered cost option which enables them to submit SU and ML values up to 200% of the proxy-cost calculated value. The advantage of this option is that it gives the market participant bidding that resource into the market the ability to specify costs for the unit that take into account their knowledge of and experience with that unit. The registered cost option does not, however, meet the needs of many market participants as they are averse to being exposed to fuel-price risk.

3.2 Multi-Stage Generating Unit Transition Costs

Multi-Stage Generating (MSG) units are capable of operating in multiple configurations due to their generating technology. The MSG modeling functionality, which is scheduled to be launched on October 1, 2010, will enable market participants with MSG units to bid in the various configurations of those units separately. Thus, the market will determine the optimal configuration in which to have the unit operate, and will optimize the transitions between configurations. Associated with transitions between configurations are transition costs (TC). The optimization will consider the costs of a transition when determining whether or not to move an MSG unit from one configuration to another. Just as high SU and ML costs could be used to economically withhold a generating unit from the market, an MSG unit owner could economically withhold one or more of the unit's configurations by specifying high costs for the transition from one configuration to another. For this reason, the mitigation of TC is now included in this initiative, which is renamed to indicate the inclusion these commitment costs with the familiar SU and ML commitment costs.

4 Proposal for Changes to Start-Up and Minimum Load

As noted in the previous section, the ISO currently offers market participants two options for providing the market with a resource's start-up and minimum load costs. The proxy cost option is composed of two pieces – an O&M adder, and an indexed fuel price (or energy price for non-gas units) – and the level of the proxy cost option determines the upper limit of the registered cost option. The registered cost option enables a resource owner to submit start-up and minimum load costs up to 200% of the proxy cost option value.

The ISO proposes to enable stakeholders to pick either the proxy cost or registered cost option for Start-Up or Minimum Load independently. For example, a generating unit may elect to have the registered cost option for Start-Up, and the proxy cost option for Minimum Load rather than having to pick the same option for both SU and ML. This is proposed to enable participants to more closely represent their actual costs associated with SU and ML.

Additionally, the ISO proposes to allow market participants to submit daily bids for SU and/or ML for a resource provided that they have elected the proxy cost option and those daily bids are below the calculated proxy cost value. This functionality has been requested by stakeholders, and is consistent with the policy behind the design of the SU and ML costs mitigation.

The ISO does not propose any more frequent bidding scheme for commitment costs other than the proposal noted above, and the option to change Master File values each 30 days. The ISO comes to this proposal after much deliberation about the merits and drawbacks of daily SU and ML bidding. Participants opposed to frequent bidding cite concerns about the potential to abuse market power. Participants in favor of daily bidding cite the need to recoup legitimate SU and ML costs without locking into a registered cost value for a month and thus being exposed to fuel price risk.

Instead of more frequent bidding, and in response to stakeholder feedback, the ISO proposes to modify the components of the proxy cost option. In order to meet the needs of participants to recoup legitimate costs while still hedging fuel price risk, the ISO proposes to expand the proxy cost option to include additional cost components.

4.1 Proposal for Modifying the Proxy Cost Option

In order to better meet the needs of market participants, the ISO proposes to add an element to the proxy cost calculation, and to refine the existing components. The ISO proposes the refinements, described below, to the fuel price index component of the proxy cost calculation, and to the O&M component. In addition to these refinements, the ISO proposes an opportunity cost component for use-limited resources.

Bidding of Operations & Maintenance Costs

The ISO proposes to offer Market Participants the option of either the O&M proxy adder, or a registered O&M value. The proxy O&M value will simply be the same adder to Start-Up costs that is used under the current design.

As a refinement to this process, the ISO offers as a proposal the option for generating resource owners to register a unit-specific cost for O&M for their generating units to be used as an adder to Start-Up costs. This process by which a resource-specific O&M cost will be calculated will mirror the approach used by PJM Interconnection, and will supplant the current option to negotiate O&M costs with the Independent Entity. The registered O&M value will be reviewed and updated, if changed, annually. While this process may be onerous, it would give those market participants who find that their unit's O&M costs are not adequately covered by the proxy O&M value to provide the ISO with resource-specific information.

It should be noted that comparisons with data from PJM that describe the average values of the submitted, resource-specific O&M costs in their market are very similar to those the California ISO currently uses for its default O&M adder values.[2] PJM Interconnection prescribes a rigorous and detailed process by which their market participants develop and submit *per*-MWh values based on the specific model and age of each of their generating units.[3] To validate these submissions by its market participants, PJM relies on a wealth of historical data on the various units and unit types in its market. According to the 2008 State of the Market Report prepared by its market monitor, this process has yielded estimated operation and maintenance expenses on the order of $6.47/MWh for combustion turbine plants, and $2.80/MWh for combined cycle plants. In the 2009 State of the Market Report,

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[2] As noted in Tariff §39.7.1.1.2, the default O&M value is $4/MWh for generating units with combustion turbine or reciprocating engine technology, and $2/MWh for units with other types of generating units.

[3] Information on PJM's O&M submission process is available at the following link: http://pjm.com/~/media/documents/manuals/m15.ashx

O&M costs for combustion turbine plants were $7.09/MWh, and $3.07/MWh for combined cycle plants. [4,5]

Refinement to the Proxy Cost Option Natural Gas Prices

Currently the ISO uses prices for two gas delivery geographies: North of Path 15, and South of Path 15. In the North, the PG&E CityGate price is used, and in the South, the SoCal Border price is used. Therefore, generators to the North of Path 15 all receive the CityGate price, while generators to the South of Path 15 all receive the Border price. The ISO proposes to introduce more spatial granularity in its gas prices used in the proxy cost option. This will mitigate concerns about the inability of generator owners to be accurately compensated for their natural gas costs. Correspondingly, it will result in greater equity among geographic locations. This is due to the fact that, in general, the PG&E CityGate price is higher than the gas price at Malin which would be the analogous delivery point to the SoCal Border. Also in general, the price at SoCal CityGate is higher than the SoCal Border price.[6]

The ISO therefore proposes to introduce two additional gas delivery points: Malin for NP15, and SoCal CityGate for SP15. Each gas-fired generating unit would be linked to one of these four delivery points and, in the event that the market participant elects the proxy cost option for an element of commitment costs (Start-Up, Minimum Load, or Transition Costs) for the resource, the applicable gas price will be used. The ISO requests feedback from market participants on the appropriate geographical boundaries to determine (1) which generators in NP15 receive the Malin price and which receive the PG&E City Gate price, and (2) which generators in SP15 receive the Border price and which receive the SoCal City Gate price.

Please note that the usage of different gas delivery points pertains only to the instances in which monthly gas prices are employed to calculate the proxy cost option in the Master File on a monthly basis. The addition of gas delivery points for purposes of the proxy cost option does not change the methodology of calculation for default energy bids, nor does it change the methodology for Reliability Must Run (RMR) start-up and minimum load costs which are based on a gas daily price.

Please note that the ISO does not propose to specifically modify the manner in which it accounts for the transport of natural gas in its proxy cost calculation. To do so

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4 These estimates were provided by a consultant to the market monitor and are based on quoted, third-party contract prices. The figures were established by Pasteris Energy, Inc. and they compare favorably with actual operation and maintenance costs from similar PJM generating units. Actual data from the PJM O&M submission process were not available at this writing of this *Straw Proposal.*

5 The 2008 and 2009 State of the Market Reports for PJM Interconnection can be found at the following link to Monitoring Analytics: http://www.monitoringanalytics.com/reports/PJM_State_of_the_Market/2009.shtml

6 Please see Appendix A to this Straw Proposal for the results of an analysis of these price differences.

would be administratively burdensome as these costs are essentially resource-specific. Rather, the ISO proposes to maintain its current methodology which entails using three natural gas transport regions based on the service territories of PG&E, SCE and SDG&E.[7] The ISO then applies a 10% adder to these general values to accommodate additional transport costs that may not be reflected in those three regions' transport cost values. However, please note that by having more granularity in the natural gas deliver points (*i.e.*, by adding Malin and SoCal CityGate), the gas prices used in the proxy cost option will necessarily better reflect the cost of <u>delivered</u> natural gas.

Opportunity Cost Component for Use-Limited Resources

The opportunity cost component of the proxy Start-Up value is more variable, and more difficult to pin down. However, there is an existing methodology. The ISO Tariff[8] provides Stakeholders with the option to submit a DEB for negotiation and these negotiations are conducted by an Independent Entity. That entity, Potomac Economics, has developed a methodology currently used for negotiated default energy bids (DEB) that could be adapted for valuing the opportunity cost of using up one of a fixed number of starts for use-limited resources. Potomac summarizes their methodology in the following way:

> The forward price duration curve is used to calculate the opportunity cost of a generator that has a use restriction. The opportunity cost is determined by the anticipated value of energy in the use limitation period determining the set of hours which maximizes the value of the energy limitation. The least valuable hour, of the set of highest priced hours, represents the opportunity cost of the resource. Theoretically, offering a higher or lower price than the price of energy in this hour would reduce the maximum profit obtainable by the resource.[9]

The ISO proposes that this methodology be adapted to capture the opportunity cost of starting up a resource with a use-limitation. In the Use Limited Supply Plans submitted to the ISO for use-limited resources, market participants provide the ISO with the maximum number of starts available by resource by month. The expected duration of a unit's run time will be calculated by taking the number of hours available for the month divided by the number of start-ups available. (If that calculation yields an average run-time greater than 24 hours, a 24-hour run time will be used.) The methodology described above will be used to calculate the value of a run-hour using the number of available hours for the month. That value will be multiplied by the expected run-time to yield the opportunity cost of starting up the resource. This start-up opportunity cost would be re-calculated on a monthly basis incorporating the applicable month's Use Limited Supply Plan for each use-limited resource.

Note that this methodology would not conserve limited starts within a particular day or week, for examples. Use limitation plans are updated on a monthly basis, and the expected number of allowable starts is likewise a monthly figure. The ISO is receptive to calculating

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7 Within the SDG&E and SCE fuel transport territories, there are tiered natural gas transport costs which are applied to generators depending on the quantity of natural gas they use.

8 CAISO Tariff §39.7.1.3

9 From calculation methodologies and descriptions provided by Potomac economics

opportunity costs based on use limitation plans with weekly information, however. To achieve this, market participants would need to submit monthly use plan updates as they do currently, with the addition of weekly break-outs of the information in that plan.

As an example of the monthly opportunity cost calculation, suppose a use-limited resource has a maximum of 120 run hours for a given month, a maximum number of MWh for the month of 15,000, and estimates 10 starts for that month. The expected run-time is 12 hours, and the average output over those hours is 125 MWh.[10] Thus, the amount of energy produced in a given run would be 12 hours times 125 MWh or 1,500 MWh.

Since a price duration curve is generated by ranking forecasted prices[11] by the number of hours in which they occurred, the opportunity costs obtained by this method would increase with each start-up. So, as monthly start-ups become scarcer, the opportunity cost value would increase. Or is the forecasted price of energy for the high price expected hours and thus this would opportunity cost would be applied to other hours and would help reduce the chances the resources gets started during low priced hours. If the applicable energy price resulting from this methodology were, for example $12/MWh, multiplying that by the 1,500 MWh would render a start-up opportunity cost of $18,000.

A market participant could specify that the opportunity cost of a start-up of their use-limited resource be evaluated in this manner, or may submit a monthly "*per* start" opportunity cost less than the value calculated using this methodology.

5 Proposal for Mitigation of MSG Transition Costs

Multi-Stage Generating (MSG) units are capable of operating in multiple output ranges due to their generating technology. The MSG modeling functionality, which is scheduled to be launched on October 1, 2010, will enable market participants with MSG units to bid in the various configurations of those units separately. Thus, the market will determine the optimal configuration for the unit in a given interval, and will optimize the transitions between configurations. Associated with transitions between configurations are transition costs (TC). The optimization will consider the costs of a transition in determining whether or not to move an MSG unit from one configuration to another. Just as high SU and ML costs could be used to economically withhold a generating unit from the market, an MSG unit owner could economically withhold one or more of the unit's configurations by specifying high costs for the transition from one configuration to another. For this reason, the mitigation of TC is now included in this initiative, which is renamed to indicate the inclusion these commitment costs with the familiar SU and ML commitment costs.

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10 Note that the average output resulting from this calculation could actually be more than the output of the unit. In this case, it would be assumed that the resource would run at full capacity for those run hours. Also, note that the expected run time could exceed 24 hours in which case an expected run time of 24 hours would be used.

11 Historical energy prices and historical fuel prices are used to calculate an implied heat rate. Forward energy and forward fuel prices are used to create a conversion factor that is applied to the historical implied heat rates.

It is important to note that the mitigation of MSG transition costs will be implemented along with the implementation of MSG modeling functionality, on October 1, 2010. The timeline for changes to start-up and minimum load will be determined based on the complexity of the final policy adopted, and on the other market enhancements being implemented.

Transition Cost rules under the Proxy and Registered Cost options

The ISO's proposal is that the transition costs be governed by two rules that bound the sum of transition costs. In order to describe these rules, some new terminology is required.

- maxSU: dollar value for starting up from offline to its highest (or most expensive) operating configuration. The ISO recommends that this value be negotiated with the Independent Entity and that it be based on objective measures such as heat rates. This value will be submitted to the ISO within the resource data template (RDT) for the MSG resource and may be updated annually; and
- maxSU(MWh): the maximum MWh output of the configuration associated with maxSU.

The following two rules are designed to place boundaries around the costs in the transition matrix without dictating the specific nature or components of the transition costs. The rationale for this design is twofold – it will provide MSG unit owners the freedom to accurately describe their transition costs while enabling the ISO to avoid onerous validation of costs for each transition. Within the boundaries provided by the rules below, market participants can determine the distribution of costs across the various transitions associated with their specific MSG resources.

- Rule 1: The sum of the following costs will be constrained to be between 50% and 150% of maxSU:
  - the initial start-up cost;
  - upward transition costs along any feasible, unidirectional path up to maxSU(MWh); and
  - downward transition costs along any feasible, unidirectional path back to offline.
- Rule 2: for any feasible transition from configuration (i) to configuration (j), the sum of the transition costs across any feasible, unidirectional transition path from configuration (i) to configuration (j) will be constrained to be between 50% and 150% of the transition cost from (i) to (j).
  - For example, suppose the transition from configuration 1 to configuration 4 is feasible and the transition cost is $8,000. Transition costs from configuration 1 to configuration 2 equal to $6,000 and from configuration 2 to configuration 4 equal to $7,000 would violate the rule. $6,000 + $7,000 = $13,000 which is greater than 150% of $8,000.

Note that the inclusion of the downward costs reflects the fact that, although shut-down costs are not explicitly accounted for in the ISO data or systems, they are implicitly included in the start-up values provided by market participants. It is simple to implicitly include shut-down costs in the SU value since it is obvious that a resource started up will eventually be shut down "along the same path." This doesn't work as cleanly for MSG resources which will likely have configuration-level Start-Up costs that are different from the costs associated with moving between on-line configurations. The ISO therefore proposes the explicit inclusion of downward transition costs in the MSG transition matrix. Not allowing the specification of downward Transition Costs would result in those costs being forced into the upward Transition Costs, even though there is no reason to assume that the downward path along which the resource is dispatched is not necessarily the same as its upward transition path. To be consistent with the treatment of shut-down cost for non-MSG resources, the ISO still expects the shut down cost for a configuration to be embedded in the start-up cost of the particular configuration. The transition cost is purely for the costs incurred by a transition from one on-line configuration to another on-line configuration.

Downward Transition Costs are those expenses incurred by moving from a higher output configuration to a lower one. For example, when shutting down a gas turbine and heat recovery steam generator (HRSG), there are potential lay-up costs on the HRSG, and there will likely be chemical costs, chiller lay-up costs, and the expense of purifying additional HRSG make-up water. When shutting down a gas turbine, there are auxiliary costs for cranking the unit during its purge cycles. Additionally, units that have been shut down requiring auxiliary power to run shutdown equipment, as well as auxiliary power to run a cranking motor to prevent additional stress on the unit and to prevent the unit from going on an extended lock-out .

Note that the details of the transition cost rules depend on whether the MSG unit has elected the registered or proxy cost option for its start-up value. Whichever option is chosen for start-up costs will also apply to transition costs as they are analogous to one another. In the case of registered start-up and transition costs, the values are static and not linked to the daily gas price except to the extent that the 200% cap is relative to the proxy cost option calculated using the monthly gas index. If the proxy cost option is chosen, then the transition costs "float" with the daily gas price just as the start-up value does under the proxy cost option.

Once changes to SU and ML are finalized and implemented, then the details of these rules will change to reflect those enhancements. More detail on the initial implementation of these rules is provided in the appendix to this paper.

Transition Costs and Bid Cost Recovery

The ISO proposes that Transition Costs will be included as costs when an MSG resource's revenue and costs are considered for the purpose of determining eligibility for Bid Cost Recovery (BCR), and when calculating the value of BCR for the MSG resource. Within the eligible commitment period defined as the ISO commitment period related to the configuration into which the MSG resource is transitioning, the settlement intervals in which the resource reached the Pmin of the target configuration will be eligible for BCR. For example, consider a one-hour commitment period with six 10-minute intervals. If the MSG resource transitioning from configuration 1 to configuration 2 does not reach the Pmin of configuration 2 until the fourth 10-minute interval, then the TC are only considered for BCR for the fourth, fifth, and sixth intervals of that commitment period.

A three-percent (or 5 MW, whichever is greater) tolerance band will be applied around the resource's operating level when determining whether or not the resource has achieved the Pmin of the target configuration. The tolerance band will be determined at the resource level, *i.e.*, it will be based on the resource's Pmax. Without this tolerance band, a unit that transitions from one configuration up to the Pmin of another configuration could otherwise end up not being paid at all for intervals in which it was running slightly under the target configuration's Pmin. Note that energy not delivered will not be paid; the tolerance band merely ensures that MSG units are not unduly penalized for small variations in metered values on the edges of their configurations' operating ranges.

6 Process and Timetable

These changes to the restrictions and functionality of bidding SU, ML and O&M costs are proposed as a direct result of feedback from stakeholders and the MSC. The ISO appreciates that collaboration, and looks forward to its continuation as we move forward in the stakeholder process. A Market Surveillance Committee meeting in which the elements of this proposal will be discussed will be held at the ISO on March 19, 2010. A conference call to discuss the proposal is planned for March 24, 2010. Although comments or questions on this proposal are welcome and encouraged at any time, formal written comments are due on April 2, 2010.

Although the schedule below indicates that the policy design that results from this initiative is to go to the ISO Board of Governors in May 2010, a delay to the July Board meeting may be necessary depending on the availability of time in the May Board meeting agenda. ISO Management is evaluating this potential schedule change at this time, and a Market Notice will be issued to inform participants of any schedule change for this initiative.

March 16	*Straw Proposal* posted
March 19	Market Surveillance Committee Meeting
March 24	Conference call
April 2	Stakeholder comments due
April 7	*Draft Final Proposal* posted
April 14	Call to answer any remaining questions
April 22	Final SH comments due
May 17-18	CAISO Board of Governors

With questions, comments, or concerns, please contact Gillian Biedler at (916) 608-7203 or *via* e-mail at gbiedler@caiso.com.

Appendix A: Comparison of natural gas delivery point prices

In order to understand the potential impact to market participants of adding the Malin and SoCal City Gate natural gas deliver point prices to the proxy cost option, the ISO has done a comparison of the differences between the two Northern California delivery points, and the two Southern California delivery points. The analysis is for the six-week period from mid-January to the end of February 2010, and is based on the Platts gas price index.

The results of this analysis for this six-week period, in $/MMBtu, are as follow:

- The price at Malin is consistently lower than the price at PG&E CityGate. On average, the Malin price is $0.31 less than the price at PG&E CityGate. This is about 5% of the PG&E CityGate price.
- While the Malin and PG&E CityGate prices are different, they are highly correlated. The correlation coefficient is 0.87 where perfect correlation between the two datasets would yield a correlation coefficient of 1.0.
- Both the Malin and PG&E CityGate prices have a standard deviation of $0.23 for the time period considered here. This fact, along with the high correlation coefficient, demonstrates that the pattern of prices at these two Northern California delivery points is very similar, with the mean of the CityGate price levels simply being higher.
- On average, the SoCal CityGate price is $0.01 less than the price at the SoCal Border. This is about 0.1% of the SoCal CityGate price.
- The correlation coefficient for prices at the two Southern California delivery points is 0.99.

While this analysis is limited to six weeks of data, it does yield empirical results that are consistent with the knowledge and expectations of those who work closely with gas price data in California.

As an aside, we'd like to note that, to mitigate for possible volatility due to the thinness of the natural gas market at a given delivery point, the ISO uses a combination of gas price indices. This analysis looked simply at the Platt's index, and so it could be based on data that exhibit more fluctuation than those the ISO would actually use for the proxy cost option fuel component.

Appendix B: MSG Transition Cost mitigation rules

The mitigation of MSG transition costs will be implemented along with MSG modeling functionality in October 2010. Enhancements to SU and ML will be implemented on a later timeline depending on the complexity of the final adopted policy design, and on other competing market enhancements being implemented.

As a result of this timing consideration, the transition cost mitigation rules described below are based on the current design of start-up costs, registered and proxy.

Definitions

SU	Dollar cost of going from offline to the lowest output level of the resource which is assumed to be the lowest configuration
maxSU	Dollar cost of going from offline to the most expensive output level of the resource
Pmin(c(i))	Lowest operating level for configuration i
Pmax(c(i))	Highest operating level for configuration i
Pmin	Minimum operating level of the MSG resource as a whole
maxSU(MWh)	Maximum MWh output at the most expensive configuration (not necessarily the same as Pmax)
c(1)	Lowest operating configuration. Associated with Pmin
gas(m)	Monthly gas price index
gas(d)	Daily gas price index
om	Default Operations & Maitenance adder
trans	Fuel transport costs + 10% adder

Transition Costs under the Registered Cost Option

SU <= 200% * [$(om)/MWh]*Pmin + [$gas(m)/MMBtu]*(MMBtu/MWh)*Pmin

maxSU is negotiated with the Independent Entity (Potomac Economics)

Rule 1: 50% of maxSU <= SU + SUM{over (i) from (2) to (N)}TC[c(i-1) to c(i)] +
SUM{over (i) from (N) to (2)} TC[c(i) to c(i-1)] <= 150% of maxSU
where N is the highest cost configuration, *i.e.* the config associated with maxSU
Note that shut down costs are included in the rule as well since SU costs implicitly include shut down costs

Rule 2: 50% of TC[c(i) to c(j)] <= SUM{TC along a feasible, unidirectional path from c(i) to c(j)} <= 150% of TC[c(i) to c(j)]
for any feasible transition, c(i) to c(j)

<u>Transition Costs under the Proxy Cost Option</u>

SU = [$(om)/MWh]*Pmin + [$(gas(m)+trans)/MMBtu]*(MMBtu/MWh)*Pmin

maxSU is negotiated with the Independent Entity

<u>Rule 1</u>: 50% of maxSU <= SU + SUM{over (i) from (2) to (N)} TC[c(i-1) to c(i)] + SUM{over (i) from (N) to (2)} TC[c(i) to c(i-1)] <= 150% of maxSU

where N is the highest cost configuration, *i.e.* the config associated with maxSU,
SU = [$(om)/MWh]*Pmin + [$(gas(m)+trans)/MMBtu]*(MMBtu/MWh)*Pmin, and
TC[c(i-1) to c(i)] = [$(gas(m)+trans)/MMBtu]*MMBtu
TC[c(i) to c(i-1)] = [$(gas(m)+trans)/MMBtu]*MMBtu
Again, note that shut down costs are included in the rule since SU costs implicitly include shut down costs
Also, note that the monthly gas price is used for this rule rather than the 1-day price. The 1-day price is used in SIBR, but not in the MF. In order to avoid impacts to SIBR, the MF value will be used.

<u>Rule 2</u>: 50% of TC[c(i) to c(j)] <= SUM{TC along a feasible, unidirectional path from c(i) to c(j)} <= 150% of TC[c(i) to c(j)] for any feasible transition, c(i) to c(j)