Federal Energy Regulatory Commission

Docket # RM10-17-000

Post-technical conference comments on the feasibility of a "net economic benefits" test for LMP compensation for demand response

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Introduction

FERC held a technical conference to address the question of feasibility and purpose for a "net economic benefits" test that would limit the occurrence of payments for demand responders, with the implication that subject to this test, curtailed demand would be paid LMP, not LMP less the applicable retail tariff (LMP – G), as many commenters have urged.

A "net economics benefits test" was proposed by the New England Conference of Public Utility Commissioners (NECPUC) together with the Massachusetts office of Attorney General Ratepayer Advocate and the Massachusetts DPU. As proposed in their comment and presentations[1], some means is necessary to limit the number of hours during which full LMP is paid to curtailed demand in order to avoid paying more to the demand than is saved by reduced power prices to all other load. While Commissioner Woolf acknowledges in his presentation that (LMP – G) may be the more "economically efficient" compensation, NECPUC settles on the

[1] Besides the filing by the Massachusetts Attorney General's Office of Ratepayer Advocate, an informative presentation by Tim Woolf, NECPUC chair can be found here: http://www.raabassociates.org/Articles/Woolf%20Presentation_10-30-2009.ppt

higher LMP compensation because of numerous, but difficult to quantify externalities reduced through energy conservation, environmental benefits, reduced transmission and distribution costs, lower wholesale price volatility. Thus, based on policy grounds, NECPUC supports full LMP compensation provided a "net economic benefits" test limits the hours such payments are offered.

Numerous parties have submitted voluminous arguments. Demand Response Supporters (DRS) have applauded the Commission's proposed rule, while others, particularly groups representing generators, have provided considerable commentary and analysis to advocate (LMP – G) compensation. Non self-interested groups such as regional transmission organizations and utility commissions (except for NECPUC) have generally opposed the rule, as have independent economists and notably, the Federal Trade Commission.

Surprisingly, an area of agreement between the two sides is the use of financial option theory to analyze demand response. Both Alfred Kahn[2] and Robert Borlick[3] have suggested that demand response can be seen as a way to monetize the right inherent in a full requirements customer's option to buy a reasonable quantity of power at a fixed or regulated rate (G). There is disagreement as to whether the financial right is worth the spot price of power (LMP), or whether there should be netting against the original strike price of the option (G).

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[2] Kahn, in reply comment of the demand response supporters in the related Docket No. EL09-68-000: (Appendix) at p. 22: "They go on to deduce that the customer has nothing to sell to the market and shouldn't be paid full LMP for selling "nothing". But the obligation to serve creates **an option to consume electricity** that comes bundled with kWhs in the package of services that customers *purchase* from retail suppliers. And it is this option, bought and paid for, that the customer sells to the ISO or system operator."

[3] *Pricing Negawatts,* Public Utilities Fortnightly, August 2010, p. 14

The Demand Response Compensation Argument

The argument for compensating demand response (DR) at full LMP is best summarized in the Kahn reply testimony[4]. "Demand response is in all essential respects economically equivalent to supply response, [and] that it should be rewarded with the same LMP that clears the market. Since DR is actually – and not merely metaphorically – equivalent to supply response, economic efficiency requires that it be regarded and rewarded, equivalently, as a resource proffered to system operators, and be treated equivalently to generation in competitive power markets."

Because a **winning** bid for "demand response" is the same thing as a **losing** demand bid (or "price responsive demand" bid), numerous economists have commented to the contrary that the primary compensation to a losing demand bidder (winning demand responder) should be avoiding the costs of power they didn't consume. This side believes that regulated or fixed price demand customers require additional incentives for ramping down or shifting to off-peak hours so they may benefit from the **same** cost savings as demand bidders in real time markets. Thus it is appropriate for a fixed price consumer or aggregator to receive the incentive of (LMP – G) for curtailing, equalizing their position with a real time price bidder but providing no more. Numerous filings by this side indicate full LMP compensation for fixed price customers is double counting and show various market distortions that result.

In response, Kahn states there is no double counting in full LMP compensation, but that "the decrease in the revenue of the generators is *matched by the savings in their marginal costs of generating that power;* the successful bidders for the opportunity to induce that customer

[4] Appendix to Reply Comments of Demand Response Supporters, FERC docket # RM10-17-000

response [ie. unsuccessful demand bidders] are compensated… by the pool, *whose marginal costs they save* by assisting customers to reduce their purchases."

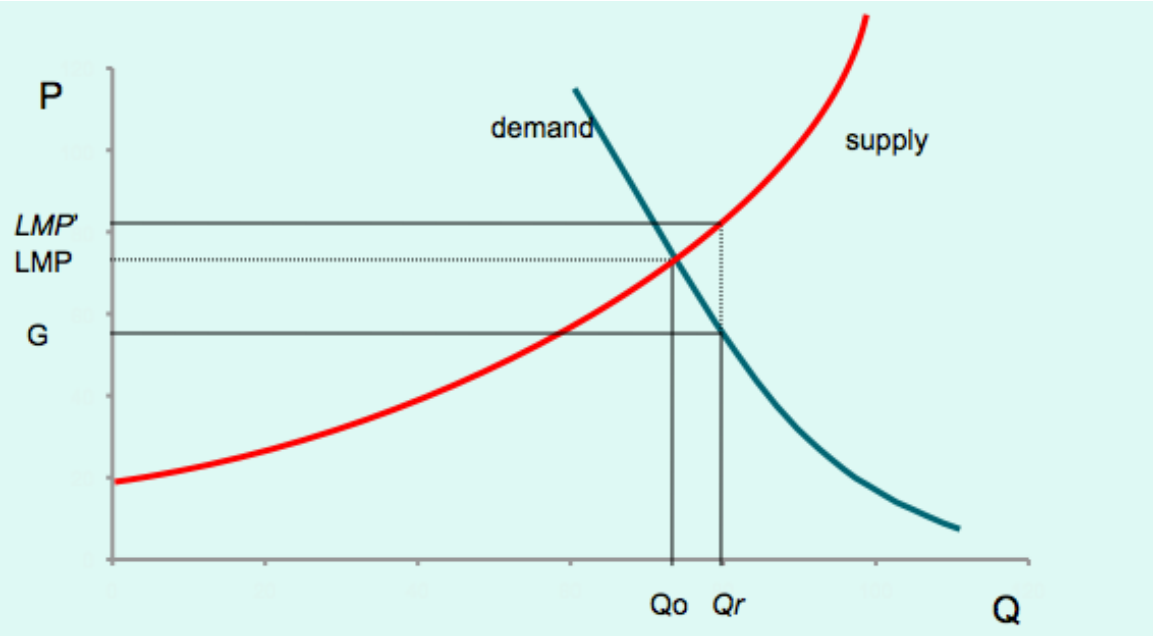
These comments miss the fact that savings in total power costs is matched by the quantity of electricity enjoyed by load. Load pays less and it gets less. Generators can hardly pass through their further fuel saving because the marginal generator correspondingly curtailed is no longer paid the revenue (LMP) that would cover the fuel cost. Kahn admits that "there is an element of strangeness in a supplier being required to reimburse a customer for refraining from purchasing from it," but explains away this peculiarity by saying the load had option value and that regulated load serving entities have an obligation to serve.

Another perspective not yet advanced in this docket is gained from extending FERC's logic to the supply side where a merchant generator[5] curtails as compared to its expected generation profile. This may occur due to maintenance or forced outages. A reduction in supply is equivalent to an increase in load. Accordingly, the generator should be charged LMP for the additional "load" added to the system in addition to suffering the non-receipt of LMP for the energy the generator failed to deliver. This outcome is no less logical than the FERC proposal.

[5] A supplier receiving LMP from the pool, without any contract to deliver a fixed quantity of electricity

Net Economic Benefits

We compare economic incentives and benefits of a power market where demand is at a fixed price, G, to a market with demand bidding and clearing price LMP:



In the figure above, demand bidding results in quantity Qo cleared at price LMP for a real time pricing market. For a fixed price demand market at price G, then a larger quantity Qr is demanded for G < LMP. Since this is further up the supply curve, a higher price LMP' results, although this price signal is only seen by the supply side of the market. Thus a net economic benefit results from allowing demand to see the true price signal,

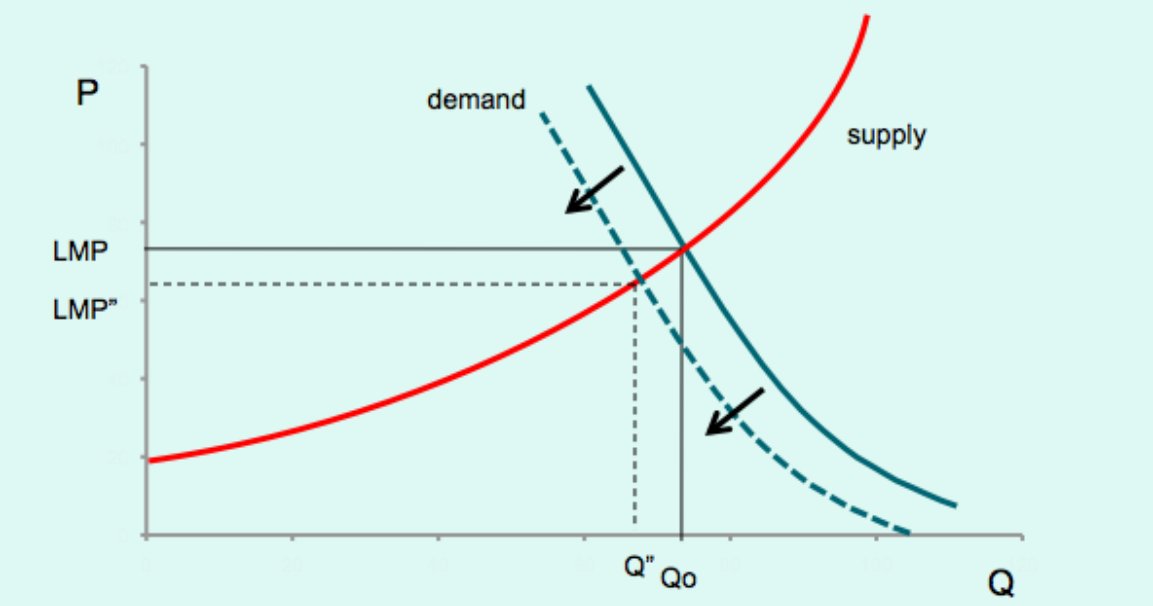
$$NEB = Qr \times LMP' - Qo \times LMP.$$

This is consistent with the ethic of energy conservation as well, since demand is reduced.

Paradoxically, if G > LMP, as during off-peak hours, then demand is artificially reduced by the absence of a price signal. Thus there would be a net economic benefit to *increasing* the

consumption of electricity then. One must be careful to avoid automatically associating an economic benefit with reduction in consumption.

Since many customers may wish to avoid high pricing volatility[6], demand response is one means to duplicate the incentive to conserve that customers would face if they were exposed to real time pricing while avoiding downside. At (LMP – G) compensation for peak hours, a customer who would otherwise pay G for electricity effectively avoids paying LMP for each kwh of energy conserved, relative to their normal use (assuming integrity to the process of measuring their baseline consumption). Alternately, the NOPR proposal to pay fixed price customers LMP for DR is equivalent to paying a real time pricing customer G for curtailing[7], ie. compensating a real time price customer with a payment of G whenever they submit a demand bid below the clearing price (LMP). This is depicted below:



[6] Mandatory real time pricing for residential customers was tried in San Diego and in Ontario in the late 1990's, with unpopular results.

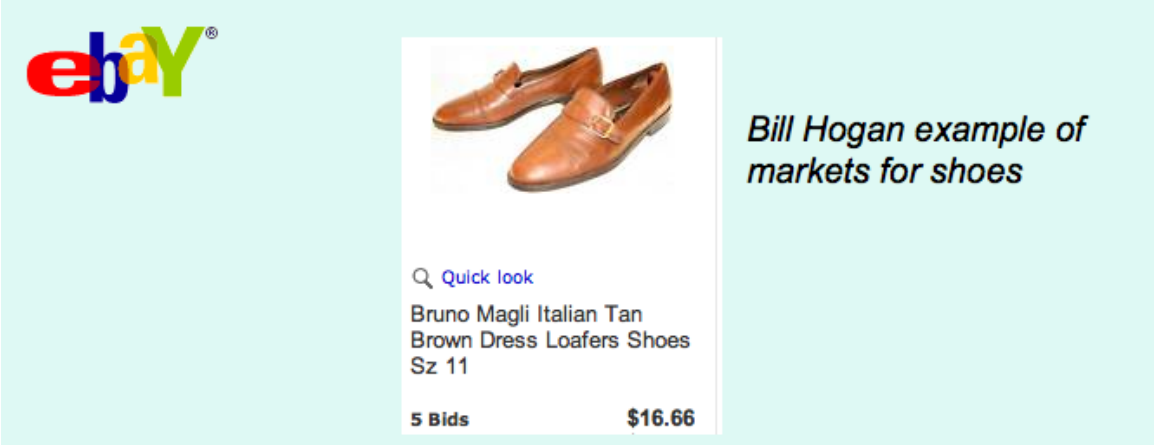
[7] In fact, since the FERC NOPR does not and can not mandate different pricing for retail customers on different tariffs, retail tariffs being out of the scope of FERC authority, a real time customer would receive LMP for curtailing in addition to avoiding incurring a cost (LMP) for electricity they did not consume.

Therefore, the question raised by the supplemental NOPR is whether the difference between the demand curves,

= LMP × Qo – LMP" × Q",

constitutes a net economic benefit, and defining appropriate conditions for its implementation.

Some insight is yet to be gained from the Hogan example of purchasing a pair of shoes, despite Kahn's pooh-pooh of its applicability[8].



A well-known demand bidding website has auction rules whereby the clearing price equals 1$ plus the *2nd highest* bid. This incentivizes prospective buyers to submit their economic maximum value as bids. At such a maximum bid, each prospective buyer is indifferent as to whether they win or lose the auction: at the maximum bid, there is no economic surplus in the transaction. If there is a big difference in bidders' preferences, a significant

[8] Kahn says shoes are a bad analogy since they typically don't exhibit fluctuating marginal prices. One might, alternatively, consider tomato markets, as this commodity is often subject to price spikes and shortage conditions, Thus readers may substitute "tomato" wherever "shoe" appears. (for an article on volatility in tomato markets see http://thetimes-tribune.com/news/attack-of-the-killer-tomato-prices-hitting-area-grocery-stores-1.659146).

economic surplus can result for the winner. If preferences are similar and competition is keen, the resulting economic surplus for the winner is modest.

Suppose there are two buyers for whom the maximum economic value of the pair of shoes is 100$ and 75$ respectively, and who submit corresponding bids. Then the clearing price will be 76$, resulting in an economic surplus of 24$ for the winner.

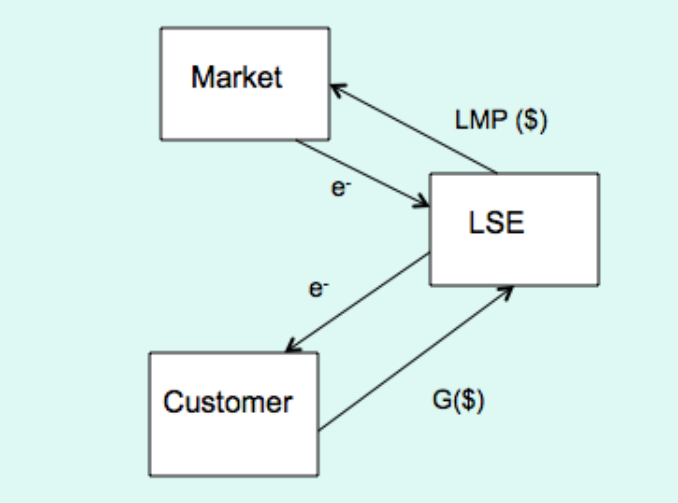
As the winning bidder would like to increase his surplus it would be in his interest to pay the 2nd bidder to reduce his demand bid. If the 2nd bidder is incentivized with a 10$ payment to reduce his bid to 25$, then a "net economic benefit" could be construed on behalf of the winner. This "net economic benefit" would equal 50$ price reduction - the 10$ payment = 40$.

For a scenario where the 2nd bidder could only be incentivized to reduce his bid by 5$ in return for a 10$ payment the "net economic benefit" = 5$ - 10$ is negative, and therefore a "net economic benefits" test would indicate that demand response in this case does not aid the winning bidder. Absent from these considerations, still, is the net economic impact on the seller.

Of course, payments from the winning bidder to the losing bidder are not economic payments, they are transfer payments. And they represent anti-competitive forces in the shoe marketplace. Furthermore, a "net economic benefits test" applied to this market is essentially an "effective collusion" test. Nonetheless, the framework proposed by NECPUC is identical: both result in payments to losing demand bidders (winning DR bidders) beyond what would be realized in competitive markets, limiting the occurrence of such payments to the extent they do not exceed the "net economic benefits" realized by remaining buyers. Thus FERC's request for comment on the concept of a net economic benefits test assuming full LMP payment for demand response poses a quandary if not an oxymoron since rational economic benefits do not result.

Options Analysis and the "Missing Money" Problem

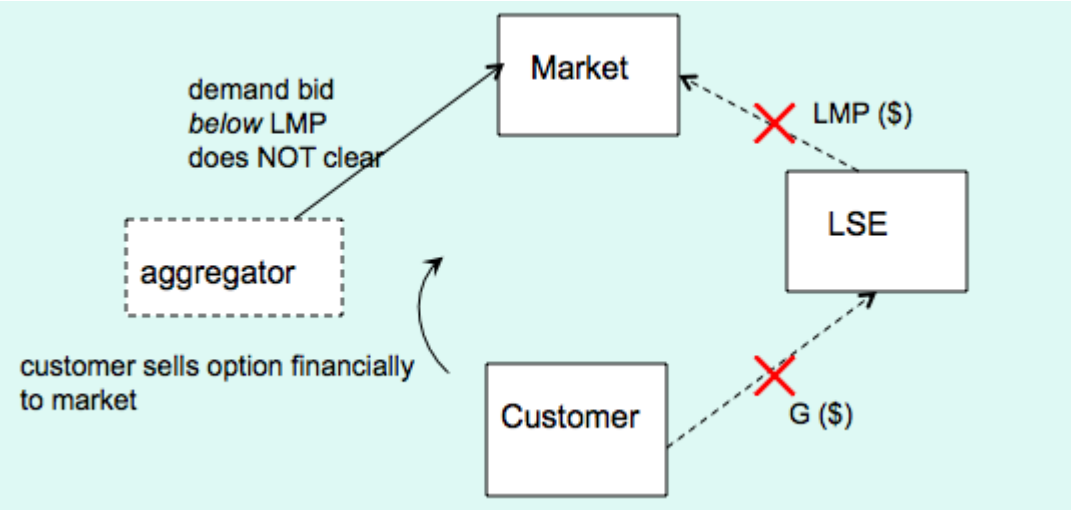
Financial options analysis, as outlined by Borlick, is a useful tool for tracking the "missing money" problem raised by NECPUC in their proposition that demand responders be paid full LMP. Modeling may resolve arguments about economic efficiency using a common basis that both sides find has merit.



A load serving entity or retail supplier purchases energy from the market at LMP and resells to a fixed price, full requirements customer at G (see above)[9]. The retail customer has the right, but not the obligation, to purchase an unlimited quantity of power at price G. Since the power is worth LMP, not G, the customer has a real commodity option on power. However, if the customer is constrained from selling the option or exercising it financially, as is for a typical full-service customer, the option is restricted. Thus in practice, the volume of power the customer consumes is determined by operational needs and the desire to minimize costs at whatever power price level.

[9] A competitive retail supplier will often hedge their price risk with a long term contract or use their short price exposure as a natural hedge for any merchant generation they may own.

Demand response provides the customer a means for monetizing value that is otherwise trapped in the restricted option when it is in the money (see below). The customer exercises the option financially rather than physically and may transact with the market directly, or indirectly through an aggregator.



Option parameter	Physical exercise	Financial exercise
Spot price	LMP	LMP
Strike price	G	*Subject of debate*
Time T to expiry	0 (or very small)	0 (or very small)
Volatility	Irrelevant for small T	Irrelevant for small T
Notional quantity	As much as customer needs for operations	Delta between customer baseline and actual physical consumption

The option value and terms are at the core of the debate: the strike price, notional quantity, spot price, time to expiry, means of exercise and resulting cash flows. These issues, however, can be resolved analytically without the introduction of qualitative or policy issues.

Notional quantity: Although the customer has the theoretical opportunity to purchase an unlimited quantity of power physically, the option quantity is limited to the amount below a physically measured "baseline" the customer would have been expected to consume.

Time to exercise: The option is exercised in the day ahead or real time markets so the time to expiry is very short when the option is monetized. It is not traded earlier than that. Then the option, at exercise or sale, has no time remaining. All the value remaining close to exercise is intrinsic option value[10], ie. the difference between the spot price and strike price. While Kahn and others state the option is "bought and paid for [then resold] to the ISO or system operator," at the time of exercise its value is the difference between spot and strike prices.

Option Premium: Since time to option expiry is short, there is no "option premium." While Kahn may be correct that beforehand, a customer has "bought and paid for an option" if he bought it from a competitive supplier, with no time remaining this premium has completely dissipated. Alternately, if the supplier is a rate regulated utility, there is no premium since the load serving entity is assured of cost recovery via a true-up in a subsequent period if rates under-recover actual power costs.

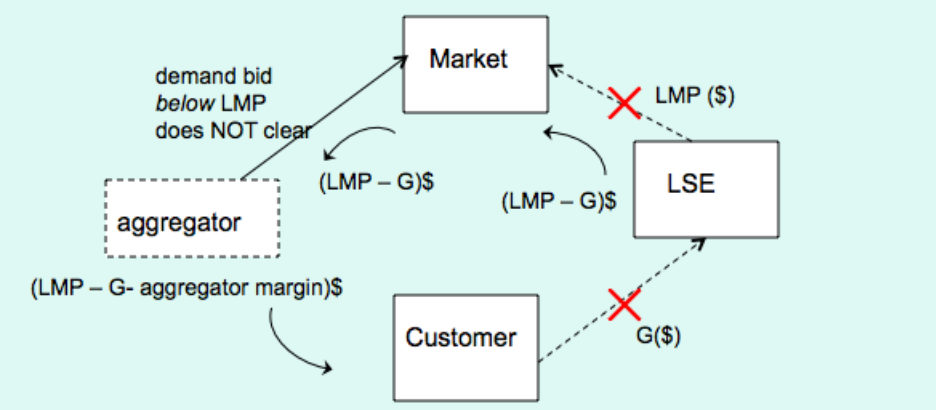
Volatility: Since time remaining to exercise is zero (or close to it), volatility does not affect option value.

Strike price: Considering that the customer has the physical option to consume power worth LMP but only pay G, for an **economically neutral** tariff design, the financial option will then have identical terms (strike = G, spot price = LMP).

Tracking the cash flows for this neutral case shows the entities are indifferent compared to whether the option is exercised physically (by direct purchase of power through the LSE) or financially (by resale through a demand response transaction, depicted below). Thus

[10] See *Options, Futures and other Derivatives* by John C. Hull, for a primer on option terms, definitions and theory

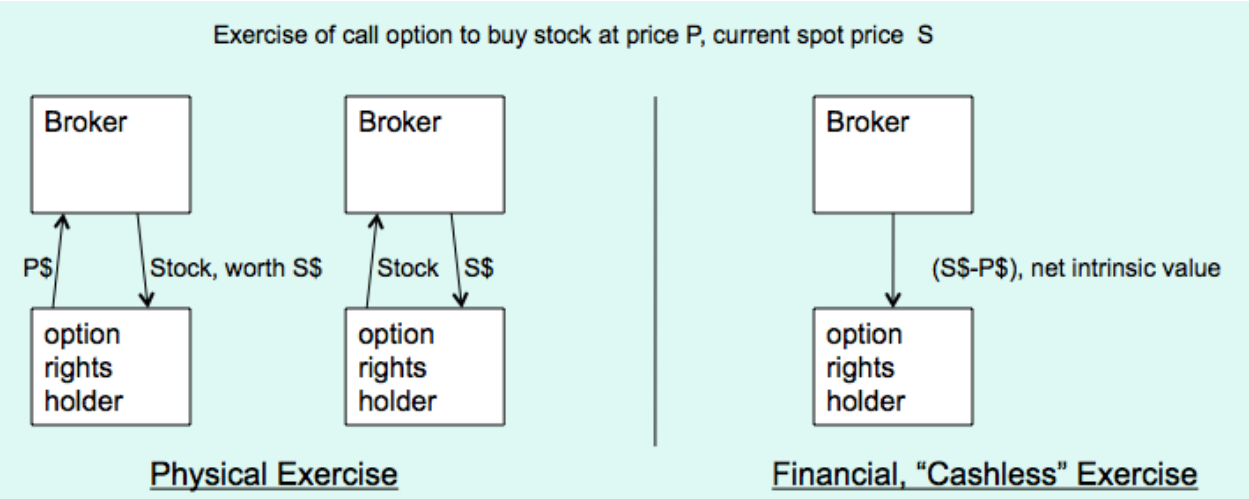
when the option is exercised financially with a net value of (LMP – G), there is no "missing money."



The FERC proposal requiring compensation for demand response at LMP translates to an option strike price of zero given LMP as spot price. This introduces an asymmetry into the option such that physical exercise has a higher strike price (G) compared to financial exercise (strike = 0). Because of this asymmetry, "missing money" is created since the cash flows through the market and the LSE are now different, depending on how the customer exercises the option, so the LSE is no longer cash neutral. These funds need to be recovered, but where from? Who incurred this new cost and to whom should it be allocated? Is there analytic justification for a different strike price depending on whether the exercise is financial vs. physical?

Finally, it has been argued by the demand response supporters that since the customer "never purchased power" when exercising the demand response option, "the customer should not be forced to buy it," avoiding a cost of G per MWh to be netted against LMP. The Federal Trade Commission stated to the contrary in its filing that in an efficient demand response scheme, the customer must "pay the usual retail price to acquire the power that it resells," thus be debited G for power they resell at LMP. Because the demand response option is exercised financially, not physically and because the option exercise is "cashless," there is some confusion. An example

below comparing physical stock option exercise to financial and "cashless" exercise resolves this question.



In a physical stock option exercise, the rights holder pays the strike price P to acquire the actual stock, worth S. In a separate transaction, he then sells the stock to realize the net, (S – P). In a financial and cashless exercise, the rights holder is not required to front the cash (P) and never actually takes possession of the stock, but the market maker simply pays the rights holder the net. Cashless exercise is a typical arrangement for employee stock options so that the considerable cash to buy the underlying security does not have to be in the employee's possession.

The cashless and financial character of an option exercise does not, as demand response supporters argue, imply anything about the strike price of the option (they argue that the strike price should always be zero because the customer never "buys" the commodity). The FTC is correct that demand responders must pay for energy they resell, since purchase of energy costing G is implicit in cashless option exercise.

Policy Arguments

Demand response supporters, industrial customers and Chairman Wellinghoff stated several policy grounds to justify full LMP payment to demand responders as well as schemes for recovering "missing money.[11]" A few of these arguments are:

"Paying LMP – G is 'nothing.[12]'"

"Industrial users require larger payments to overcome internal cost hurdles for acting on demand response to make it worth it."

"Price responsive demand [real time pricing] is not achieving anything in retail markets, therefore the Commission must drive the adoption of demand response in wholesale markets by increasing compensation to what is 'comparable' to generation.[13]"

On "missing money," comments indicated that demand response supporters, industrial users and Enernoc desired these costs to be recovered as widely as possible, preferably rolled into the ratebase so that all rate classes would be exposed to them. Enernoc in particular expressed concern that if only distribution customers were exposed to these charges, an additional barrier would result from customer objections to the charges.

Of these comments, the desire for higher compensation to overcome internal hurdles is nothing more than stating the self-interest of the commenter. In particular, numerous interveners have shown that most of these cost hurdles are simply the value of goods produced or sales that would be lost if a facility shut down[14]. A typical comment, by WalMart, said their internal

[11] Stated at the FERC technical conference on demand response, September 13, 2010
[12] Donald Sipe
[13] Chairman Wellinghoff statement at FERC technical conference
[14] eg filings by the FTC, CPG Advisors and others

barriers reflected the costs of "curtailing our facilities and curtailing our employees." Needless to say, reducing economic activity should not be incentivized by FERC. On the other hand, costs of implementing smart meters typically represent 1-2% of LMP, thus are not material, particularly for the "big boy" consumers who already have advanced metering.

Requests that "missing money" be spread as broadly as possible to avoid "creating new barriers" are also self-interested policies to ensure that rate classes subsidizing demand responders are not aware of their higher charges. Instead, one could suggest that the missing money be recovered solely from demand responders, by charging a higher retail demand charge or tariff adder to ensure that the asymmetric value of the demand response option is not allocated to other rate classes.

If real time pricing programs have not achieved hoped-for success, what are the barriers, and to what extent should DR programs be either a long term solution or transitional programs? However, a wholesale program involving aggregators, whose operating costs consume 50% of payments received, is not a satisfactory end-run around state regulation of retail tariffs that should permit more direct, real time pricing programs.

Recommendation

Given the analysis presented by this comment and many other interveners, there is no objective economic basis for creating a "missing money" problem, for overcompensating demand responders at full LMP, or for creating "net economic benefits" that are in fact transfer payments. It would be more straightforward if FERC would accept these analyses. If it insists on issuing a rule requiring LMP compensation for demand responders, FERC should base its

decision on policy grounds, with a subsidy for demand responders tied to the level of social benefits and true market barriers it can quantify.

/ s / Constantine P. Gonatas

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