FINAL

Opinion on Economic Issues Raised by FERC Order 745, "Demand Response Compensation in Organized Wholesale Energy Markets"

by

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1. Introduction

On March 15, 2011, the Federal Energy Regulatory Commission released Order 745. The purpose of the Order was to require that demand response (DR) resources participating in RTO or ISO markets are paid at the locational marginal price when such resources contribute to the supply-demand balance as a substitute for generation and when the demand response resources pass a net benefits test defined in the order.

The Market Surveillance Committee, having registered its support for the California Independent System Operator's request for rehearing of FERC Order 745,[1] now wishes to provide a fuller analysis of the core economic problems with the design of that order and with the likely results of its implementation. This analysis grows out of our continuing concern for the successful implementation of demand reduction measures, which we feel will be negatively affected by public reaction to the outcome of Order 745 if it is implemented in its present form. We also believe that this outcome will be entirely unintended, and that the Federal Energy Regulatory Commission (the Commission) would fully share our views concerning such an outcome, were it to occur.

Our first conclusion is that Order 745 assures that demand-response and supply-response will be treated differently by the power markets. Since this difference is significant and is based on no economically relevant factor, but only on the location of the service relative to the customer's meter, the effect of Order 745 will be arbitrary and capricious. This is demonstrated in Section 2 with an example that assumes that an ideal DR technology that perfectly fulfills the Commission's assumption of the equivalence of the two approaches to balancing the market. Since the intention of Order 745 is the equitable treatment of supply and demand, unless modified, the Order will fail to achieve its objective under even the most ideal circumstances.

[1] CAISO Market Surveillance Committee, "Opinion regarding FERC Order 745, 'Demand Response Compensation in Organized Wholesale Energy Markets'", April 29, 2011.

We then highlight several additional economic problems with the rule and the benefit-cost test used to implement it. We point out that the Order 745 will pay for inefficient demand response, consumption whose economic value exceeds its cost but would be curtailed under the payment mechanism imposed by Order 745 (Section 3). In Section 4, we argue that Order 745 creates a danger that that ISOs will have to pay for potentially large amounts of phantom demand response that provide no production cost savings and have no impact on the actual market price (Section 4). In Section 5, we make three sets of criticisms of the "net benefits test" used to screen out demand response that fails to decrease consumer prices. One is that this test does not concern market efficiency, as measured by total surplus, but only the surplus for one set of market parties (load) (Section 5.1). We observe that a market objective of reducing consumer payments rather than maximizing net market surplus is a fundamental change in market philosophy that is inconsistent with open access. Our second criticism is that we find that the benefits test ordered by FERC does not correctly calculate the pecuniary benefits from using high cost demand response to depress the spot price of power (Section 5.2). Our third criticism of the net benefits test is that the rate-reduction benefits supposedly measured by this test will prove almost entirely illusory. The root of this problem is that the "benefits" measured by the net benefits test result not from actual cost savings, but by shifting the capacity revenues of inframarginal generators (including wind and solar) from suppliers to consumers. While this transfer may be possible in the short run, these capacity revenues are not economic profits, but return of and on investment. Hence, market forces will soon correct this imbalance as prices would rise to the level needed to attract investment. However, the correction will never show up in the (short run) net benefits test. The eventual market correction will prevent the "benefit" measured by the net benefits test from actually flowing to non-DR load.

2. Order 745 Treats Identical Demand- and Supply-Responses Differently and Inefficiently

In this section of the Opinion, for the sake of clarity we will analyze a simple situation considering a type of demand response that is most obviously equivalent to a supply response. For the moment, we assume away issues of measurement and verification, although we return to them later in the opinion. The analysis demonstrates that even under these conditions, the LMP payment system established by the Order treats DR and supply on a fundamentally different basis, and will result in increased market inefficiencies and higher costs for consumers.

2.1 A Simple Comparison

In order to avoid ambiguities that at times creep into theoretical discussions, we examine a concrete example of demand response. In particular, we consider dispatchable behind-the-meter generation, such as the widely publicized fuel cell-based Bloom Box.[2] In Order 745 the Commission recounts that "EPSA states that paying LMP for demand response will merely encourage load to switch to off-grid power (or behind-the-meter generation), while still being compensated." The Commission makes no objection to this example of DR, apparently accepting such behind-the-meter generation as a legitimate form of DR. Indeed it is commonplace, and preventing it

[2] Bloom Boxes have been installed as a form of demand reduction by entities such as Google. These boxes are built from an array of four inch cubes, which might soon be usable in residential settings. So for instance, instead of turning off an air conditioner when the LMP is high, a DR provider might install a small fuel cell in a residence and turn that on while leaving the air conditioner running.

would require on-site inspections, so we believe that counting behind the meter generation as DR in this example is consistent with Order 475.

What is telling about this example is that DR is fully equivalent to supply because it actually is generation. It becomes DR only by virtue of being situated behind the meter. Moreover, because this form of DR is generation, measurement and verification can, in principle, be done perfectly, just as we have assumed, simply by metering the generators.

In Section 3, "Commission Determination," of part IV.A, under the discussion of the "Compensation Level," the Order states that:

> *"When the above-noted conditions of capability and of cost-effectiveness are met, it follows that **demand response resources** that clear in the day-ahead and real-time energy markets **should receive the LMP for services provided**, as do generation resources."* [emphasis added].

As will be seen shortly, this conclusion, that demand response resources should receive the LMP, though it agrees with several other Commission formulations of this principle, contradicts the regulatory text itself (new paragraph (g)(1)(v)). That text states that the ISOs and RTOs shall pay DR providers the LMP. This can be well beyond the value of that power to load, however, which also benefits from avoiding the purchase cost of energy.

Returning to our example of DR provided through distributed generation, one can see that load will be willing to pay up to the avoided cost of retail power for the distributed generation. When combined with the LMP payment from an ISO/RTO, DR providers will therefore receive more than LMP. The total payment could amount to twice as much or more of the LMP at times when the LMP is well below the retail price.

For example, consider prices in Pacific Gas and Electric's (PG&E) service territory (within the CAISO market). For a typical residential consumer, the marginal price of energy, G, was $139.07/MWh last month, and the first unit of energy was billed at $122.33/MWh. From this we can reasonably conclude that a DR provider who installed a small dispatchable distributed generator could charge the consumer $120/MWh for the electricity it provided. We will assume here that the DR provider retains ownership of the equipment, as is becoming more common.

While it may be objected that California's retail electricity prices are higher than those in other states with consumers served by RTOs, the Commission's justification for Order 745 is not based on specific prices, and the order does not contain an exemption for markets with prices at one level or another.

The average price of wholesale power in the CAISO was roughly $40/MWh in 2010. Suppose that the benefit-cost test required by Order 745 would be passed by DR when LMPs are above about $45/MWh (the particular value is not important for the purposes of this example).[3] This

[3] It can readily be shown that a simple implementation of the "benefit-cost" test would find that DR that is paid the LMP would pass that test when the LMP is higher than the level at which the supply elasticity falls below unity (assuming that the elasticity decreases for greater amounts of supply. For actual supply curves, this can occur at much lower levels. Of course, this price threshold will depend on system conditions; furthermore, actual supply curves do not show a smooth increase in slope and elasticity over output, further complicating the calculation of such a threshold price. As a final complication, as we explain later

means that under Order 745, the DR provider would receive $(120 + 45)/MWh, or $165/MWh "for services provided."

This is almost four times the LMP, that is, four times the amount that FERC states that the DR resource "should receive", if we take at face value the Order's statement that DR "should receive the LMP for services provided" (Paragraph 53). To be clear, we believe that the DR resource should receive the LMP, or $45/MWh, but not the LMP plus the avoided cost of purchasing power, which means that we consider Order 745 to be over-paying by a factor of nearly four in this case. This failure to adjust payments for DR services for avoided energy costs is one of the root problems with the Order. Indeed, as the example illustrates, there is an important difference between what the DR provider "receives" in aggregate and what it receives in the form of direct payments from an ISO.

But getting the price wrong may not be the most telling point. Consider what happens if the DR provider moves the Bloom Box cubes across the street to its own establishment and generates the same electricity in front of the customers' meters. The result is, of course, that the customers will stop paying the DR provider $120/MWh since the provider is no longer saving the customer any money. Consequently, the DR provider will now receive only the LMP, which is just $45/MWh in the above example. Of course, since the fuel cell is physically so close, some or most of its power will still go to the same houses it went to before.

So nothing that matters physically has changed. As shown in Figure 1, the same physical generators are generating the same power at the same time and supplying the same houses that use it for the same purpose. But because of an arbitrary rule concerning a generator's location relative to a customer's meter, the supply-side generators will treated very differently by the market than demand-side generators. Table 1 shows various possibilities as the LMP varies.

in this opinion, however, consideration of forward contracts and vertical integration change this test, generally pushing the threshold elasticity downwards.

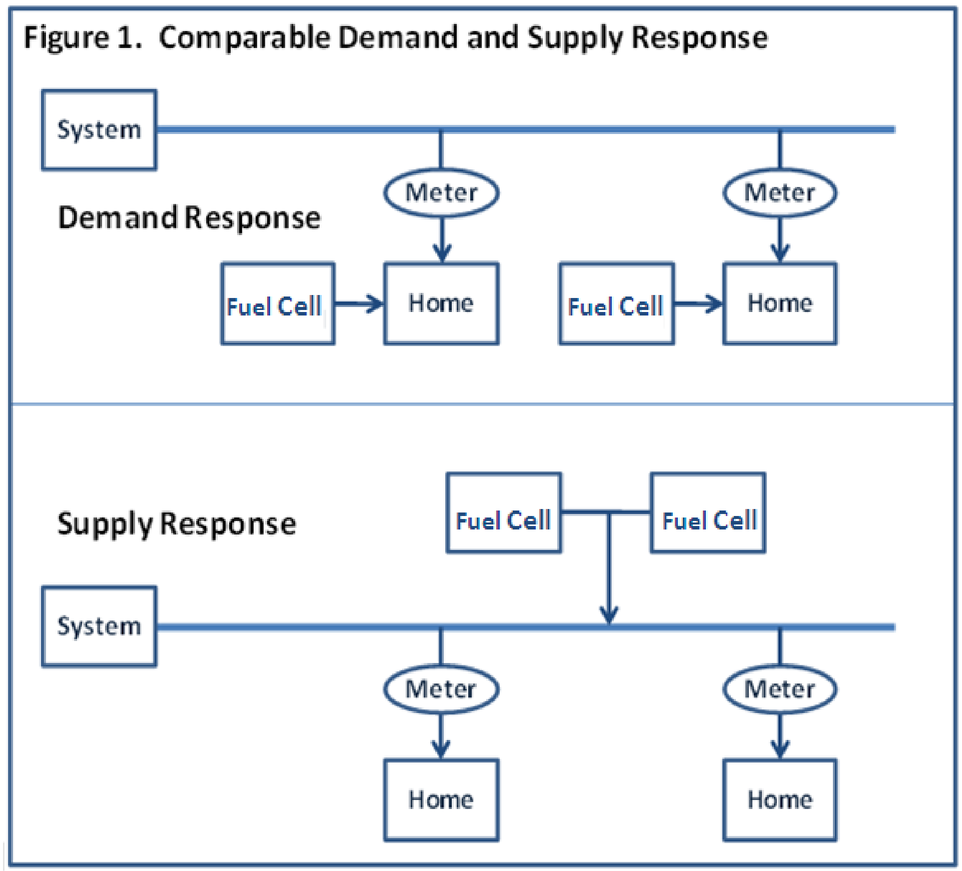

Table 1. Payments Received by DR for Services Provided*

	Payments Received by DR			Payments Received by Supply
LMP	**Payment from the ISO**	**Payments from Load (G)**	**Total DR Payment**	
$30	$0	$120	$120	$30
$60	$60	$120	$180	$60
$120	$120	$120	$240	$120
$240	$240	$120	$360	$240

*Values estimated for residential DR in PG&E's service territory within the CAISO.

As can be seen, when the same technology is labeled "demand response" because it is behind the meter" it receives significantly greater payments than when it is labeled "supply response" because it is located in front of the customer's meter. This is almost the very definition of arbitrary and capricious. And, this is the outcome for the most easily verified and controllable DR,[4] which is fully equivalent to supply response. The DR payments for demand reductions provided by the

[4] This verifiability is possible only if output of the generator was separately metered; if defined using baseline net demand, then it would be imperfect.

behind the meter generation in the example would be required under Order 745 for any ISO or RTO that administers an economic demand response program.[5]

2.2 Discussion of Reasons Offered for Paying LMP

There can be no question that Order 745 fails to yield equal treatment by the market of supply response and demand response even when they differ in name only. In fact, the outcome of the LMP requirement is unduly discriminatory. The Commission has offered various explanations for requiring that the ISOs pay LMP to demand response on top of payment it receives from load. Let us review the most important of these reasons in the light of the above examples.

- **"The Commission concludes that paying LMP can address the identified barriers to potential demand response providers" (Paragraph 58).**

  The Commission has said that it believes "paying demand response resources the LMP will compensate those resources in a manner that reflects the marginal value of the resource." It has also said "…this Final Rule is designed to remove barriers to demand response participation in the organized wholesale energy markets." These two views are consonant if the barriers being removed are those due to underpayment of DR services. If the compensation to demand response resources is limited to the avoided retail rate, then when the retail rate is less than the LMP, (as would be the case in times of scarcity conditions such as reserve shortages), underpayment would be a significant barrier.

  However, that barrier occurs only when the retail rate is less than the wholesale cost of power, and correction of that barrier requires only an additional payment equal to the difference between the wholesale cost of power and the retail rate. The existence of a costly barrier provides no reason to pay *more than the value* of the resource to the market. No one would suggest paying more for bread because it was inconveniently packaged or its freshness was difficult to determine.

  So the conclusion must be that intentionally designing the market so that DR providers receive as much as two or three times the value of DR (as in the above example)—or even 10 percent more—is not justified. In fact the Commission seems to agree with our analysis when it says "The Commission emphasizes that removing barriers to demand response participation is not the same as giving preferential treatment to demand response providers" (Paragraph 59). This indicates that "barriers" are not a justification for the Order 745's payment policy, and are only a justification for making sure that demand resources "receive the LMP for services provided," just as the Commission concluded, no more and no less.

- **In Order No. 719, the Commission found that allowing demand response to bid into organized wholesale energy markets "expands the amount of resources available to the market, increases competition, helps reduce prices to consumers and enhances reliability" (Paragraph 61).**

[5] The only possibility of avoiding this would be (if the Commission were to allow this) for the ISO to prohibit DR providers from providing demand reduction through such behind the meter supply technology. To be effective, such a prohibition would require on-site inspections because the source of the demand reductions cannot be detected at the meter.

While we agree that cost effective demand response can have these effects, the demand-response technology that moves across the street in our example and is re-labeled supply response would have the same effect as the demand response. Hence, in the present example, this consideration does not justify any difference in treatment between demand response and supply response; so this reason does not justify Order 745's payment policy.

- **"Requiring ISOs and RTOs to incorporate such disparate retail rates [G] into wholesale payments to wholesale demand response providers would, even though perhaps feasible, create practical difficulties for a number of parties" (Paragraph 63).**

  We agree that it could be appropriate for the Commission to allow ISO or RTO to set prices that are approximately correct when more exact pricing would be too costly relative to the benefits. However we cannot understand why the Commission would prohibit an RTO from using more accurate pricing if it and its market participants so desired.

- **"[D]emand response resources participating in the organized wholesale energy markets can be cost-effective, as determined by the net benefits test." (Paragraph 61).**

  As the context indicates, the Commission is saying that having the ISO pay the $60 LMP on top of the avoided $120 payment to purchase the power at retail (in these examples) is justified because it will be cost-effective when the net-benefit test so indicates. This will be our next topic of discussion, but in brief, the net-benefits test is a short-run test that, by definition, does not measure social benefit (increase in the sum of economic surplus gained by all market parties). Rather, it is intended to measure benefit to just one of the market parties (load), and in fact does not even correctly measure that benefit.[6]. So to the extent the justification of the LMP payment depends on the results of the net benefit test, the justification must be disregarded.

3. Paying Too Much Leads to Inefficient Demand Response

The above examples illustrate the inefficiencies that result from discriminating between resources based on which side of the meter they are on. We considered the location of distributed generation in that example. These inefficiencies also result if the resource was a 'true' demand resource, in the sense of representing decreased use of energy rather than distributed generation.

In particular, Order 745 requires that ISOs pay the LMP for reduced consumption by demand response resources under conditions when reducing consumption is inefficient. The economically efficient goal should be for resources to reduce their consumption whenever the value of their consumption is lower than the cost of supplying it.

However, the incentives created by Order 745 will likely cause some demand response resources to bid their load at prices well below those prevailing during shortage conditions, even if those prices fall well short of the true value of the power to the resource. (An example is provided lat-

[6] See discussion in Section 5.1, *infra*.

er in this section.) While it will likely be the case that the application of the "net benefits test" ordered by the Commission will at times make demand response resources submitting bids at low price levels ineligible to be dispatched off and paid the LMP for reduced consumption relative to their baseline consumption, there is no guarantee that this will always be the case.

Hence, demand response resources could submit offers to curtail load at prices just slightly above the normal level of LMPs (perhaps still below the retail rate they pay) and at times be paid the LMP for not consuming their baseline power. As was pointed out by many commenters in the proceeding,[7] this is inefficient. The net benefit to the consumer of consuming power at the retail rate equals the gross value minus the retail cost of the power. The social net benefit is the gross value minus the marginal cost of power. However, the net benefit to a load that provides DR under the Order's LMP payment rule would be much less than either of these values, equaling the consumer's *net benefit* of consumption (the gross value of power consumption less the avoided retail cost of the power) *minus* the LMP (which it would be paid as a DR response). Consequently, there is an over-incentive to reduce power consumption.

Consider a factory whose value of power is 20¢/kwh and pays a retail rate of 11¢/kwh. The consumer's *net* benefit of consumption after paying the retail price is 9¢/kwh. Efficient use of power would trigger reductions when prices rose above 20 ¢/kwh, but encourage consumption when prices were below this. By paying this facility the LMP without any adjustment for the retail price, this factory would find it profitable to provide demand response whenever the LMP rising above its net benefit of 9¢/kwh. Yet curtailing demand when LMPs are, say 12¢/kwh, would actually *destroy* 8¢/kwh of economic value to the market (the difference between gross value of consumption and marginal cost).

While the Commission alluded to various potential barriers to providing the efficient level of demand response such as "lack of a direct connection between wholesale and retail prices, lack of dynamic retail prices (retail prices that vary with changes in marginal wholesale costs), the lack of real-time information sharing, and the lack of market incentives to invest in enabling technologies that would allow electric consumers and aggregators of retail customers to see and respond to changes in marginal cost of providing electric service as those costs change,"[8] none of these conditions are relevant when the LMP is below or modestly above the normal range of LMPs and the retail rate. Yet the Commission's order would require that ISOs pay demand response resources the LMP for reducing their consumption in these circumstances, unless the DR fails the Commission's "net benefits test", which we discuss later in this Opinion.

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[7]See, for example, Comment of the Federal Trade Commission, May 13, 2010 pp. 6-10, Comment of the Federal Trade Commission October 13, 2010 pp. 3-5; Comments of the ISO New England Inc Internal Market Monitor, May 13, 2010, pp. 7-9; Comments of the Independent Market Monitor for PJM, May 13, 2010 p. 7; and Comments of Potomac Economics Ltd, May 13, 2010 pp.6-7.

[8]Paragraph 57

4. Phantom Demand Response

In the example in Section 2 in which we discussed the impact of where a resource resides relative to the meter, we assumed that the DR was provided by distributed generation whose output could be readily and accurately verified. For DR in the form of demand reductions rather than distributed generation, the overpayment can result in additional and very substantial market distortions because of the incentives it provides for "phantom" DR through, for example, inflated baselines. In this section, we describe why we believe that the FERC order creates the potential for a substantial amount of "phantom" demand response – payments for fictitious reductions in demand that did not exist in the first place. Such phantom DR would impose costs on consumers without providing any offsetting benefits.

DR is to be paid LMP if it passes the separate benefit-cost test and complies with ISO metering and verification requirements. The key difficulty with this requirement that leads to a danger of a substantial increase in phantom DR is that it is inherently impossible to measure power that would have been consumed but was not with the same accuracy as actual generation or consumption. Payments for power that was not consumed must in practice be measured by comparing actual consumption to some baseline measurement of expected consumption. Participants in price responsive load programs have the ability to submit bids that cause their demand to be "dispatched" whenever they know that their actual consumption will fall below their baseline for any reason, including holidays, reduced demand for their product, changes in the production cycle, etc. There are substantial real-world difficulties associated with defining baselines, ensuring that they are not inflated, and verifying the performance of demand resource. The CAISO Market Surveillance Committee has previously adopted Opinions that documented these problems, including evidence of inflated baselines resulting from overly large payments to DR.[9]

ISOs have until now limited the costs imposed on consumers by such phantom demand response through minimum bid price rules, LMP-G payment rules,[10] or limiting DR payments to emergency conditions only.[11] However, we are concerned that the first two protections against phan-

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[9] F.A. Wolak, J. Bushnell, and B.F. Hobbs, "The California ISO's Proxy Demand Resource (PDR) Proposal," Opinion of the Market Surveillance Committee of the California Independent System Operator, May 1, 2009a, www.caiso.com/239f/239fc54917610.pdf; F.A. Wolak, J. Bushnell, and B.F. Hobbs, "Comments on Barriers to Demand Response and the Symmetric Treatment of Supply and Demand Resources," Opinion of the Market Surveillance Committee of the California Independent System Operator, June 30, 2009b, http://www.caiso.com/23e7/23e793a012800.pdf .

[10]Rules that pay the demand response resource the difference between the locational marginal price at its node or zone and some measure of the retail rate or base line cost of power.

[11]These rules have been imposed precisely because of past problems with phantom demand response,. For example, the New York ISO established a $50 minimum bid level for its price responsive load program (Day-Ahead Demand Response Program) in 2003 and raised it to $75 in 2004 for precisely this reason, see the Commission's Order in Docket ER03-303-000, 102 FERC para 61,313, March 21, 2003, and its letter order in Docket ER04-1188-000 October 29, 2004. Neenan Associates, NYISO Price-Responsive Load Program Evaluation Report, January 8, 2002, noted with respect to the price responsive load program that "A significant portion of the accepted bids came in the early morning or late evening hours, and as would have to be the case, they were bid in at very low prices." P. 1-49, see also Table 1.2D pp. 1-122-1-127; New York ISO, "Proposed Changes to Day Ahead Demand Response Program," Business Issues Committee, May 19, 2004; PJM uses a demand response payment mechanism that adjusts

tom DR will be eliminated under the Commission's Order unless the "net benefits test" ordered by the Commission allows minimum bid prices to be set at a sufficiently high level or allows other rules such as LMP-G pricing to be applied.[12] The Commission's order precludes minimum bid prices set at a level higher than that defined by the FERC benefit-cost test (in effect, where supply elasticity exceeds 1), as well as precluding LMP-G pricing for demand response. The only limitation under Order 745 on the obligation to pay the LMP to demand response resources for demand reductions, even those with bids below the normal range of LMPs and the retail rate, is the "net benefits test" and the requirements for measurement and verification.[13]

If the Commission's order precludes minimum bid requirements in excess of the net-benefits threshold price (or worse precludes them entirely), this would allow demand response resources to bid as to require that ISOs pay the LMP for every reduction in consumption below the baseline, even when this reduction is coincidental and stems from the normal variations in consumption that cannot be accounted for in the baseline. This kind of phantom demand response may not lead to huge payments to individual resources, but can in aggregate entail large payments by consumers without any offsetting benefit.

Unfortunately, this lack of benefit is not accounted for in the "net benefit test" ordered by the Commission. While it is likely that the "net benefits test" ordered by the Commission would operate to relieve the California ISO of the obligation to make payments to providers of phantom demand response in some hours, this would not be because the demand reductions are phantom, but only if it were found that the real-demand response would not satisfy the benefits test. Hence, it appears that there would still be many hours in which California ISO and its consumers would have to pay for fictional demand response under the Commission's order. This would be a substantial and unwarranted burden on California power consumers. While it may be case that the "net benefits test" will be implemented in way that implies that DR bid in at LMPs that are below the retail rate will never qualify for payments under the Order, this is not assured by the order but depends on the result of the elasticity calculation embodied in the net benefits test.

The elimination of any threshold price except that implied by the net benefits test has the potential to undermine the validity of the baselines used to measure demand response. This is because

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for the price of power ("LMP-G") to address the potential for phantom demand response, see Monitoring Analytics, 2010 State of the Market Report for PJM, pp. 139-145.

[12]There are several statements in the order that we interpret as providing that the ability of a resource to provide demand response and the benefits test are the only explicit limitations on the requirement that ISOs pay the LMP for baseline power that is not consumed. For instance, in Paragraph 48 it is stated: "we find, based on the record here, that, when a demand response resource has the capability to balance supply and demand as an alternative to a generation resource, and when dispatching and paying LMP to that demand response resource is shown to be cost-effective as determined by the net benefits test described herein, payment by an RTO or ISO of compensation other than the LMP is unjust and unreasonable. When these conditions are met, we find that payment of LMP to these resources will result in just and reasonable rates for ratepayers." Paragraphs 54 and 82 make similar points.

[13]Paragraphs 48 and 54, cited *infra.*, appear to us to call for paying the LMP to demand response resources that reduce consumption during normal system conditions, if the "net benefits test" is satisfied. If our understanding is mistaken, and the Commission intends to restrict the application of the payments to demand response resources under Order 745 to shortage conditions, i.e., hours of reserve shortage, then it is critical that the Commission clarify in a rehearing order that this is the intent of the Order.

many days could be "event days," days in which the resource would be dispatched to provide demand response, and hence would not consume its baseline power. Over time, the "baseline" could come to be based disproportionately or perhaps largely on the days with the highest level of load, with other days excluded as "event days," further magnifying payments for phantom demand reduction.[14]

For example, suppose that the baseline were based on the average load during the same hour of the last ten non-event days, and a demand response provider had an initial baseline of 5 MW. Then suppose it had ten days with loads absent any curtailment of 2, 3, 4, 4, 5, 5, 6, 6, 7 and 8 MW, respectively, an average of 5 MW. Absent minimum bid prices, the demand response resource would offer 3 MW of price responsive load at a low price on the day on which it had 2 megawatts of load, offer 2 MW of price responsive load on the day on which it had 3 MW of load, and offer 1 MW of demand response on the days on which it had 4 MW of load. Over these days the provider would be paid for 7 MW of phantom demand response arising from the normal variations of its power consumption relative to the baseline. Moreover, the low load days would now be event days and excluded from the baseline, so the average load in the non-event days would rise to 6.16 MW, making it possible for the demand response provider to in the future offer 1 megawatt of demand response on the days on which it only had load of 5 MW. In addition, it would be paid for an extra MW of phantom demand response on the days on which its actual load was 2, 3 or 4 megawatts. This erosion of the baseline would continue, as the market participant would be able to offer 1.16 megawatts of price responsive load on days on which it had only 5 MW of load, and these days would be treated as event days in subsequent baseline calculations; as a result, the average non-event load would then be pulled up to 6.75 MW.[15]

It is possible that ISOs might be able to craft baseline rules that limit the payments to phantom demand response or that the net benefits test will often operate to avoid the need for such payments, but this will not necessarily be the case. This ambiguity means that the Order opens the door to requiring consumers to pay for phantom demand response, so ISOs should be allowed to

[14] In the extreme case, if the FERC order were applied in a manner that prohibited all minimum bid requirements, even minimum bids set at a level lower than the floor price for payment defined by the net benefits test, this would allow demand response providers to submit bids so low that there would be no non-event days and would create the potential for enterprising demand response providers to identify industrial facilities capable of consuming large amounts of power, but which are uneconomic to operate at real-world power prices. These resources could be bid in to ISO markets as demand response resources at bid prices so low they are always, or nearly always, dispatched off by the ISO during the day, so that they could maintain an inflated baseline based on operations scheduled specifically to establish the baseline.

While the Commission stated that "demand reductions that are not genuine may be violations of the Commission's anti-manipulation rules," (paragraph 95) it appears that a phantom demand response resource, of the type described above, would not violate the Commission's anti-manipulation rules if the resource could demonstrate its ability to consume the power in the event the price of power were lower than its bid.

[15] The higher the minimum bid price threshold allowed by the net benefits test, the less the attenuation of the baseline. For example if price on the 2 megawatt day were below the price threshold established by the net benefits test and a minimum bid requirement set at that level prevented the market participant from offering price responsive load in that hour, that hour would not be excluded as an event hour, so the baseline would initially raise only to 5.57 megawatts rather than 6.16 megawatts.

establish some form of minimum bid price for demand response independent of the “net benefit test.”

5. Net Benefits Test

In emphasizing the ability of demand- and supply-side resources to substitute for each other, and the need to ensure they are paid the same, the Order makes clear that the Commission’s central goal is improvement of market efficiency by ensuring that consumer demand is met at least social cost.[16] We agree that market efficiency should be the guiding principle of market design (although we argue in the previous section that in fact, paying LMP to DR will frustrate that goal and discriminate in favor of resources on the demand-side of the meter).

However, the Order contradicts itself when it mandates a separate test for one class of resources that is based on a different goal entirely. The “net benefits” test of cost-effectiveness that the Order imposes is not concerned with market efficiency as it does not attempt to consider the societal cost of meeting demand (equivalent to considering benefits to all market parties), but instead focuses on just pecuniary benefits to consumers. We believe that the “net benefits test” proposed by the Commission is deeply flawed both theoretically, because it singles out short-term pecuniary benefits to one market party or set of market parties, and practically because it does not ensure even its stated goal.

The stated objective of the benefits test of reducing payments by consumers[17] is inappropriate, and this test does not even correctly measure net consumer payments. Such a test is required of DR and no other resource. We believe that the Commission’s instituting a net benefits test beyond the market test of bidding and being accepted in an auction indicates that the Commission is aware that paying LMP to DR is not necessarily efficient, and does discriminate inefficiently, at least at some times, in favor of demand response.

No such test would be necessary if instead a payment of LMP-G was made to fully verified DR. Genuine DR that can be profitable under this payment is efficient (increases market surplus) while any DR that cannot make money under that price reduces market surplus. With the correct payment, no separate screen, such as the Order’s benefit-cost test, is needed.

Below, we first explain why we believe that the implied objective of the benefits test is inappropriate and inconsistent with market efficiency. Then we discuss reasons why the test, as proposed, incorrectly calculates the short-term pecuniary benefits to ratepayers. Finally, we explain why in the long run the expenditure of resources on inefficiently expensive DR will not be successful in lowering prices.

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[16] This is implied by the Order’s emphasis on paying resources that that can substitute for each other the same price.

[17] Footnote 162, Paragraph 80.

5.1 Inappropriateness of Consideration of Pecuniary Benefits

The essence of the "net benefits test" that FERC imposes in Order 745 is the net billing effect,[18] which measures the pecuniary impact of demand reductions in reducing total payments by consumers for power by depressing the spot price of power.[19] As just pointed out, this judges cost-effectiveness from the point of view of pecuniary benefits to one group of market parties, not the total cost of meeting consumer demand. This test is related to the criterion for the profitable exercise of monopsony power, rather than measuring reductions in the resource cost of meeting consumer load. This is a large and important departure from the FERC market design principle, which is nondiscriminatory market access to promote maximum market efficiency, as measured by the usual market efficiency metric of producer plus consumer surplus (plus any transmission congestion surplus). This departure violates the fundamental market principle of 'the law of equal marginal costs' in which two resources meeting the same need receive the same revenue or benefit; this law is enforced by market rules that maximize net market surplus, not the benefits to one particular set of market parties.

As we pointed out above, the Order recognizes that market efficiency is the primary objective of market design. However, the benefits test is inconsistent with that objective. We question whether it is good public policy to incur costs that will be recovered from consumers in order to discriminate against resources in the manner we have documented in Section 2 and depress spot energy market prices. We think this policy is unlikely to benefit consumers, for reasons we explain in the next two subsections.

This last point is the one we think is particularly important to keep in mind. In the end the costs of all the market inefficiencies incurred in order to implement elaborate schemes to depress spot prices will be borne by consumers. Meanwhile the "benefits" of depressed spot prices that are not the result of production costs savings are likely to be brief or completely illusory. Hence, we think that the policy that benefits consumers is to make the market as efficient as possible, and Order 745 as it appears to be structured is a major step in the wrong direction.

5.2 Incorrect Characterization of Short-Run Pecuniary Effects

However even if one thought the criterion of reducing payments by load, rather than minimizing the social cost of reliably meeting load,[20] was desirable, and even if the demand reduction were real, the benefit-cost test appears likely to grossly overstate the actual pecuniary benefits to consumers from demand response.

From the standpoint of measuring the pecuniary benefits to consumers, the FERC benefits test is accurate only for a power buyer with no forward hedges (i.e., a buyer that is not hedged either through generation ownership, contracts or financial rights ownership). In particular, we note

[18]See, for example, paragraphs 78, 79, and 80

[19]Total payments calculated based on the spot price of power which as noted above does not measure the actual cost of purchased power in the case of load serving entities that own generation, have purchased or been allocated congestion hedges, or have contracted forward for power.

[20] With social cost defined using the usual metric of market efficiency (the change in the sum of market participant surpluses, including consumer surplus, transmission congestion rent, and producer surplus).

that a reduction in the spot price of power does not, even in the short run, benefit the following customers:

- customers of investor owned utilities meeting customer load with their own generation;[21]
- customers of municipal utilities or cooperatives meeting customer load with their own generation;
- customers served under multi-year power contracts, including Provider Of Last Resort contracts, qualifying facility contracts and renewable generation contracts;
- customers for purchases hedged through ownership of congestion rights, CRRs in California, FTRs or TCCs in other ISO markets, when prices are reduced only in constrained areas.

Thus, the FERC "net benefits test" does not correctly measure even the pecuniary benefits to consumers from depressing the spot price of power by replacing low cost generation with higher cost demand response which the order apparently seeks. One reason that this is the case is that the test described in the Order does not take account the extent to which consumers have contracted forward for power supply through either ownership of generation or financial or physical contracts for power.[22] It does not benefit a consumer of a municipal utility that uses its generation to meet its customers load to incur additional costs to suppress the spot energy price; that is just a dead weight loss to the consumers of such a utility.[23]

[21] The incremental cost to consumers of this power is the cost of the generation fuel, variable operations and maintenance costs, and any emission allowance or tax costs that vary with output. Reductions in the the spot price of power do not reduce this cost of the power generated by such utilities to meet customer load.

[22] If forward contracts are correctly accounted for, the benefit-cost test's implicit criterion of less than unit elasticity for the supply curve actually becomes a much lower value of elasticity. This would significantly raise the implicit price threshold at which DR would pass the test, and would make it significantly more difficult for DR to pass the test. See B.F. Hobbs, "FERC Order 745 Benefit-Cost Test: Two Simple Analytics", www.caiso.com/2b6f/2b6f81672f7c0.pdf . For instance, if the forward price is 20% higher than the LMP, and forward contracts amount to 70% of the load, then the threshold elasticity is 0.26, not 1.0. At higher elasticities, paying LMP to DR would increase prices to consumers. Unfortunately, careful application of this test would require estimates of both the amount of forward contracts and their prices, information which is not readily available.

[23] The "net benefits test" also appears premised on the absence of congestion across the ISO footprint. Footnote 162 of the Order states the test as follows: "(t)hus the test is to determine where: (Delta LMP x MWh consumed) > LMP new x DR." Not only is this test not correct if the "MWh consumed" is for the footprint as a whole but the price impact is more local. The test is not correct even if the Delta LMP is calculated for the same region as the MWh consumed, because this would fail to account for congestion rents. If the Commission wished to measure the pecuniary benefits to consumers of reducing the spot market price, the correct measure would be the Delta LMP x the MWH of *generation* within the constrained region. Since the load would exceed the generation within a transmission constrained load pocket, perhaps by a lot, the "net benefits test" stated by the commission would overstate the pecuniary benefits to consumers of paying less for energy.

Finally, the way Order 745 discusses short run supply curves and pecuniary benefits grossly understates the complexity of implementing such a principle in LMP-based electricity markets. It also appears to order an approach to calculating the elasticity of supply that would likely materially understate it. Understating the elasticity of supply would further overstate the pecuniary benefits from demand reduction. In ISO and RTO market designs, the "real-time supply curve", i.e., the real-time bid stack for the five minute dispatch, depends on the unit commitment decisions in the day-ahead market, and then in an intra-day evaluation process (HASP/RTPD in California) in which additional unit commitment and import/export scheduling decisions are made. Any benefit analysis that takes the unit commitment/import scheduling decisions as fixed will likely calculate a "supply curve" that is much less elastic than the true supply curve.[24] Moreover, in California, the real-time dispatch minimizes the production cost of meeting load not only in the current dispatch interval, but optimizes over time, adding further complexity to any effort to implement the benefit calculations ordered by the Commission. Indeed, depending on exactly how the Commission intends the benefit calculation to impact the real-time dispatch,[25] the effort to implement the benefit calculation would be so complex that it would require delaying implementation of other software changes needed to accommodate higher levels of intermittent generation on the California ISO grid.[26]

5.3 Long Run Ineffectiveness of Inefficient Expenditures to Depress Prices

[24] It should also be kept in mind that for consumers to reap the pecuniary benefits from real-time spot price suppression, that suppression needs to be reflected in day-ahead market prices. If the load serving entity that serves those customers is not aware of, and cannot predict, the trigger price or amount of real-time demand response and buys power in the day-ahead market, it will not be purchasing power at artificially low real-time prices. Instead, it will be selling back power at artificially low real-time prices, benefiting generators, not consumers. If the real-time demand reductions are predictable day-ahead, load serving entities would reflect the expected reductions in the amount of power they buy day-ahead, leading to lower real-time prices. If load serving entities are sometimes right in expecting and getting demand response but sometimes wrong in expecting but not getting demand response or not expecting but getting demand response, it becomes difficult to assess what portion of the potential pecuniary benefits from spot price suppression would actually flow to load serving entities and their customers. Our reading of the order does not suggest to us that the Commission has imposed any requirements that demand response resources provide any such advance information in order to qualify for such payments.

[25] If it is intended that the benefit calculation would only affect whether demand response resources were paid the full LMP when dispatched, but they would be dispatched based on their bid without regard to the benefit calculation, this could be implemented with an after the fact benefit calculation to determine compensation and would not unduly complicate the real-time dispatch (although it could lead to reliability impacts if uncertain payment impacted the response of demand response resources to dispatch instructions. If it is intended that demand response resources would only be dispatched based on their bid if the dispatch satisfied the benefits test, this would be so complex to even to attempt to implement with the current dispatch software that it would certainly greatly complicate and perhaps even preclude prospective improvements in real-time dispatch software intended to reduce the production cost of meeting load and improve reliability.

[26] See, for example, California ISO, Discussion Paper, "Renewable Integration: Market and Product Review," July 2010 p. 16; California ISO, "Renewable Integration & Product Review-Phase 2," April 12, 2011 pp.17-19; California ISO, "Discussion & Scoping Paper on Renewable Integration Phase 2," April 5, 2011 pp. 12-15.

In the long run, the impact of demand response on spot prices will be reflected in the forward price of power and capacity. However, because the long-run supply curve is much more elastic at the margin than the short-run dispatch curve, the impact of demand response on forward prices will be much less than estimated by the "net benefits test." In the long run, the sum of contract payments and energy payments must cover the cost of new generation and going-forward costs of old generation. As a result, the effect of paying more than LMP to behind-the-meter-resources (as demonstrated in Section 2) is to inflate costs in a vain attempt to suppress spot energy prices, because this will just raise the contract and capacity market payments consumers must make to keep existing and needed generation available.[27]

The Commission gave short shrift to capacity markets in the Order, saying "This Final Rule is focused only on organized wholesale energy markets, not capacity markets. … Indeed, in some cases, the capacity markets already reflect energy and ancillary service revenue in determining capacity prices." We appreciate the Commission's inclination to disentangle this complex issue from the even more complex and equally contentious issues of capacity markets. And on this point we will follow the Commission's lead in that we will not discuss the formal structure of capacity markets or capacity payments.

But the Commission contradicted itself when it said "in some cases, the capacity markets already reflect energy and ancillary service revenue …" What needs attention is the capacity revenue that already comes from the energy market, and not just in some cases but in every case. That capacity revenue is the source of the supposed "benefit" of reducing the LMP, and failing to examine the source of this benefit, in even a cursory manner, means the Commission's central justification for paying LMP[28] is unsupported, and as it turns out, unsupportable.

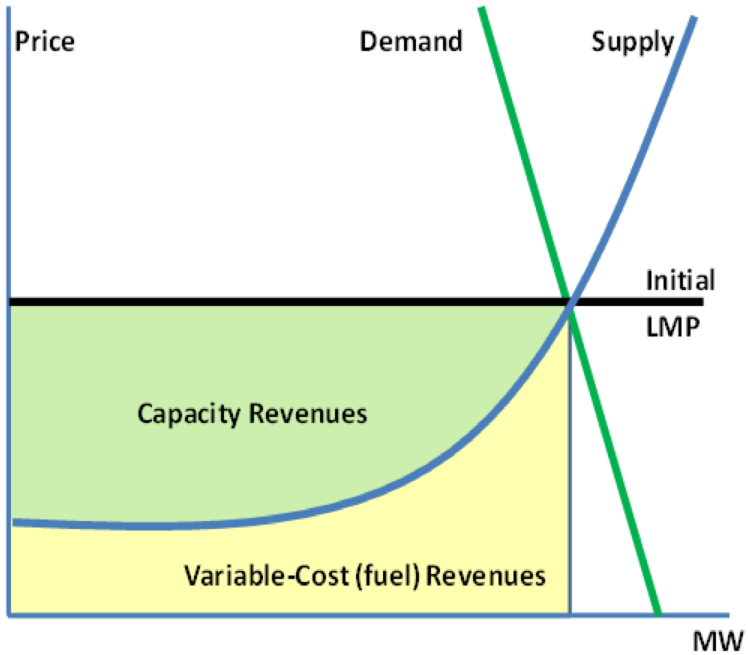
5.3.1 Where the Benefits Come From. Figure 2 shows short-run supply and demand curves for a particular hour in a RTO market. As Figure 2 shows, variable costs, which are mainly fuel costs, are given by the yellow area below the short-run supply curve, which is also known as the short-run marginal-cost curve. All of the area below the LMP and to the left of the market-clearing quantity (yellow and green combined) is revenue that flows to generators. (We disregard the existence of forward contracts and other complications for purposes of this discussion.) As can be seen, much of this revenue—the green area—is not needed to cover variable costs. The green area, rather is the revenue above operating costs, sometimes called the ``capacity rent'' earned by generators. If the supply curve represents the true incremental costs of production (e.g. there is

[27] The Commission notes at paragraph 85 that "indeed in some cases, the capacity markets already reflect energy and ancillary services revenue in determining capacity prices." However, the Commission needs to be mindful of the fact that that a reduction in energy market margins will necessarily raise the capacity payment in the long run if adequate generation investment is to be maintained. Hence if Order 745 had the intended effect of reducing energy spot prices, it would, other things equal, result in an increase in the capacity prices paid by unhedged consumers. Thus the order would boil down to consumers paying less out of one pocket to generators, and more out the other pocket to generators, while also having to pay for the inefficient demand response.

[28] "[D]emand response resources participating in the organized wholesale energy markets can be cost-effective, as determined by the net benefits test" (Paragraph 61), which was the first reason given by the Order for paying LMP to demand response.

no market power) these revenues are largely, and in many cases entirely, needed to cover capacity costs, i.e., the return of and on the investment in generating capacity.

Figure 2. Capacity Revenues and Variable-Cost Revenues



Now assume that the LMP shown in Figures 2 and 3 is somewhat above the threshold implied by the net-benefit test of Order 745 (i.e., where supply elasticity falls below 1). Also assume that a DR program takes place that passes the net-benefits test and shifts the demand curve to the left as shown in Figure 3.

Figure 3. Load's DR Benefit Comes from Capacity Revenues (Gross Margin)

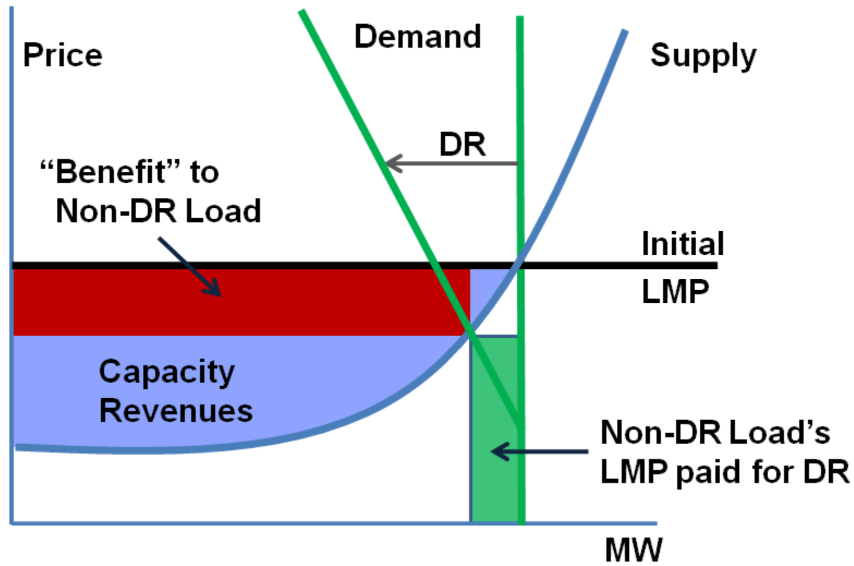


Figure 3 shows the pecuniary benefit that load will derive from the reduction in the LMP caused by the demand response. As can be seen it is greater than the cost to load of the DR program (which is the new LMP times the amount of load reduction), so the net-benefits test would be passed. This is true for any region of the supply curve that is inelastic.

But this benefit to load is entirely derived from by reducing generator gross margin that the Commission has repeatedly agreed is needed—and indeed insufficient—to cover capacity costs. Moreover, the DR response shown, which causes this transfer, has no effect on the costs of these generators. The completely standard DR program shown in Figure 3 takes revenues from suppliers, revenues which the Commission has frequently agreed the generators need to cover their capacity costs, and has given these revenues to non-DR load. This is the benefit to load measured by the net benefits test.

Technically, a market design that has all load pay a price greater than the market price[29] to subsidize demand response in order to depress market prices has an effect analogous to the exercise of monopsony power—market power exercised by customers—but it is clear from the Order that it was not intended as such. Instead the Order's hope has been that this benefit to load resulted from a genuine cost savings. In fact, the point of economic efficiency is to reduce *costs* and thereby lower the *cost* to load. Unfortunately the two, completely distinct meanings of "cost" in this statement frequently cause confusion. The costs that are reduced by efficiency gains are capital and short run production costs. Under competition, these will generally lead to reduced purchasing costs for load. However, reductions in the cost of purchasing power can arise from sources other than a reduction in the cost of production—for example a large buyer could pay an expen-

[29] I.e., pay LMP+G which is greater than LMP; as Section 2 shows, this is what non-DR load would be paying demand response under the Order's LMP pricing rule.

sive generator to produce power out of merit in order to depress the energy price the buyer would pay to other generators. The latter would be a classic case of monopsony power.

There may be efficiency gains (that reduce the cost of production) if DR programs reduce peak load, and there could be other efficiency gains if DR programs are sufficiently inexpensive. Indeed, we believe that the potential benefits of efficient DR are likely to be large, and the MSC has said so in several previous Opinions.[30] However, efficiency gains in the form of reduced costs of meeting load are not the only reason that DR can reduce prices; inefficiently expensive DR can also reduce consumer expenditures by transferring income from producers to consumers, in a manner similar to the exercise of monopsony power. By not checking any other possibility, the Commission has implicitly assumed that the price reduction measured by the net benefits test is entirely the result of efficiency gains. This assumption is not only unwarranted, but as Figure 3 shows, at times clearly mistaken. In that wholly typical case, the price reduction does not result from a reduction in the cost of meeting load that enables lower value power demand to be met, but instead results from reducing high value power demand, and any "benefit" to consumers is only a wealth transfer.

The net-benefits test is not based on reducing the social cost of meeting load resulting from efficient DR programs. This conclusion in no way negates the view that DR programs can increase efficiency, as well they can. But that benefit cannot be seen in the short-run impact on prices, especially when DR programs are receiving more than LMP in return for their services.

5.3.2 Why the Benefits Will Not Last. Furthermore, although Figure 3 shows a transfer from suppliers to load, this transfer is likely unsustainable. Such transfers will leave incremental generation with a sub-normal return on equity, which means either that (1) supply will exit or new supply will fail to enter, leading to a leftward shift in the supply curve compared to where it would have been otherwise or (2) the market will correct the problem by raising prices to a level sufficient to incent investment, putting an end to the transfers. There is no other outcome. Investment in new supply will cease until the market returns to generation again to cover capacity costs. We now consider each of these two scenarios.

First, DR programs could be so strong that they permanently prevent the need for new capacity, while the old capacity slowly retires, with the end result that all generation takes place behind the meter under the guise of demand response. In this case DR programs could siphon off the capacity revenues of existing generation. This would speed the rate of retirement somewhat, and result in loss of value for all existing generators. If this were to occur simply because the Commission has allowed a more-efficient type of competitor into the market, then this outcome would be efficient and could not be criticized. But if this outcome occurs because DR providers are receiving LMP+G, while old-fashion supply is receiving only LMP, the loss of value would be a regulatory taking.[31]

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[30] Wolak et al., 2009a,b, *op. cit.*

[31] In that case, the costs of DR are likely to increase over time in order to permanently avoid the need for new generation. For instance, say in period 1 we pay $100,000 for DR that reduces the price from $50 to $48, and reduces payments to generators by $150,000. Then in period 2, unless that payment to DR is made again, price would not only rise back to $50 without DR, it would rise above $50 because there is less generation. Now the market needs to buy even more DR to keep the price at $48, and might have to spend $100,000 for DR just to keep the price at $50.

However, the second possible scenario is more likely. In this scenario, DR programs will not be strong enough to keep ahead of both load growth and generation retirement. As a consequence, some (though less) new investment will remain necessary. But the market will refuse to invest at all until normal capacity revenues are restored. But to restore normal capacity revenues from the energy market, it will be necessary to put an end to the flow of capacity revenues into the pockets of load.[32] And investors must be convinced that this has been stopped permanently. Most likely, the market will handle all this in its normal way. There will be a slight shortage of capacity, and spot prices will, on average, go back up by the amount they were reduced by the DR programs.

So the likely outcome is that the benefit transfer to load will end sooner or later by raising prices and without any disruption. Fortunately, markets are quite robust. The result will be that the short-run net-benefits test of Order 745 will continue to assure load that it is successfully picking the pockets of generators, but this will be an illusion. In reality non-DR load will be paying for the subsidized costs of DR programs. Because of the inefficiencies in this arrangement, rates will rise, and eventually non-DR load will discover that it is their pockets that are being picked and not those of the generators.

6. Conclusion

We have demonstrated that the effect of FERC Order 745 will be to discriminate in favor of demand response by instituting a market design that will pay it well in excess of LMP, especially during periods of moderate and low prices. This discrimination is arbitrary, based on the location of resources on one side or the other of the customer's meter. The result is likely to be inefficient deployment of DR, including distributed generation, and the risk of increased phantom DR. The net benefits test is not a test of market benefits, but of pecuniary benefits to one set of market parties, which we believe is an inappropriate philosophy for a market test. The net benefits test also fails to correctly represent short run pecuniary benefits, and in the long run, most of those benefits will be illusory because capacity or energy prices would need to in compensation rise to ensure sufficient return to generation investment. Consequently, paying more than LMP to inefficient DR resources will ultimately result in increased costs to consumers, not decreased costs.

The implicit subsidization of wholesale DR through the LMP payment mandate will also increase obstacles to retail demand response, especially real-time pricing. This is because such retail programs will be at a financial disadvantage, as participants would only have an demand reduction incentive equal to the real-time price, as opposed to the LMP+G incentive implicit in Order 745. As a result, Order 745 will have the effect of encouraging DR in the bulk power market at the expense of retail programs; in the long-run, this may mean less involvement of demand in the market, not more, and certainly will result in more problems with verification and monitoring.

Because of these fundamental economic issues with Order 745, we urge FERC to revisit several aspects of its DR policies. Most importantly, FERC needs to allow ISOs that are implementing

[32] Alternatively, and equivalently, a new capacity charge could be levied on load.

DR programs to set payments such that DR providers and consumers together receive *total* benefits that approximate LMP, rather than receiving a payment equal to LMP from an ISO in addition to avoiding payments for the energy that is not consumed. Many of the other incentive problems we highlight in this opinion stem from these excess revenues that could flow to DR providers when a full LMP payment from ISOs is required for demand reductions. A past MSC opinion has argued for a mechanism such as "buying a baseline" to accomplish this,[33] but certainly setting payments according to LMP-G principles is a step in the right direction. If the LMP-G payment approach is adopted, then as a second step we would advise eliminating the net benefits test. If the excess payments are minimized, then there is little need for an additional net benefits test. Finally, we believe that ISOs must be allowed reasonable discretion to develop rules and protocols to help minimize the potential economic harm to the market from phantom demand response.

[33] Wolak et al., 2009a, *op. cit.*