



MMU White Paper: PJM Demand Side Response Program

PJM Market Monitoring Unit

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Introduction

This is a white paper on the status of Demand Side Response (DSR) program, prepared by the PJM Market Monitoring Unit (MMU) in the context of the ongoing discussions regarding the future of the DSR program. The purpose of this paper is to present the basic economic parameters for discussion of the demand side program and to discuss current subsidies in that context. The PJM Demand Side Response Working Group has been discussing proposed modifications to the DSR program since October 2006 without reaching an agreement. The current tariff provision that requires the payment of LMP to participants in the demand side program when the LMP is greater than \$75 per MWh will expire on December 31, 2007 absent a two thirds vote of the Members Committee to extend this provision.

The purpose of PJM's demand side Economic Program is, or should be, to address a specific market failure, which is that many end use customers do not pay the market price, or LMP. This represents a market failure because when customers do not pay the market price, the behavior of those customers is inconsistent with the market value of electricity. When customers pay a price less than the market price, customers will tend to consume more than if they faced the market price and when customers pay a price greater than the market price, customers will tend to consume less than they would if they faced the market price. This market failure is relevant to the wholesale power market because the power used by customers is generated and sold in the wholesale power market.

Based on this purpose, the design goal of the Economic Program incentives should be to replicate the price signal to customers that would exist if customers were exposed to the real-time wholesale price. The real-time hourly LMP is the appropriate price signal as it reflects the incremental value of each MWh consumed.¹ The goal of the program should be neither to encourage increased or decreased consumption, but to permit customers to face the market price and to make consumption decisions consistent with that price.

The PJM Economic Program is a wholesale program and its goal should be to ensure that the appropriate wholesale price signal is provided to customers but should not be to address retail rate issues. The design of retail incentives is a matter for state public utility commissions.

¹ This does not mean that every retail customer should be required to pay the real-time LMP, regardless of their risk preferences. However, it would provide the appropriate price signal if every retail customer were obligated to pay the real-time LMP as a default. That risk could be hedged via a contract with an intermediary.

End use customers pay retail rates including components that reflect the cost of generation (or power purchased from the grid), the cost of transmission and the cost of distribution. Under a rate design consistent with the purpose of the demand side program, the hourly LMP would replace only the generation component of retail rates in order to provide the appropriate wholesale market price signal to customers. The LMP reflects the economic value of wholesale power and does not reflect the value of transmission or distribution services.

Structure of Incentives – Economic Program

The goal of the Economic Program incentives is to ensure that customers paying retail rates with an embedded generation component that is not linked to the market LMP have the option to see the appropriate price signal. The Economic Program provides an accounting mechanism, managed by PJM, that requires the payment of the real savings that result from load reductions, or a share of them under a contract, to the load reducing customer. Such an accounting mechanism is required because of the complex interaction between the wholesale market and the incentive and regulatory structures faced by Load Serving Entities (LSEs) and customers. The broader goal of the Economic Program is to transition to a structure where customers do not require mandated payments under an administrative program but where customers see and react to real-time wholesale market signals or enter into contracts with intermediaries to provide that service. The optimal design for the Economic Program would be related solely to wholesale market incentives and would not distinguish between load reductions above or below \$75 per MWh. Even as currently structured, the Economic Program represents a minimal and relatively efficient intervention into the markets.

Incentives associated with the current Economic Program are based upon the actual load reduction provided in excess of committed day-ahead load reductions plus the adjustment for losses. The actual payment depends on the level of zonal LMP.² If zonal LMP exceeds \$75 per MWh, customers are paid the full LMP. If zonal LMP is less than \$75 per MWh, customers are paid the LMP less the generation and transmission components of the applicable retail rate. The rationale for this difference when implemented was based on the frequency distribution of LMP. The idea was that \$75 represented the break point between high prices and typical prices. The logic was that it is therefore appropriate to increase incentives when prices are high because savings are greater.

From a retail market perspective, in the absence of an Economic Program, for an individual customer on a standard fixed retail rate, the savings that result from a load reduction equal the applicable retail rate. If the customer pays a total retail rate of \$150

² Relevant aggregate LMPs may also be used in some cases.

per MWh, the customer saves exactly \$150 when load is reduced by 1 MWh. Standard retail rates include payments for generation, transmission and distribution.

From a wholesale market perspective, in the absence of an Economic Program, for an individual customer on a standard fixed retail rate, the savings that result from a load reduction equal the generation component of the applicable retail rate. If the customer pays a retail rate that includes a generation component of \$40 per MWh, from a wholesale power market perspective, the customer saves exactly \$40 when load is reduced by 1 MWh.

If the customer paid the LMP for each MWh used, rather than the generation component of retail rates, the savings to the customer from a load reduction would equal the LMP. This is the appropriate price signal and this is the price signal that the Economic Program should be designed to replicate. This price signal does not reflect a subsidy.

From a wholesale power market perspective, in the absence of an Economic Program, for an LSE the savings that result from a customer reducing load equal the difference between the LMP and the generation component of retail rates.³ The LSE pays the hourly LMP to purchase the energy required to serve the customer at a fixed retail rate.⁴ In this case, the savings to the LSE from a reduction of 1 MWh by the customer equal the difference between the cost not incurred by the LSE, the LMP, and the revenue not received, the generation component of the retail rate. The LSE avoids paying the LMP to purchase a MW but the LSE loses the revenue from the generation component of retail rates.

If the LSE pays the LMP to purchase energy to serve the customer, the wholesale-related savings received by the LSE will equal the LMP less the generation component of retail rates. The corresponding wholesale-related savings received by the customer, paying a fixed retail rate, will be the generation component of retail rates.^{5,6}

³ The LSE's perspective is also a function of retail rate design and revenue recovery issues. The LSE loses retail revenues related to the transmission and distribution components of rates whenever a customer uses less power. Those rate design and revenue recovery issues are state regulatory issues rather than wholesale power market issues.

⁴ This is true regardless of whether the LSE is long or short. In either event, the opportunity cost is the LMP so that the value of the MWh to the LSE is the wholesale price.

⁵ The incentives and underlying resource savings are the same regardless of whether the LSE purchases power to serve load at hourly LMP or under a fixed price contract with a generator. In the contract case, the savings are the same although the distribution of the savings may vary.

⁶ It is frequently the case that a Curtailment Service Provider is the intermediary between the customer enrolled in the Economic Program and the LSE.

From a wholesale power market perspective, the optimal payment under the Economic Program whether LMP is above or below the \$75 per MWh threshold would be the LMP less the generation component of retail rates, because the generation component of retail rates is a substitute for the LMP. If a customer is paying \$40 per MWh for the generation component of energy in retail rates but by reducing load eliminates the need for the LSE to purchase a MWh at \$900 per MWh, the total resource saving is \$900 per MWh. The customer receives \$40 per MWh of that saving by not paying the generation component of the retail rate and should receive the balance, \$860 in this example, from the LSE payment.

The payments to customers under the program are made by the LSEs serving the customer and by all LSEs in the customers' zone. Under the program, the LSEs serving the customer pay load-reducing customers LMP less the generation and transmission components of the retail rate.⁷ When LMP is greater than or equal to \$75 per MWh, the amount not paid by the LSE, equal to the generation and transmission components of the applicable retail rate, is charged to all the LSEs in the zone of the load reduction (called "recoverable charges").

The result, when LMP is greater than \$75 per MWh, is that customers receive payments from both sources under the Economic Program and the total payment equals the LMP. Given that the optimal payment to curtailing loads would be the LMP less the generation component of retail rates, the payments by zonal LSEs represent a subsidy to curtailing customers to the extent that they cover the generation component of retail rates, but do not represent a subsidy to the extent that they cover the transmission component of retail rates.⁸ Put another way, the payment by the LSE of LMP less the generation and transmission component represents an underpayment of the savings associated with the demand side response. The underpayment is the amount of the transmission component of retail rates. When the zonal LSEs pay the transmission component of retail rates to the customer, that is not a subsidy as it should not have been subtracted in the first place. The same is true of the distribution component of retail rates. Neither the transmission nor the distribution component of retail rates reflect wholesale generation resource savings when a customer reduces load. When the zonal LSEs pay the generation component of retail rates to the customer, that is a subsidy because the appropriate payment is LMP less the generation component.

⁷ Curtailment Service Providers (CSP) typically stand between the customer and the LSE. The CSP receives the payment and shares it with the customer based on a contractual agreement. For simplicity, this paper will refer to the customer. This simplifying assumption does not change the approach or conclusions.

⁸ This assumes that the transmission and generation components of retail rates can be unbundled, which is a reasonable assumption.

If the total amount of recoverable charges reflecting this generation and transmission payment for the entire program exceeds \$17.5 million in a year, participants receive LMP less an amount equal to the applicable generation and transmission charges for the remainder of the year, regardless of the level of LMP. This threshold was reached for the first time in 2007.

Subsidy

From a wholesale power market perspective, it does not represent a subsidy if a customer's payments are reduced by the LMP when it reduces load. Since the customer's payments are reduced by the generation component of retail rates when load is reduced, the appropriate payment to the customer under the Economic Program is the LMP less the generation component of retail rates. This payment does not reflect a subsidy because it ensures that the customer receives a total benefit equal to the LMP, the wholesale market-based value of power.

Any wholesale power market related reductions of customer payments in excess of the LMP do reflect a subsidy. To the extent that the payment under the Economic Program results in reductions in customer payments greater than the LMP, this reflects a subsidy. Subsidies can result, under the Economic Program, from a direct payment to the customer which is in excess of the LMP less the generation component of retail rates. This occurs under the Economic Program when LMP is in excess of \$75 per MWh. This also occurs under the Economic Program when any payments are made to customers who pay the LMP as a component of retail rates. Conversely, there is an underpayment under the program if customer payments are reduced by less than the LMP. This occurs, under the Economic Program, when LMP is less than \$75 per MWh.

As an example, assume that the LMP is \$100 per MWh and the generation component of retail rates is \$25 per MWh. A customer that reduces consumption by 1 MWh would pay \$25 less if only the generation component of retail rates were avoided. If the full LMP value of the energy were avoided, the customer would avoid \$100 per MWh. The current program pays the customer the \$100 LMP and the customer avoids the \$25 retail generation component for a total savings of \$125. This represents a subsidy in the amount of the \$25 generation component of retail rates.

There is nothing inherently wrong with providing a subsidy when they the subsidy is designed to address a clearly defined market failure and the level of the subsidy is carefully designed to be that amount required to address that market failure. The payment of the generation component of retail rates represents a subsidy that was explicitly designed to meet that public policy objective.

However, the subsidy that results when a customer who already pays the LMP in retail rates was not explicitly designed to meet that public policy objective and should be eliminated from the program.

As an example, assume that the LMP is \$100 per MWh and the generation component of retail rates is \$100 per MWh. A customer that reduces consumption by 1 MWh would pay \$100 less if the generation component of retail rates were avoided. If the full LMP value of the energy were avoided, the customer would avoid the same \$100 per MWh. The current program pays the customer the \$100 LMP and the customer also avoids the \$100 retail generation component for a total savings of \$200. This represents a subsidy in the amount of the \$100 generation component of retail rates.

Costs and Benefits of Economic Program

The quantifiable costs of the Economic Program include the direct administrative costs of operating the programs by PJM plus the cost of subsidies paid to market participants. The costs of the current Economic Program associated with payments by zonal LSEs are the payments for the generation component of retail rates (the subsidy). The benefits are difficult to quantify because the benefits are the efficiency gains which result from customers responding to market prices rather than artificial prices based on average retail rates. Both the costs and benefits are viewed from the perspective of the wholesale market.

The payments of the LMP savings by the LSEs provide a direct saving to curtailing customers.⁹ In addition, customers save in the amount of the retail rates that they do not pay as a result of curtailing. These customer-specific savings are not the focus of this analysis, but serve to offset any customer-specific costs and provide an incentive for participation.

The benefits of the program are the resultant increase in market efficiency. The benefits of the program are not equal to any market price impacts, which represent a transfer from generation to load. Regardless, the potential benefits of increasing demand side responsiveness in improved efficiency of the market are large and certainly exceed the relatively small program costs by a wide margin.

Future Program Design

From an economic perspective, the optimal program design for the Economic Program would include the following features:

- Payments to reduced load equal to the LMP less the generation component of retail rates, regardless of the market price;
- Any additional subsidy should be narrowly defined;
- No program payments to customers who pay the LMP as part of their price;

⁹ The exact payments to the customers depend on an allocation defined by a contract between the CSPs and their customers.

- Detailed and accurate measurement and verification, including the ability of PJM and the MMU to review actual reductions in usage and to approve or deny program payments based on that review;
- Payments to customers based on LMP less the generation component of retail rates should be made by LSEs and not by other market participants.

The payments to customers who reduce load should be based on LMP less the generation component of retail rates because this reflects the resource savings associated with reducing consumption by a MWh. This payment does not represent a subsidy to customers. The measurement of the savings is not a function of an arbitrary trigger market price level, as under the current design. To the extent that there is a concern that savings are being claimed at low LMP, the issue should be addressed by improved measurement and verification and the ability of PJM and the MMU to do additional, more detailed tests to verify or deny actual reductions and associated savings. No payments should be made in the absence of verifiable usage reductions in response to the program.

There should be no program payments to customers who already pay the LMP as part of their price because there is no market failure to address in this case. The payment of LMP by customers is the goal of the program. There are no additional resource savings achieved by customers paying market prices who curtail. The program would send a significantly distorted price signal to customers who already pay LMP.

The Economic Program payments to customers who already pay LMP represent a significant proportion of total payments under the program. Of the \$17.5 million paid out in recoverable charges in 2007, 30 percent was paid to customers who were on retail rates where they paid day-ahead LMP and an additional 12 percent was paid to customers who paid real-time LMP with a cap.¹⁰

Accurate measurement and verification is essential to ensuring that the Economic Program achieves its objectives and achieves its goal of paying for actual resource savings rather than paying for phantom savings. Any measurement and verification protocol based on broad average usage levels will be inaccurate at least part of the time. That is why, when a payment is contested, PJM and the MMU must have the explicit authority to apply more detailed measurement techniques to verify claimed usage reductions and to ensure that no payments are made in the absence of verifiable reductions.

Payments to cover the LMP less the generation component of retail rates should continue to be made by LSEs serving the customers that reduce load. This appropriately

¹⁰ When the PJM accounting is complete the total payments may exceed \$17.5 million.

matches the resource savings with the payments. When an LSE can avoid purchases at the market price in place of purchasing at the market price and selling at the generation component of retail rates, the savings accrue to the LSE. The savings do not accrue to other market participants and thus should not be paid by other market participants.

While PJM is engaged in the effort to facilitate the integration of demand response into its markets, PJM should continue its efforts to educate market participants about current programs and opportunities. The programs are an essential part of the transition strategy and together with efforts to integrate demand side resources into all PJM markets and to remove institutional barriers to demand side resources, constitute a portfolio approach to developing the demand side of the power markets. PJM should consider appropriate modifications to the existing programs to ensure that they are providing price signals consistent with efficient outcomes as described above.