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April 3, 2008

Kimberly D. Bose, Secretary
Federal Energy Regulatory Commission
Office of the Secretary
888 First Street, NE
Washington, DC 20426

**RE: Docket No. AD08-4-000**
**Capacity Markets in Regions with Organized Electric Markets**

Dear Ms. Bose:

Attached please find an informational filing made by the American Forest & Paper Association ("AF&PA") with regard to the Financial Performance Obligation proposal. The Financial Performance Obligation is to be discussed at the upcoming Technical Conference in this docket.[1] This document brings together relevant portions of AF&PA's comments filed in the Commission's Competition ANOPR (Docket No. RM07-19-000) along with some limited additional material that attempts to answer some of the most frequently asked questions about the proposal. We hope that this organization of the material, much of which is already in the public record, will provide the basis for constructive discussion at the Technical Conference regarding both the technical aspects of the proposal, and the underlying economic rationale.

This informational filing contains some examples of potential settlement mechanics which we hope will be useful as illustrations of the concepts involved. However, we recognize that the actual development of settlement algorithms is an exercise in mathematical modeling that we have not had the resources to explore thoroughly. We hope by these examples, therefore, only to illuminate basic principles of settlement. We do not recommend extensive debate of alternative settlement algorithms at this time. Algorithms which may better effectuate implementation of these general concepts can be developed by those with greater expertise and

[1] The Technical Conference is scheduled for May 7, 2008.

resources in this area if the FPO approach is pursued. Such algorithms would, we recognize, need to be tailored to the specific settlement scheme in place in each RTO. We look forward to the opportunity for further discussion of these ideas with interested parties and the Commission.

Sincerely,

*/s/ Donald J. Sipe*

Donald J. Sipe
Counsel to AF&PA

Enclosure
CC: Service List

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# FINANCIAL PERFORMANCE OBLIGATION

## I. DESCRIPTION OF FINANCIAL PERFORMANCE OBLIGATION.

Financial Performance Obligations would require every unit which receives a capacity payment to financially guarantee the delivery of energy to the real time market at or below a specified strike price in any hour in which it is dispatched by the RTO to provide service. The obligation is financial in nature, and is not a requirement that physical delivery of energy from the unit must be made in any hour. The unit may fulfill its obligation either by operating to provide an amount of energy up to the capacity it is receiving capacity payments for in any hour, or it may purchase energy from the real time market at its nodal price and effectively re-sell it through the settlement system at or below the strike price. Under the FPO, load pays the lesser of the clearing price or strike price in any hour. Amounts collected from load are paid to all generators based upon their load ratio share obligation in each hour. In addition, every generator is charged or paid the clearing price for any deviation from its load ratio share in any hour. In any hour a unit is not dispatched, and the price is below the strike price, this is a wash. However, if a unit fails to supply in any hour where the price is above the strike price, it effectively pays the difference between the strike price and clearing price for each MWhr deviation from its load ratio share for that hour.[2]

Under any capacity mechanism such as RPM, in which the cost of new entry is set by reference to a particular proxy unit, the strike price of a Financial Performance Obligation should be set at the marginal production cost per MW, as established by the applicable heat rate for the proxy unit and a properly indexed fuel price. Under the Financial Performance Obligation approach, ratepayers pay the cost of capacity (including the appropriate return on investment) plus the marginal operating costs of the proxy unit. If the economic theory underlying RPM, LICAP, and FCM is sound, this should return sufficient amounts to recover operating costs plus capital costs and spur new investment.

The Financial Performance Obligation is designed to link the revenue streams from capacity and energy to better reflect the product that has value to consumers. Under an FPO approach, LMP continues to drive efficient dispatch and manage congestion. But under an FPO

[2] Generator ratio share =10MW. Strike price $100MW. Clearing price $200MW. Generator is paid by load $1,000 (10 x 100), Generator only produces 9MW, generator pays clearing price ($200) for 1MW deviation. Generator nets $1000-$200=$800 or (9MW x 100) –1MW (CP 200 – SP 100).

approach, LMP is a tool for allocating the risk of and/or preference for dispatch among suppliers who each have a settlement obligation to supply energy to load at a specific fuel indexed strike price in return for receiving a competitively bid capacity payment. From the consumer point of view, this recreates an important aspect of the obligation to serve that traditional return on rate-base (now, capacity payments) was meant to secure. Further, it recreates in the organized market structure the common sense cost relation that would exist in any rational bilateral contract for long term supply[3] between capacity and energy components.

The Financial Performance Obligation serves the same function, albeit more efficiently, as the current Energy and Ancillary Service ("EAS") adjustment under PJM's RPM and the Peak Energy Rent ("PER") adjustment under the New England FCM construct. Under all capacity market constructs approved by the Commission, the purpose of an explicit capacity payment is to replace "missing money" from the energy market, i.e. money necessary to support the capital costs of units in excess of inframarginal rents. The theoretical underpinnings of each of these capacity markets is that the energy markets (for a variety of reasons) do not allow collection of sufficient scarcity rents (i.e. money in excess of the marginal operating cost of a peaker) to fully support necessary capital recovery. By pegging capital recovery to the cost of a peaker, scarcity rents (the amount the peaker needs to recover in excess of its operating costs) are no longer necessary to the market. If suppliers were to receive both scarcity rents and capacity payments, they would double recover their costs.

Thus, the establishment of an explicit capacity payment makes it necessary to adjust out monies in excess of the operating costs of a peaker from the energy market. Under the FPO, the strike price is set at the operating costs of a peaker. The FPO is best viewed as a real time, unit specific, and precisely accurate EAS adjustment mechanism to assure that ratepayers do not pay twice for capacity. However, the timing and settlement mechanics of the FPO provide additional benefits which are not available through standard EAS mechanisms. These benefits arise from the effects of shifting supplier and consumer frames of reference for economic decisions in a fashion which incents long-term hedging, demand response, strong operational incentives for on-peak performance, and market power mitigation. The primary driver of these additional efficiencies is not any "mathematical" increase in risk of loss to suppliers. The Financial Performance Obligation, in fact, is mathematically identical to a perfect EAS adjustment or PER adjustment. The theory behind each of these adjustments is to take the same amount of money out of supplier compensation in return for their receipt of a capacity payment. The efficiencies under an FPO approach arise from the framing effects of the adjustment.

Under standard economic theory (often termed Expected Utility Theory), the prospect of "not earning" a hundred dollars in the energy markets should be equivalent in any supplier's mind to the risk of losing a hundred dollars in the same market. Thus, it should (theoretically) make no difference whether suppliers who need to recover $1,000 in capital costs, are given $900 up front in a capacity payment, and told that they have an "opportunity" to earn the other $100 in the energy market so long as they perform (standard EAS), or whether they are given $1,000 up front and told that if they don't perform they will lose $100 in the energy market

[3] No reasonable business man would agree to a fixed price for either capacity or energy in a bundled contract while leaving the other component solely in the discretion of the supplier.

clearing process (the structure of the FPO). In either case, the supplier is at risk for not recovering its full capital needs if it fails to perform in the energy market. There is no difference in the risk of non-performance. In either case, if the supplier fails to perform it recovers only $900 out of the $1,000 it needs. However, framing this prospect as a risk of loss (the FPO model) as opposed to an opportunity to gain (the EAS/PER approach) has powerful incentive effects.

For a full discussion of the economic theory underlying this phenomenon, we refer readers to Appendix 1, which contains a discussion of select portions of the literature on these topics and their application to the current LMP markets. Although we will refer to these framing effects where appropriate throughout this discussion, we leave detailed analysis of their underpinnings to the Appendix.

AF&PA believes the FPO will alter the reference point for evaluation of long term contracting opportunities. Under an FPO, suppliers should no longer view the clearing price as a risk free entitlement, but rather as an opportunity with some potential downside to be hedged through appropriate forward contracting or investment in capital infrastructure. When scarcity is no longer an unmitigated short-term benefit to suppliers, investment strategies designed to maximize long-term profitability may not be so constrained by the current evaluation period aggravation of loss aversion under LMP. This may serve to bridge the current valuation gap between buyers and sellers and thereby facilitate a greater level of long term contracting at both wholesale and, where state law permits, retail.

## II. FREQUENTLY ASKED QUESTIONS.

### 1. How is the Strike Price set?

**Answer:** The Strike Price is set based on the operating characteristics of a hypothetical peaker ("the proxy unit"). The proxy unit has an identifiable heat rate and fuel type. Using the heat rate and a fuel index, the marginal operating costs for the proxy peaker unit generate a single energy price, "the strike price", that is applied to every unit receiving a capacity payment. Every unit receiving a capacity payment has an obligation to provide energy at or below the strike price up to the amount of its capacity commitment in any hour it is dispatched by the ISO. If the unit is unavailable to deliver energy, it must replace the energy it is otherwise obligated to deliver from purchases in a real time market.

### 2. Is There any Experience Establishing a Strike Price in Organized Market Settings?

**Answer:** Yes. PJM, ISO-NE and New York each currently set the equivalent of a strike price as a methodology for calculating the EAS and PER adjustments. Conceptually, the FPO strike price is no different than these. The discussions surrounding exactly what heat rate should be used, or what unit operating characteristic should be used to set the strike price have already been had in each of the regions. In concept, such prices are already being calculated and could simply be adopted for use under the FPO. The major difference in the FPO is not in the

calculation of the strike price or in the amount of money to be recovered by the adjustment, but in the timing and accuracy of the adjustment.

**3. Why is the FPO a More Accurate Adjustment Than Current EAS or PER Mechanisms?**

**Answer:** Current EAS mechanisms contain several undesirable features which render them ineffective as hedges for load, inappropriate as pricing mechanisms, poor restraints against market power abuse and a deterrent to long term contracting. These problems arise from three main design flaws all of which are corrected under the Financial Performance Obligation approach.

First, the EAS approaches currently in place are based on the use of historical and/or estimated data which invariably fail to represent unit or even class specific actual revenues in the delivery year. Layering the hypothetical characteristics of a proxy unit over a historic or (even less accurate) a projected load and price duration curve and manipulating these figures into an estimate of what a proxy unit "should have" or "might" earn based on a presumed forced outage rate and host of other assumptions, while better than not protecting consumers at all, produces numbers which in addition to being contentious, highly sensitive to small changes in methodology or assumptions and burdensome to calculate, are also guaranteed to be "wrong" when applied to any particular unit.

Moreover, EAS adjustments based on historic information are not a hedge, but simply an inaccurate, partial refund mechanism. Consumers are not actually hedged against price volatility in the current market (or even presented with an actual refund). Rather, suppliers are presented with an "adjustment," usually known in advance, to a capacity curve or price which they then incorporate into any bid. The longer the historic period used, the more arbitrary the adjustment becomes either as a measure of expected revenues or as a reflection of current costs. In the case of new entrants, even if the adjustment were accurate, their capacity price is being adjusted to "refund" revenues other people earned in prior years.

Second, the timing of the adjustment defeats its purpose as a hedge. Known in advance,[4] the adjustment simply becomes an input into every supplier's next set of profit maximizing capacity bids, raising these as far as the curve allows to compensate. Thereafter, in every hour, units still seek to maximize energy revenues because (1) higher prices will always increase profits and (2) next years' EAS adjustment is a communal average that will not net out extraordinary profits by any particular supplier if there is some way these can be earned.

Third, and related to the second point above, unlike a true hedge (like a bilateral contract) the EAS adjustment leaves the price of capacity and the price of energy to be determined in two independent transactions each of which offers a clearing price, profit maximizing, endowment inducing, risk free chance to get the highest price paid to anyone in any hour or year. Presenting these two decision points as entirely independent, frames the decision on each component in a

[4] The New England PER is an exception, it is set after the capacity auction clears, but before the delivery year.

fashion, which as described in Appendix 1 of this paper 1) over values each clearing price entitlement; 2) over weights any potential loss from selling at a potentially lower price and 3) under values any potential gain from selling at a potentially higher price.

By contrast, the Financial Performance Obligation exactly nets out, on a unit-by-unit basis in real time, the appropriate adjustment to assure that ratepayers in fact receive safe and reliable service at just and reasonable rates.

**4. Does the Financial Performance Obligation Approach to Adjusting for Scarcity Rents Increase Supplier Risk?**

**Answer:** No.

As discussed above, the FPO changes the timing of the adjustment, but the amount is exactly equivalent to the amount that should be recovered under current EAS or PER adjustments. Under current EAS adjustments, monies received by units in excess of the strike price are netted out of the capacity payment. If the unit fails to perform in real time, it will not receive full capital recovery because it will not have earned monies which have been deducted from its capacity payment previously. Under the FPO, it is exactly the same dollars which are netted out (albeit as described above, more accurately). The risk is therefore mathematically identical. Framing the risk, however, as a risk of losing $100.00 rather than a risk of not earning $100.00 has powerful incentive effects. It is this "framing effect", not any increase in actual risk, that causes suppliers to feel they must respond to this potential "loss". This is precisely the point.

Some suppliers have argued that because of this mathematical equivalence, there is no need to have an EAS adjustment mechanism at all. These theorists have argued that the competitive market can be relied upon to force suppliers to discount their capacity bids by expected energy revenues. For the reasons explained fully in the appendix, there is little to support this view of how competitors presented with a series of profit-maximizing opportunities each of which may be open to a certain level of market power, actually behave. However, if this paradigm were accurate, then suppliers have no reason to complain that they cannot accurately estimate their chances of energy revenues in the market (i.e. the "risk" of the FPO), and efficiently include the same in their capacity bids (which will no longer be discounted by implied EAS adjustment). The argument that suppliers will be forced to inflate their capacity bids to ridiculous levels in response to estimating this "risk of loss" while claiming, on the other side, that competition (and the same competitors) can be trusted to estimate "perfectly" the same risk framed as an "opportunity to earn" is not terribly persuasive.

**5. Does the Strike Price Represent a Cap on the Energy Market?**

**Answer:** No.

The Day Ahead and Real Time energy markets continue to operate as they always have with suppliers bidding into those markets to reflect their preference for dispatch. The Strike Price caps the revenues received from load in real time (which is exactly what the EAS

adjustment is designed to do after the fact) but does not prevent a generator or supplier that provides more than its load ratio share of energy during an hour from receiving payments in excess of the strike price for any amount over their load ratio share. Those excess payments, however, are not collected from load, but are collected instead from suppliers who have failed to deliver their load ratio share in any hour (i.e. have failed to perform on peak when called upon by the ISO/RTO). In essence, suppliers performing in excess of their Load Ratio Share Obligation receive the strike price for the excess energy provided from load, and the difference between the strike price and the clearing price for the energy provided from the defaulting supplier.

In Appendix 2 and 3 to this discussion paper, we provide illustrative examples of FPO settlement principles. Appendix 2 provides a simplified illustration of real-time settlements. Appendix 3 is a preliminary illustration of combined Day Ahead and Real Time settlement. We caveat these examples with the observation that AF&PA has not had time or resources available to develop full settlement manuals. These calculations are only meant to serve as conceptual illustrations to assist in understanding the principles involved. We recognize that the development of actual settlement manuals, protocols, and formula will require more detailed technical attention from those with more expertise in the area of settlements.

**6. Is the FPO a Replacement for Current Capacity Products?**

**Answer:** No.

The FPO replaces only the current method for netting out scarcity revenues under current capacity constructs. Although strong incentive effects arise from an FPO structure, the underlying capacity product construct remains the same.

**7. Does the Fact that it is Called a "Financial Performance Obligation" Mean That Suppliers No Longer Need to Back Capacity Commitments With Physical Assets?**

**Answer:** No.

The rules regarding backing capacity bids with physical resources in each market would remain unchanged. The settlement obligation incurred by a supplier under the FPO is financial in nature, in the sense that it will adjust revenues received based upon performance. However, in order to receive capacity payments in the first place, performance must be backed by units with appropriate physical characteristics. Again, the FPO replaces only current EAS or PER adjustment mechanisms for financially adjusting out revenues earned through scarcity pricing.

**8. Does the FPO Remove the Need for "Availability Adjustments" to Reduce Payments For Capacity From Suppliers That Don't Perform?**

**Answer:** No.

The FPO is intended only to ensure that suppliers do not collect capacity payments twice, once through an energy payment, and again through a capacity payment. Availability

adjustments, on the other hand, are designed to assure that consumers get the service they pay for (as opposed to simply not paying for it twice). The FPO removes only that portion of capacity payments which would be recovered through scarcity rents. The whole reason there is a capacity construct at all is because of the belief that there are not enough scarcity rents in the energy market to compensate suppliers for their capital costs. If this is true, then a supplier could miss every single hour of the year and still be paid a portion of its capacity payment. Since there is not enough "money" in scarcity rents to recover capital costs, deducting scarcity rents should still leave the supplier with a portion of its capacity payment. This is in fact what happens with EAS adjustments. Under the EAS adjustment, the availability adjustment reduces revenues only from that portion which the supplier does not receive from the energy market. The same effect would occur with the FPO. It is true that by framing the EAS adjustment as a potential loss, the FPO creates powerful incentives for generators to perform on peak. It is untrue, however, that those incentives make it just and reasonable for ratepayers to pay a residual capacity payment to units who do not perform.

**9. Does the FPO Reduce Incentives for Demand Response by Reducing Volatility in the Energy Market?**

**Answer:** No.

Any reduction in volatility in the Real Time energy market caused by the FPO is due to constraints upon incentives to exercise market power. This is not the type of volatility that Demand Response was meant to counter. Rather, the anti-trust laws and Commission oversight were meant to counter such volatility. Legitimate volatility caused by true scarcity of resources will still be reflected in the energy market, although supplier's incentives to artificially manipulate such volatility will be greatly diminished. Provided markets are designed to allow comparable participation by Demand Response Resources in the energy and capacity markets, the FPO will actually enhance Demand Response opportunities.

Further, the provision of an effective energy hedge to load may enable the Commission to design markets that do not rely on capped energy prices at all, thus increasing the ability to use scarcity pricing. Because the FPO effectively eliminates recovery of scarcity prices from consumers in Real Time, rather than after the fact, the political problem of sending consumers "price signals" in the multiple thousands of dollars, and then reassuring them that it is alright to pay this amount because they will "get it back" in a lower capacity cost later, is avoided.

Customers who believe they would like to participate in the energy and capacity markets can become Demand Resources and take on the responsibility of facing Real Time prices without the protection other customers receive. Those less-able to respond through short-term actions receive the appropriate long-term price signal for energy efficiency measures and other Demand Response implementations which reduce energy consumption across a broader range of hours. Although there is still price volatility up to the operating costs of the peaker (the strike price) faced by all consumers, it may also be possible to operate a Real Time energy market with unconstrained pricing for those consumers with Demand Response opportunities suited to that more robust climate.

**10. How Does the FPO Create Enhanced Opportunities for Demand Response?**

**Answer:** The FPO allocates the short-term risk of market volatility to suppliers. When confronted with the risk of non-performance, suppliers should be incented to hedge this risk more powerfully since it is framed as a potential loss rather than as simply a foregone opportunity for gain. Faced with a prospect of a "loss" (an out-of-pocket expense) for not performing in an hour, the availability of Demand Response Resources which could reduce load has precisely the same value to a supplier as the opportunity to buy alternative supply in the hour of exposure. At the present time, suppliers have no incentive whatsoever (because they have no perceived risk from market volatility) to cultivate Demand Response as part of a portfolio to hedge exposure to Real Time price volatility. Any Demand Response Resource which could permanently reduce load over expected peak hours, and consume, instead, in an off-peak lower cost period, or which could respond quickly to dispatch instructions in the event of a generator trip would have value as part of an energy hedging strategy to a supplier.

**11. Why is it Important to Place the Short-Term Risk of Energy Price Volatility on Suppliers Rather Than Customers?**

**Answer:** It is an axiom of market design that the most efficient way to allocate risk is to give it to the party that can hedge it most effectively. Unlike suppliers, the only choices available to consumers to hedge this risk are demand response, entering into long-term contracts or, paradoxically, regulation. For the reasons discussed above and in Appendix 1, the current market does not properly support either Demand Response or long-term contracting. Suppliers, on the other hand, have a multitude of avenues readily available to hedge this risk. It is true that consumers will pay the price for this hedge in capacity clearing prices, but that price should be far lower and less disruptive to society (for all the reasons discussed above), than going without the hedge or leaving this risk with consumers. Importantly, most of the mechanisms available to suppliers to hedge this risk are the precise types of market behavior which will lead to greater long-term contracting and assure resource adequacy.

One of the most obvious ways to hedge the risk of price volatility is with additional physical supply adequate to cover the obligation undertaken for the receipt of capacity payments. Because suppliers now have a direct interest in hedging price volatility, there is a market created for physical supply and financial bilateral trades on a long term basis which match the capacity obligations undertaken by suppliers. Assuming RTO's will continue to require the purchase of capacity to meet ICR, this means suppliers have a direct financial incentive to plan for and support additional infrastructure sufficient to hedge the risk of excessive price volatility (i.e. scarcity). By creating the physical, financial, and product infrastructure to efficiently allocate and hedge the risk of market volatility among suppliers, any particular supplier's exposure to such risk should be reduced. As these hedging tools become more common at the wholesale level, risk premiums associated with long-term contracts for consumers should also go down. No longer will LMP represent only a series of short-term decision points and profit maximization opportunities for suppliers. LMP will also represent a potential "risk of loss" that can be effectively hedged.

If the current short-term dynamic in the LMP market is not changed, it is doubtful that

consumers will ever be able to effectively hedge this risk in a reliable fashion through long-term contracting. A full discussion of this issue is contained in Appendix 1, but the Commission should be aware that unless suppliers share some responsibility to hedge future scarcity, there are truly few alternatives left open to customers as customers to assure reliability. Because individual customers are unable to efficiently plan or finance the long-term capital projects needed to supply their own load due to economy of scale issues, this industry has traditionally been regulated. The most effective response for consumers who need to assume this risk is to aggregate their loads, nominate a particular supplier (usually a utility) to build specific capacity to meet their future needs, and to enter into a long-term contract for service which guarantees to the supplier recovery of investment and to consumers cost-based rates. If the market continues to put the full risk of scarcity on consumers, this may be the only practical response. Proposals to establish Power Authorities and other governmental procurement options in response to a perceived lack of supplier incentive to hedge scarcity and provide reliability at reasonable prices, are rational responses if the market truly leaves this problem purely as a consumer risk to hedge. Because of the long-term contracting dynamics discussed in the Appendix and the economies of scale which have always mandated some form of joint procurement by consumers to the extent they are asked to hedge the Resource Adequacy risk, regulation is an economically rational response to a competitive market that does not allocate some risk of scarcity to the supply side. Allocating some portion of the risk of scarcity to suppliers in a fashion which incents them to respond may, therefore, be necessary in order for competitive models to have a fighting chance at providing resource adequacy at reasonable cost. The FPO may not solve all of the incentive problems of current market designs, but it is a step in the right direction.

# APPENDIX 1

## THE IMPORTANCE OF DECISIONAL DYNAMICS IN THE DEVELOPMENT OF MARKETS

Too often the discussion of "incentives" in market structures is overly simplistic. There is an unstated assumption, that an incentive can be represented as an amount of money which can be either gained or lost and that gains and losses can be summed using a simple linear calculus to determine net incentives for or against particular behaviors. Thus, if the predicted sum of a series of short-term transactions is X with a verified probability of Y, then a long term contract which yields XxY adjusted by an appropriate discount rate, should be just as attractive as the series of short term transactions to any rational market participant. In short, when discussing market structures and the "incentives" they supposedly provide to various players, we often assume such quantities are linearly additive, largely independent of context, and temporally neutral. In what follows, this simplified model of economic decision making will be referred to as "expected utility theory." Expected utility theory has been widely assumed to represent an accurate model of economic decision making. In fact, however, it has been repeatedly demonstrated that decision makers do not operate in accordance with its percepts in many real market contexts.

One of the more interesting exchanges at the Commission's hearings on competitive markets was that between Professor Hogan and Mr. Thilly regarding the economic incentives surrounding Valentines Day. At a certain point, frustrated by the uncritical assumption that the market "must" be working because normative theory predicted that it "ought" to, Mr. Thilly told the story of a putative recent analysis by academic economists that had clearly demonstrated that money was the "most efficient" Valentine's Day gift. Dr. Hogan's response was that, for the record, he always gave chocolate.[5] Although this exchange was good natured, it made several important points which were implicitly recognized by everyone at the hearing. The first is that "everyone knows" market behavior is motivated by more than expected utility calculus. The second that, in fact, expected utility theory routinely predicts behaviors that no one truly believes will occur. The third is that even classically trained economists understand this, as Dr. Hogan emphasized. Yet while everyone at the hearing "got the joke" and recognized its relevance to the discussion, no one seemed to know what to do with the punch line.

This reticence may be due, in part at least, to a fear that there is no constructive use to be made of such a recognition; that if we "lose our faith" in the simplistic calculus of profit maximization in a vacuum postulated by expected utility theory we are left, well . . . with just the vacuum. This anxiety is unfounded. At least since the late 70's, there has been a growing body of economic theory and analysis that provides a useful critique of expected utility theory on the basis of empirical observation and experiment.[6] This work has demonstrated conclusively that

[5] Commission Conference on Competition in Wholesale Power Markets, Docket No. AD07-7-000 Transcript, 155, 13-14 (February 27, 2007).

[6] Of particular relevance to this discussion is the development by Daniel Kahneman and Amos Tversky of an empirical and descriptive model of decision making under risk called "Prospect Theory."

expected utility theory does not accurately describe or predict the actual behavior of even highly sophisticated market participants in many real world situations. Basic axioms of expected utility theory, including but not limited to 1) The substitution axiom[7] 2) Description invariance[8] 3) Linearity of probability[9] and 4) Dominance[10] have all been shown to be predictably and systematically violated by decision makers in certain situations. These observed violations, however, are not random; they turn out to be just as predictable as Professor Hogan's preference for giving chocolate on Valentine's Day. Because of this, acknowledging and anticipating these departures from "rational choice" can lead to market designs that produce predictably better results than could be achieved by pretending market behavior is actuated only by the axioms of expected utility theory.

A good example of how reliance on expected utility theory can be unhelpful is the now longstanding debate about the effects of LMP on long term contracting. There is now general agreement that the electricity markets would function better and provide more reliable service if there were more long term contracting taking place. Consumers have often argued that one of the chief impediments to long term contracting is the institution of LMP pricing. They have claimed that the "guarantee" to every supplier in every hour of the highest cleared bid by any supplier (LMP) makes suppliers reluctant to enter into long term contracts at reasonable prices. Suppliers, on the other hand, say they would be willing to enter into long term contracts, but consumers are simply unwilling to pay a reasonable price. Traditional expected utility theory provides only the unhelpful obfuscation that, clearly, one side or the other of this debate must be "right". This is because, under expected utility theory there should be some "value" out there that both sides, if they were "rational", should be able to agree on how to calculate. In the case of a contract whose term is shorter than the build cycle, this value is roughly the simple sum of the expected short term clearing prices for the expected term. If there is risk associated with the estimates of short term prices, that too should be amenable to reasonable assessment. That some reasonable parties may differ from others on these assessments is not the issue; in a competitive market the collective wisdom of many players all making their own estimate should find the "right" number. Under expected utility theory there is "no rational explanation" for "sellers", as a class, to have a consistently different view than "buyers", as a class, of the value of long term

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*See*, Kahneman, Tversky, Prospect Theory: An Analysis of Decision Under Risk, Econometricia, 47:2, 263-91 (1979) and Advances in Prospect Theory, *Journal of Risk and Uncertainty*, 5, 297-323 (1992).

[7] A.K.A. "cancellation." This posits that if a person prefers an outcome B, to outcome A, then they should also prefer alternative outcome scenario "B or P" to "A or P".

[8] This posits that presented with two descriptions of the same outcome (e.g. a. five dollars now and ten dollars on Friday or b. two dollars plus three dollars now, no money until Friday, then ten dollars on Friday) their preferences for that outcome compared with some other outcome (e.g. twenty dollars in two weeks) should not change.

[9] This posits that the utility of any prospect is increased equivalently by raising the probability of its occurrence from .1 to .2 or from .25 to .26.

[10] If one option is better than another in one state and at least as good in all other states, it is the dominant option and should invariably be chosen.

contracts. Yet this anomalous result has become the standard in the organized markets. [11] Relying only upon expected utility theory, the commission is powerless to frame a remedy, so instead, must simply blame one side or the other (or both) for not understanding the "true economic situation". Thus, either 1) suppliers are irredeemably greedy and asking for too much money or 2) consumers are hopelessly naive and do not understand the new realities of escalating fuel costs and too long neglected transmission infrastructure.

By adopting a descriptive approach to the problem, however, the commission can move beyond this and 1) identify the consistent patterns in market behavior that have led to this impasse and 2) use that knowledge to construct market mechanisms to eliminate the impasse. Looking at the long term contracting impasse from the standpoint of descriptive economics, we conclude it is the expected result given certain, well documented behavioral tendencies in real world economic decision making working in conjunction with current market structures.

### 1. A Descriptive Economic Analysis of the Current LMP Pricing Regime as it Effects Valuation of Long Term Contracts.

As noted accurately by several commentators, there is a valuation dynamic associated with real time LMP pricing that hinders formation of long term contracts. This dynamic has been questioned, not based on any evidence of acceptable levels of long term contracting, but because it is supposedly "irrational" based on expected utility theory's view of how market participants will act. In fact, several well documented and persistent valuation dynamics lend not just plausibility, but almost an aura of inevitability to the failure of LMP (as currently structured) to create a reasonable platform for long term contracting.

The first of these is loss aversion. Described in the early 1980s by such authors as Tversky and Kahneman, it is now a well documented fact of economic decision making under risk, that losses loom larger than gains in real world utility calculus. Second, despite being a violation of a central tenet of expected utility theory[12], there is ample empirical evidence that the way an economic choice is framed can influence how the choice is perceived (e.g. either as a gain or a loss) and therefore effect the choice made. One of these framing effects is known as

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[11] "Customers and sellers differed sharply, however, on the nature and extent of any impediments to long-term contracts. Customers argued that suppliers are reluctant to sell power under long-term contracts at a price attractive to those customers. They argued that the presence of liquid spot markets gives suppliers an incentive to sell most of their output on a daily or hourly basis, not through long-term contracts. By contrast, suppliers and their representatives said they are willing to sign long-term power contracts but asserted that buyers simply do not want to pay the long-term cost of power. In particular, they alleged that customers do not want to pay enough to finance new generation and any needed transmission investment. With respect to existing assets, suppliers argued that customers often want a price pegged to a particular fuel (e.g., coal or nuclear), even if that price does not reflect the long-term market value of electric power."

ANOPR at 87, *supra* (footnote omitted).

[12] Expected utility theory assumes description invariance: equivalent formulations of a choice problem should give rise to the same preference order.

the Endowment Effect[13] under which recipients of a good or benefit tend to value that good or benefit disproportionately. Such disproportionate valuation substantially impacts their willingness to trade or give up the endowment in return for other goods or money. Third, there are "evaluation period"[14] effects which arise from the frequency with which decision makers evaluate performance and outcomes. In this regard, LMP's hourly and daily evaluation protocols likely contribute to a form of economic myopia that consistently skews valuation assessment of long-term contracting opportunities. Evaluation period effects can be significant for firms facing such "irrational" pressures as quarterly reporting of gains and losses, where a single bad quarter can cost a career or damage stock prices even when such fluctuations are relatively meaningless in terms of long term profitability. [15] Analyzing the "incentives" created by LMP in light of the above, the current lack of long term contracting in the organized markets would not have been difficult to predict.

**a.) The LMP "Reference Price" and the Effects of Loss Aversion.**

Locational Marginal Pricing guarantees to each seller the highest price received by any seller in any given interval. Further, one does not need to find any particular customer[16] in order to be guaranteed this price or exert any particular effort to determine an appropriate price to bid.[17] Under LMP, transaction costs are comparatively minimal. The minimization of transaction costs may create its own inertia, but far more importantly for our purposes here, is the

[13] The endowment effect (or *divestiture aversion*) is a hypothesis that people value a good or service more once their property right to it has been established. In other words, people place a higher value on objects they own relative to objects they do not.

Thaler, R. Towards a Positive Theory of Consumer Choice. *Journal of Economic Behavior and Organization*, 1, 39-60 (1980).

[14] Benartzi, Thaler, Myopic Loss Aversion and the Equity Premium Puzzle, *Quarterly Journal of Economics*, 110:1, 31 (1995).

[15] Analysis of the asymmetrical bias in corporate reporting surrounding gains and losses which evince considerable creative accounting 1) to avoid having to report a small loss in favor of concocting even a smaller gain and 2) the tendency to account for as many losses as possible in any single quarter when it is determined there is no way to avoid reporting a loss in order to "get it over with." The fact that there is no "rational" explanation for this behavior under expected utility theory does not stop it from occurring with the predictability of clockwork. *See also* Professor Ross L. Watts, Conservatism in Accounting Part I: Explanations and Implications, *American Accounting Associates*, 207-221 (September 2003).

[16] Contrast this situation to the gas market where although there is an index price, the index is based on reported bilateral transactions between particular buyers and sellers.

[17] Unless 1) one believes one is the marginal unit, or 2) that the marginal unit price will be below your cost of production .This of course does not count for purposeful attempts to manipulate the market price by bidding at significant increments over cost of production or similar behavior by participants in true scarcity situations where the tolerance of the political process would, absent much greater demand response than is available at present, presumably be the only break on pricing in an unconstrained market.

knowledge that by staying with the real time LMP or entering into contracts whose price terms simply pass through LMP results,[18] one cannot be faulted in any particular interval for "losing money". Few marketing employees would expect to be fired for "not making" a million dollars, but could very easily lose their positions if it could be shown they had "lost" a million dollars.[19] The market dynamics created by LMP create a perception that in any hour where a contract price is not as high as a particular hour of LMP, a loss has been suffered. This perception does not need to be rational to be a significant motivator of behavior. The over-weighting of losses as compared to gains means that in any evaluation of a long term contract, even if the expectation were that losses would be balanced by corresponding periods where the contract price exceeded the clearing price, those losses (as opposed to the gains) would be overweighted and require a risk premium out of proportion with the value being offered.[20]

One of the major insights of descriptive economics is that decision makers evaluate risk from particular reference points rather than in terms of overall wealth. In particular, the carriers of value are net changes, either negative or positive, from a particular reference point. Further, from any particular reference point, losses are weighted more heavily than gains when evaluating prospects.[21] This means that a potential loss of $1.00 is given more evaluative weight than a potential gain of $1.00. Under expected utility theory, by contrast, people are "supposed" to weight a dollar (either positive or negative) as equivalent to any other dollar. LMP creates a reference "price." Although the price is not known in advance, what is known is that, in any

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[18] One of the complaints consumers often make is that although "long term" contracts are available, many of these simply use the market clearing price plus a markup as their pricing terms rather than providing a stable fixed price in the long term commitment as past bilateral contracts would have.

[19] Or as articulated by Kahneman, Knetsch and Thaler:

> The striking difference between WTA and WTP [Willingness to Accept-Willingness to Pay] in these studies probably reflects the large difference in the responsibility costs associated with voluntary assumption of additional risk, in contrast to a mere failure to reduce or eliminate existing risk. The asymmetry between omission and commission is familiar in legal doctrine, and its impact on judgments of responsibility has been confirmed by psychological research (Ritov and Baron, forthcoming). The asymmetry affects both blame and regret after a mishap, and the anticipation of blame and regret, in turn, could affect behavior.

The Endowment Effect, Loss Aversion and Status Quo Bias, Daniel Kahneman, Jack L. Knetsch and Richard H. Thaler, *Journal of Economic Perspectives*, 5:1, 193-206 (1991).[Text Added to Quote]

[20] We have noted above the contention of consumers that where long term contracts are available, they are over priced and the corresponding contention from suppliers that consumers do not want to pay the "value" of long term contracts. The point here is not to claim that either side in this debate is right or wrong about the true valuation of long term contracts, rather it is to demonstrate that because the parties frame the decision differently, their valuations can be expected to differ such that that no amount of "experience" or education is likely to bring them around to a common valuation.

[21] As a simple intuitive example of this, most people find 50/50 bets of Win $100/Lose $100 distinctly unattractive.

hour, that price will reflect the highest bid cleared and thus, every supplier, except, perhaps the marginal one, knows it will receive more than its cost in every hour it operates under LMP. For purposes of this analysis, it does not matter whether the supplier expects to receive a great deal more, or just barely more than its cost. In either case, LMP provides a reference point from which long term contracting opportunities are evaluated.

**b.) LMP Hourly Evaluation Contributes to Myopic Loss Aversion and Hence Higher Risk Premiums.**

Unfortunately for long term contracting opportunities, however, that evaluation does not take the form of a simple arithmetic summation of expected clearing prices over the term of the contract (although, even in this context, potential losses would be overweighted compared to gains). For LMP embodies an evaluation period effect which presents any long term contract as a series of risky prospects, rather than as a single gamble. This can be expected to drive up risk premiums beyond what would otherwise be the case.

This effect has been termed "Myopic Loss Aversion" by Shlomo Benartzi and Richard Thaler (1995)[22] and has been postulated as an explanation for the well documented historic phenomenon of the premium required by inventors in the stock market as opposed to the lower returns for bonds. Looking at the historic performance of the two markets, stocks have outperformed bonds by a very large margin over the past century. As noted by Benartzi and Thaler, even assuming "plausible levels of risk aversion", "the combination of a high equity premium, a low risk free rate, and smooth consumption is difficult to explain."[23] It is clear that stocks are more volatile than bonds. But under expected utility theory, this short term volatility should be "rationalized" into a simple arithmetic sum (like the series of LMP prices) over the anticipated term of the investment. Under such an analysis and any reasonably long term investment framework (e.g. 10 years), the premium demanded for stocks (or, conversely, the inanity of bond holders) is "irrational" even granting loss aversion. However, by presuming an evaluation period shorter than the expected investment horizon, the premium is explainable in terms of simple loss aversion.

Frequent evaluations of loss or gain have a multiplicative effect on the impact of loss aversion. Put another way, unpacking any single risky prospect into a series of risky prospects of equivalent value increases the premium demanded to overcome loss aversion. In the case of stocks, although most investors remain in the market for a long time, they typically evaluate performance on a quarterly or yearly basis. Because stocks are volatile, frequent evaluations provide frequent opportunities to observe changes in value from the reference point of the previous year or quarter. Some of these will invariably be negative. Because, as noted above, it is these changes in value from a reference point that are significant drivers of economic decision-making, any negative change from a previous year or quarter is experienced as a "loss" and is overweighted as against any period showing a gain. Hence, these frequent evaluations multiply

[22] Myopic Loss Aversion and the Equity Premium Puzzle, *Quarterly Journal of Economics*, 110:1, 73-92 (1995).

[23] *Id* at 73.

the effects of loss aversion even when performance over the expected investment horizon is positive. Interestingly, even "knowledge" that one is investing for the long term does not considerably dampen this effect.[24]

The hourly and daily evaluation period dynamic created by LMP, frames any long term contract as a series of risky prospects each of which is subject to the disproportional weighting of losses. As with stocks, the shorter the evaluation period, the greater the risk premium demanded to compensate for short term volatility. Importantly, increasing the volatility of this market in the short term would, under this analysis, have the likely result of exacerbating this dynamic unless other changes recommended by AF&PA are adopted. Proposals to raise or eliminate the bid caps could aggravate the long term contracting dilemma faced by consumers under LMP if not coupled with other market reforms.

### c.) LMP as an Over-Valued Endowment.

Finally, compounding this already significant dynamic, is the over valuation of the guarantee of the highest price in any hour offered by LMP because of the "endowment effect." [25] Suppliers who are "handed" a guarantee of the highest price paid to any provider in any hour, can be expected to place an disproportionate value upon that entitlement. Receiving the highest cleared bid is perceived as a default entitlement, and the only risk of failure to perform is the correspondingly undervalued forgone gain of receiving it. In short, LMP creates a framework for economic decision making under which the ability to receive the market clearing price is an over-valued endowment, and any risk of downward deviation is viewed as a "loss" and weighed disproportionately against the potential gain of receiving more than that price. Further, because LMP frames economic decision making in an hour by hour settlement process, it creates an evaluation period effect that increases risk premiums. From the buyers side, not surprisingly, while the LMP market is undesirably volatile, the risk premiums quoted to avoid this volatility seem disproportionate to the risk covered.

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[24] "The reason for this is that in prospect theory, the carriers of utility are assumed to be changes in wealth, or returns, and the effect of the level of wealth is assumed to be second order. Therefore, every year Y will solve her asset allocation problem by choosing the portfolio that maximizes her prospective utility one year away, just as X does. In this sense, when we estimate the evaluation period of investors below, we are also estimating their implicit time horizons.

Of Course, in a model with loss aversion, the more often an investor evaluates his portfolio, or the shorter his horizon, the less attractive he will find a high mean, high risk investment such as stocks."

*Id* at 307 (footnote omitted).

[25] *See* Loss Aversion in Riskless Choice: A Reference-Dependent Model, Amos Tversky and Daniel Kahneman, *Quarterly Journal of Economics*, 106:4, 1039-61, (1991), The Endowment Effect, Loss Aversion and Status Quo Bias, Daniel Kahneman, Jack L. Knetsch and Richard Thaler, *Journal of Economic Perspectives*, 5:1, 193-206 (1991).

### 2. Moving Towards a Solution.

Again, the issue is not whether one side or the other in the debate is mistaken in their valuation of long term contracting opportunities. As the Commission has aptly noted, it cannot command parties to enter into long term contracts based on what it believes rational people should agree to. But neither can, or should, the Commission ignore the actual behavior of market participants, rational or otherwise, based upon modes of analysis that do not accurately reflect that behavior.

Although the jury is still out, the Commission appears to have incorporated many of the same incentive features into its recent formulations of capacity markets. Under each of these regimes, (RPM, FCM, and ICAP), clearing prices (unlike price indices in the gas market which are actually the product of averaging a series of bilateral transactions) represent an entitlement to everyone who bids and may create the same dynamic of over weighting any departure from that entitlement on the down side, while under valuing any chance of a gain beyond it. For these reasons these designs may produce the same results for long term contracting. The forward nature of some of these contract structures, which mandates some form of forward procurement, will likely be the backbone of any long term contracts, but is unlikely to be supplemented by much independent long term contracting so long as a no-lose, minimal transaction cost auction clearing price is the default entitlement for capacity suppliers in the market. In determining the length of commitment for a standard product, the Commission should consider the effects of any evaluation period its settlement rules for capacity may entail.

These observations do not imply that the Commission needs to abandon either LMP or structures like RPM in order to have long term contracting take its proper place in the future supply pantheon of the organized markets. LMP has several well-documented benefits including encouraging efficiency in dispatch, correctly pricing congestion, and encouraging suppliers to bid at marginal cost. Yet both LMP and current resource adequacy mechanisms are embedded in an overall market structure under which they acquire the undesirable characteristics described above. If other market structures could condition these effects, LMP could continue to deliver the benefits of efficient dispatch, congestion management, and minimizing transaction costs without hindering long term contracting.

AF&PA proposes a specific market structure or product called a Financial Performance Obligation which we believe addresses some of these undesirable dynamics. The Financial Performance Obligation is designed to link the revenue streams from capacity and energy to better reflect the product that has value to consumers. Under an FPO approach, LMP continues to drive efficient dispatch and manage congestion. But under an FPO approach, LMP is a tool for allocating the risk of and/or preference for dispatch among suppliers who each have a settlement obligation to supply energy to load at a specific fuel indexed strike price in return for receiving a competitively bid capacity payment. From the consumer point of view, this recreates an important aspect of the obligation to serve that traditional return on rate-base (now, capacity payments) was meant to secure. Further, it recreates in the organized market structure the common sense cost relation that would exist in any rational bilateral contract for long term

supply[26] between capacity and energy components. Finally, AF&PA believes it will fundamentally alter the reference point for evaluation of long term contracting opportunities. Under an FPO, the clearing price is not a risk free entitlement, but an opportunity with some potential downside to be hedged through appropriate forward contracting or investment in capital infrastructure. When scarcity is no longer an unmitigated short term benefit to suppliers, investment strategies designed to maximize long term profitability may not be so constrained by the current evaluation period aggravation of loss aversion under LMP. This may serve to bridge the current valuation gap between buyers and sellers and thereby facilitate a greater level of long term contracting at both wholesale and, where state law permits, retail.

[26] No reasonable business man would agree to a fixed price for either capacity or energy in a bundled contract while leaving the other component solely in the discretion of the supplier.

# APPENDIX 2

## EXAMPLES DEMONSTRATING THE APPLICATION OF THE FINANCIAL PERFORMANCE OBLIGATION (FPO) IN REAL TIME SETTLEMENT

Below are two examples demonstrating the application of the FPO. In the first example, the strike price is above the clearing price. In the second, the situation is reversed, and the strike price is below the clearing price. The assumptions for both examples are the same, and the basic rules for implementing the FPO also are included below.

In both examples, one resource (A) fails to deliver its load ratio share. Each of the other resources replaces 1 of the 9 MWs Resource A should have delivered. The examples demonstrate the financial implications for the various resources.

Settlement works exactly the same for supply or demand side resources. Each must pay the real time price for energy at its node for any deviation and that extra money goes to the resources that provide service (energy) the non-performing resource did not provide.

**Assumptions:**

Total Capacity Resources = 100M

Number of Resources = 10 at 10MW

Load in Relevant Hour = 90MW

Load Ratio Share for Each Resource = 9MW

**FPO Rules:** In each hour each resource:

1. Gets credited with its load ratio share at the lower of the clearing price or strike price.
2. Owes or gets paid the clearing price for every megawatt deviation from its load ratio share.

**EXAMPLE 1: Strike Price Greater Than Clearing Price**

STRIKE PRICE = $2
CLEARING PRICE = $1

One resource (A) fails to deliver its 9MW; the other resources perform and each replaces 1 of the 9 MWs Resource A should have delivered.

Resource A:

1. Gets credited with 9MW (its load ratio share) at the clearing price ($1) = $9
2. Is charged the clearing price ($1) for 9MW of deviation = $9
3. Result: $9 - $9 = $0

All Other Resources:

1. Get credit for 9MW (their load ratio share) at the clearing price ($1) = $9
2. Are paid the clearing price for 1MW deviation from their load ratio share = $1
3. Result: $9 + $1 = $10 for each resource

Total for All Resources: 90

Load: Pays $90 for 90MW

**EXAMPLE 2: Strike Price Less Than Clearing Price**

STRIKE PRICE = $1
CLEARING PRICE = $2

One resource (A) fails to deliver its 9MW; the other resources perform and each replaces 1 of the 9 MWs Resource A should have delivered.

Resource A:

1. Gets credited with 9MW (its load ratio share) at the strike price ($1) = $9
2. Gets charged the clearing price ($2) for each megawatt deviation = $9 x $2 = $18

3. Result: Owes $18 - $9 = $9

All Other Resources:

1. Credit for 9MW (their ratio share) at the strike price ($1) = $9

2. Are paid the clearing price for 1MW deviation from their load ratio share = $2

3. Result: $9 + $2 = $11 for each resource

Total for All Resources: 9MW x $11 = $99

| | |
|---|---|
| Load: Pays Strike Price of $1 for 90MW: | $90 |
| Resource A: Pays $9 (see above) | 9 |
| TOTAL | 99 |

# APPENDIX 3

## EXPANDING SETTLEMENTS TO DAY AHEAD PLUS REAL TIME MARKET

There are two approaches to applying the FPO in a multi-settlement context. The first approach is to recognize that load would not logically pay prices Day Ahead that exceed the Strike Price they are financially guaranteed in real time. Under the first approach, bids exceeding the Strike Price do not clear in the Day Ahead market. With prices at or below the Strike Price, the FPO is always a wash day ahead, so, as will be shown below, the maximum exposure of a unit not performing in real time is the difference between the Strike Price and the clearing price times real time load ratio share commitment. As we will see, its obligation could turn out to be less depending upon the dispatch Day Ahead. Under this approach the Day Ahead market is financially binding and acts to reduce the risk of the FPO to non-performing resources in real time. The single drawback to this approach is that if a significant number of units put in bids above the Strike Price (a situation which, under our current market design should be cause for significant concern about he competitiveness of the market and the legitimacy of such bids and lead to investigation by the Market Monitor) the RTO may not be able to clear all load Day Ahead. Again, given the Strike Price, this should be an extremely rare (and highly suspicious) circumstance.

The second approach would allow bids in excess of the Strike Price to clear Day Ahead, but that increment of output in excess of a resource's Day Ahead Load Ratio Share that is settled above the Strike Price might not be financially binding in all cases in order to assure delivery in Real Time of the FPO guaranteed Real Time Load Ratio Share at the Strike Price. Only a small fraction of any Day Ahead settlement is ever likely to be effected by this re-settlement, but it seems less desirable than the first alternative. For this reason, we offer two examples of the first approach for illustrative purposes but only a discussion of key changes to effectuate the second approach.

We have not had time or resources to develop a complete settlement manual for all contingencies, but hope the following general illustrations will assist in understanding the underlying principles.

In a Multi-Settlement System, each Resource's Obligation Consists of the Following Components:

1. Day Ahead Load Ratio Share Obligation (**DARS**): The resource's Committed Capacity divided by the sum of the Committed Capacity of all resource's times the Day Ahead Hourly Load.

$$\frac{CC}{\sum CC} \times DAHL$$

2. Real Time Load Ratio Percent (**RTLRP**): The resource's Committed Capacity divided by the sum of the Committed Capacity of all resources times Real Time Hourly Load.

$$\frac{CC}{\sum CC} \times RTHL$$

3. Real Time Load Ratio Share Obligation (**RTRS**): The resources Day Ahead Load Ratio Share (DARS) plus the resource's Day Ahead Deviation plus the resources Real Time Incremental Load Ratio Share.

   DRS+DAD+RTIRS=RTRS

   Provided for purposes of this calculation, if DAD is negative DAD=0 when calculating RTRS.

4. Day Ahead Deviation (**DAD**): Resource's Deviation in the Day Ahead market from the Resource's Day Ahead Load Ratio Share Obligation.

5. Real Time Deviation Reconciliation (**RTDR**): The Real Time Load Ratio Share of a resource (RTRS) minus the Real Time Operating Level (RTO) divided by the sum of all positive RTRS-RTO for all resources times the number of MW settled above the Strike Price in the Hour (MWCP).

$$\frac{RTRS\text{-}RTO}{\sum RTRS\text{-}RTO} \times MWCP$$

   Provided that when RTRS-RTO<1 then RTDR=0 for that unit.

6. Real Time Incremental Load Ratio Share (**RTIRS**): The lesser of either 1) the difference between Real Time Load Ratio Percent and Day Ahead Load Ratio Share Obligation (RTLRP-DARS) or; 2) the Committed Capacity minus Day Ahead Schedule (CC-DAS):

   Provided that if either are less than 1 RTIRS=0.

7. Committed Capacity (**CC**): Amount of capacity sold by resource in the auction.

8. Day Ahead Schedule (**DAS**): The scheduled operating level assigned to the Resource Day Ahead.

**Real Time Settlement Rules:**

1. Resources that meet or exceed RTRS are paid the Strike Price for RTIRS and the Clearing Price for MW delivered above RTRS.

2. Resources that fail to deliver RTRS owe the greater of the difference between the Clearing Price and Strike Price for each MW RTDR or 0 (if the Strike Price is above the Clearing Price) and are paid the lower of the Clearing Price or Strike Price for all MW delivered above DAS.

**Assumptions:**

Day Ahead Load=80MW
Real Time Load=90MW
Total Capacity=10 Resources 10MW each
Day Ahead Load Ratio Share=DARS=8MW each

EXAMPLE 1:

Day Ahead Clearing Price= $1
Real Time Clearing Price= $3
Strike Price= $2

**A. DAY AHEAD SETTLEMENT**

With Day Ahead Load of 80MW, each resource has a DARS of 8MW.
One of the ten resources (Resource A) fails to bid in or clear Day Ahead:

**RESOURCE A**

1. Gets credited with its Load Ratio Share (8MW) At the Day Ahead Clearing Price ($1)=**$8**

2. Is charged the Day Ahead Clearing Price ($1) for each MW of deviation from its Day Ahead Load Ratio Share (DAD=**8MW)=$8**

3. **TOTAL Resource A owes Day Ahead=$8-$8=$0**

Each of the other 9 resources accepted Day Ahead supply 9MW except for the Clearing Price setter, Resource B, who supplies 8.

1. Resource B is credited with its Day Ahead Load Ratio Share (8MW) at the Day Ahead Clearing Price ($1)**=$8**

2. Resource B has no Day Ahead Deviation (DAD=**0**) and so:

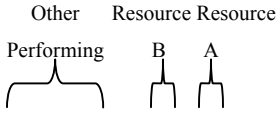
3. **TOTAL for Resource B Day Ahead=$8**

Each of the other 8 performing resources receives:

1. Credit for 8MW (their DARS) at the Day Ahead Clearing Price ($1)**=8MWx$1=$8**

2. Payment for 1MW deviation from DARS (DAD=1MW) at the Day Ahead Clearing Price=**1MWx$1=$1**

3. **TOTAL each other Performing Resource receives=$8 + $1= $9**




Load pays ($8x9) + $8 + 0**= $80 for 80MW Day Ahead.**

**NOTE:** These results are financially binding and will not be disturbed in Real Time Settlements.

**B. <u>REAL TIME SETTLEMENT.</u>**

Real Time Load comes in 10MW higher than Day Ahead so that Real Time Load**=90MW**.

The Clearing Price is above the Strike Price at $3.

All Resources have a Real Time Incremental Load Ratio Share of 1MW.

**RESOURCE B:**

RESOURCE B has a Real Time Load Ratio Share Obligation of 9MW.
RESOURCE B (as all other performing resources) must run at 10MW to meet load.
RESOURCE B has RTIRS=1MW
RESOURCE B receives:

1. Credit at the Strike Price ($2) for 1MW RTIRS**=$2**

2. Payment for 1MW above RTRS at the Clearing Price ($3) **=$3**

3. Because RTRS-RTO<1 RTDR=0

4. **TOTAL for Resource B in Real Time Settlement=$5**

All other Performing Resources have RTIRS=1MW. Based on Day Ahead Sales, they are already operating at 9MW and can only increase 1MW each to operate at Committed Capacity of 10MW each.

Each other Performing Resource Receives:

1. Credit for 1MW (their RTIRS) at the Strike Price ($2)**=2**
2. Because RTRS-RTO=0 for these units RTDR=0.
3. **TOTAL in Real Time for each other Performing Resource=$2**

**Resource A:**

1. Has Real Time Load Ratio Share of

| DARS | DAD | | RTIRS | |
|---|---|---|---|---|
| 8 | +0 | + | 1 | = 9 |

2. Based on its RTRS it gets charged the difference between the Strike Price and Clearing Price for its RTRD as follows:

$$\frac{9^{27}}{9} \times 1\ MW^{28} = 1MW$$

3. Total owed by Resource A=1 x ($3-$2)=$1

**TOTAL REAL TIME PAYMENT TO ALL RESOURCES=**

$^{RESOURCE\ B}\ \$5 + (^{OTHERS}\ 8 \times \$2) = \$21$

RESOURCE A pays $1

**TOTAL Paid by Load in Real Time=$21-$1=$20 for 10MW at the Strike Price ($2)**

**TOTAL FOR DAY AHEAD PLUS REAL TIME**

Load Pays DA=$80
Load Pays RT=$20
**Total $100**

Resource A Pays DA=0

**TOTAL PAYMENT $101**

[27] As the only resource not performing it picks up 100% of any shortfall. It would have a lesser fraction if other resourced failed to perform as well.

[28] Total MW sold in Real Time above the Strike Price.

| | |
|---|---|
| Resource A Pays RT=$1 | |
| **Total** | **$1** |

| | |
|---|---|
| Resource B Receives DA=$8 | |
| Resource B Receives RT=$5 | |
| **Total** | **$13** |
| Other Resources Receive DA=$72 | |
| Other Resources Receive RT=$16 | |
| **Total** | **$88** |

**TOTAL RECEIPTS**

**$88**

**EXAMPLE 2:**

Same assumptions on Resources.

Day Ahead Clearing Price = $1
Real Time Clearing Price= $3
Strike Price = $2

**Day Ahead Settlement:** Because Day Ahead is below the Strike Price, total amount for 80MW of load will continue to be $80. The FPO continues to be a wash Day Ahead. However, in this example we assume that, based on the bids, the system operator makes up the non-performing resource's DAD by dispatching the four cheapest resources (Set C) at 10MW each and the other 5 available units (Set B) at 8MW.

**In Real Time:**

1. Each unit in Set C receives no additional revenues because they are already operating at full Committed Capacity and have no RTIRS because CC-DAS=0.

2. B Units each are settled just as resource B in the previous example each receiving $2 for one megawatt sold at the Strike Price and $3 for one MW sold at the clearing price. Thus, 5 MW are now sold at the clearing price 5x3=$15.

**Resource A:**

1. Still has RTRS = 9
2. But now has an RTDR of

$$\frac{9}{9} \times 5\text{MW}$$

Leading to 5MW x ($3-$2) =$5

Thus, while 1) the Day Ahead Market helps reduce exposure in Real Time to payments for underperformance and 2) the FPO can never exceed a resource's a Real Time Load Ratio Share times the difference between the clearing and Strike Price, the exposure may vary based upon Day Ahead dispatch. However, a resource is usually better off (and is never worse off) with the Day Ahead Settlement if it fails to deliver in Real Time.

This also demonstrates that while it may be a wash DA for purposes of settlement, knowing the Day Ahead Load Ratio Share and Deviation for each resource is needed to compute RTIRS, RTRS and RTDR for Real Time settlement.

These examples could be refined to cover failure to deliver Day Ahead scheduled quantities in Real Time and other contingencies.

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**Second Approach**: Allowing Day Ahead bids above the Strike Price to clear.
Although this approach is not recommended, it may be accommodated by restating the definition of RTIRS as follows:

Real Time Incremental Load Ratio Share (**RTIRS**): The difference between Real Time Load Ratio Percentage and Day Ahead Load Ratio Share Obligation (RTLRP-DARS).

Removing the "lesser of" limitation in the prior definition could require a resource dispatched at full Committed Capacity Day Ahead above the Strike Price, to still be financially responsible for additional megawatts under RTIRS and hence have a settlement obligation under RTDR. Having already received an amount higher than the Strike Price for its DAD, the resource can either 1) cover RTIRS with additional output (if available) or 2) pay the difference between the Strike Price and Clearing Price for RTDR. The financial effect of the later, combining Day Ahead and Real Time settlements is:

DAD (DACP-SP)-RTDR (RTCP-SP)

Where:

**DAD**=Day Ahead Deviation
**DACP**=Day Ahead Clearing Price
**SP**=Strike Price
**RTDR**=Real Time Deviation Reconciliation
**RTCP**=Real Time Clearing Price

One way of looking at this is that sales in excess of DARS above the Strike Price Day Ahead are not financially binding due to the residual settlement exposure for some of those same MW in real time. Though this is not a fatal flaw, it may not be desirable.

Document Content(s)