UNITED STATES OF AMERICA
BEFORE THE
FEDERAL ENERGY REGULATORY COMMISSION

California Independent System Operator Corporation	**)** **)**	**Docket No. RM18-1-000**

REPLY COMMENTS OF THE DEPARTMENT OF MARKET MONITORING FOR THE CALIFORNIA INDEPENDENT SYSTEM OPERATOR CORPORATION

The Department of Market Monitoring (DMM) for the California Independent System Operator (CAISO) files reply comments in the above-captioned proceeding in response to initial comments filed by the PJM Interconnection L.L.C. (PJM).[1] DMM did not submit initial comments on the Department of Energy's proposed rule because CAISO has no centralized capacity market and the rule would not apply to CAISO. However, PJM's initial comments propose changes to spot markets rather than capacity markets. If applied to CAISO, the pricing proposed by PJM would undermine CAISO's spot markets. Therefore DMM submits these comments to explain why CAISO markets would be harmed if the Commission required CAISO to use pricing rules similar to the PJM proposal.

Overview

The primary goal of spot markets based on locational marginal pricing (LMP) operated by ISOs or RTOs is to create efficient market dispatches that maximize total consumer and supplier surplus while maintaining system

[1] *Initial Comments of the PJM Interconnection, L.L.C. on the United States Department of Energy Proposed Rule,* RM-18-1-000.

reliability. To maximize total consumer and supplier surplus, LMP markets need efficient prices. Standard economic price theory shows that prices based on marginal costs are the most efficient prices that support the levels of consumption and production (i.e. the dispatch) that maximize total consumer and supplier surplus. When electric market prices equal marginal supply costs and value of demand, market participants have incentives to supply and consume the most efficient quantity of electricity that maximizes total consumer and supplier surplus. In a competitive market with efficient pricing, market participants will also bid their true costs and willingness to pay.

PJM proposes to abandon marginal cost pricing. Under PJM's proposal, LMPs will no longer reflect the optimal prices at which both buyers and sellers want to consume and supply the quantities of goods that maximize total surplus. Market prices will no longer provide incentives for market participants to follow dispatch instructions or to bid their true costs and willingness to pay for electricity. Without bids representing participants' true costs and willingness to pay, a market optimization cannot maximize consumer and supplier surplus. The PJM proposal undermines the ability of an LMP-based spot electricity market to accomplish its primary purpose of maximizing market surplus.

The central issue PJM's proposal seeks to address is not new. The question of the optimal pricing system to use when discrete or lumpy costs result in decreasing average costs is well understood in economics. The problem is not unique to spot electricity markets. The efficient pricing solution under decreasing average costs – multi-part pricing – is well known among economists.

The solution to efficient pricing given decreasing average costs is straightforward. First, consistent with core economic price theory, set the per unit price (e.g. $/MWh) equal to marginal cost. Second, charge consumers a separate amount to recover any costs of production not recovered by suppliers through marginal cost pricing. CAISO uses this multi-part pricing system. Incorporating PJM's price formation proposal into this (or any other) rule-making decision would undermine marginal cost pricing and the efficiency of CAISO's spot markets.

The primary purpose of ISO markets is to maximize total consumer and supplier surplus

The primary purpose of CAISO's LMP spot market is to maximize total consumer and supplier surplus. The CAISO market optimization and pricing are derived directly from core economic price theory. The CAISO market optimization clears submitted supply and demand bids to create efficient market solutions and efficient market prices which maximize total consumer and supplier surplus. Efficient market prices are the prices at which both buyers and sellers want to consume and supply the quantities of goods that maximize total surplus. Efficient prices also incentivize load and supply to follow the efficient market dispatch. Further, in a competitive market with efficient pricing rules, market participants would want to submit bids that reveal their true marginal costs of supply and value of consumption. Without bids that represent market participant's true costs and valuations, the dispatch produced by an LMP market cannot maximize total consumer and supplier surplus. The dispatch produced by the market optimization will not be the efficient market dispatch.

Solution to pricing when average costs are falling is well known

The central issue discussed in PJM's comments is not new. PJM describes the problem of non-convex costs – a condition where average costs are falling as output increases. With falling average costs, marginal costs will be below average costs. As PJM states: "Under non-convex conditions, producers may incur losses if the price is set at marginal cost."[2] The price PJM refers to is the per unit price (i.e. $/MWh). With falling average costs, the marginal cost per unit is below the average total cost per unit. The producer would lose money if they were only paid the marginal cost price per unit to provide the optimal quantity. A producer incurring losses to provide the optimal quantity would be inefficient because the producer would choose not to provide anything to the market even though consumers value the producer's total output more than the producer's total cost of supplying the output.

The efficient solution to the problem of falling average costs is also well-known to economists. In 1946, the Nobel prize-winning economist Ronald H. Coase clearly articulated the problem of falling average costs and its solution in "*The Marginal Cost Controversy.*"[3] When average costs decrease with output, the "form of pricing which is appropriate is a multi-part pricing system."[4] The principles of efficient multi-part pricing are simple. First, consistent with core economic price theory, set the per unit price equal to marginal cost. Second, charge consumers a separate amount to make the producer whole for any costs

[2] PJM comments p. 44.
[3] Coase, Ronald H., "The Marginal Cost Controversy", *Economica*, Vol 13, 1946.
[4] Coase, p. 173.

not recovered through marginal cost pricing. CAISO uses this multi-part pricing system.

PJM's proposed departure from marginal cost pricing will undermine LMP markets

Contrary to core economic price theory, PJM proposes to not set prices equal to marginal cost. PJM states:

> "…in the presence of non-convexity, there are no market prices that can support the competitive market solutions without requiring additional payments through, for example, make whole payments and resulting uplift mechanisms."[5]

The fact that the multi-part pricing solution supports efficient spot market prices when average costs are lower than marginal costs is why multi-part pricing should continue to be used — not a reason to abandon marginal cost pricing. Instead of marginal cost pricing, PJM proposes to set prices equal to the average "…incremental costs of the most expensive units needed to serve load…"[6] Under the PJM pricing proposal an ISO would use a pricing run in its optimization, separate from the scheduling run. In PJM's proposed pricing run, the costs are "relaxed" so non-convexities are "made" convex. Rather than using the actual cost structure, this method sets prices based on cost structures that do not actually exist. In supplemental comments on the Commission's Fast-Start Pricing NOPR, CAISO laid out an example of how prices that do not reflect actual

[5] PJM comments p.44.

[6] PJM comments p.45. The "incremental" costs as used by PJM are the average costs of committing and running a generating resource, as described in page 3 of PJM's June 15, 2017 paper on *Energy Price Formation and Valuing Flexibility*: http://www.pjm.com/~/media/library/reports-notices/special-reports/20170615-energy-market-price-formation.ashx.

marginal costs – which are prices that do not reflect the actual trade-offs faced in the market – result in irrational outcomes.[7]

PJM's proposed pricing is divorced from core economic price theory and creates prices that do not represent actual marginal costs. PJM's proposal requires a pricing run separate from the scheduling run so that the proposal can set prices separately from the actual trade-offs available in the market. Because the prices do not represent the actual marginal costs or trade-offs, and are not grounded in core economic price theory, PJM's proposal is actually an administrative pricing rule that moves away from efficient spot market pricing.

PJM's pricing proposal also creates incentives for producers and loads to deviate from their optimal dispatch and to submit bids that do not represent their true costs and valuations. By creating these incentives, the proposed pricing undermines the ability of an LMP-based spot electricity market to accomplish its primary purpose. Market optimizations cannot find the dispatch that maximizes economic efficiency if market participants do not bid their true costs and valuations.

Make-whole payments that support the efficient market results are efficient. But "PJM proposes a way in which such uplift can be minimized."[8] Minimizing uplift, particularly if the uplift supports efficient markets, should not be the objective of market enhancements. The objective should be maximizing total

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[7] *Supplemental Comments of the California Independent System Operator Corporation*, RM-17-3-000, August 18, 2017.

[8] PJM comments, p. 43

consumer and supplier surplus. PJM's proposed pricing undermines this objective.

PJM's "opportunity cost" payment does not solve incentive problems

PJM proposes "appropriately designed uplift payments"[9] in an attempt to remove a supplier's incentive to deviate.[10] However, PJM's proposed pricing and uplift payments create perverse incentives for market participants to submit bids that do not represent true costs and valuations.

Table 1 shows an example of why a supplier has an incentive to submit bids that do not represent a resource's true marginal costs if PJM's pricing proposal was adopted. The table shows a supplier's true marginal cost (Row A), submitted bid (B), and the PJM proposed extended price (C) which the example assumes does not change across cases. Row D shows the scheduling run dispatch where the efficient dispatch using actual costs is 40 MW. Row E shows the producer's max bid MW. Row F shows PJM's proposed uplift payment intended to incentivize the resource to not deviate from the scheduling run dispatch. Row G shows the generator's profits from inefficient generation above the optimal dispatch level of 40 MW. Finally, Row H shows the total profits from the inefficient generation and the payment to not deviate.

[9] PJM comments p.46

[10] The concept of the "opportunity cost" payment incorporated in the PJM proposal is described in more detail in PJM's June 15, 2017 paper on *Energy Price Formation and Valuing Flexibility*. http://www.pjm.com/~/media/library/reports-notices/special-reports/20170615-energy-market-price-formation.ashx.

Table 1. Incentive not to bid marginal cost

Row		Case 1	Case 2	Case 3	Case 4	Formula
A	Marginal Cost	$30	$30	$30	$30	
B	Submitted Bid	$30	$20	$20	$20	
C	Extended Price	$60	$60	$60	$60	
D	Dispatch MW	40	40	46	50	
E	Max Bid MW	50	50	50	50	
F	Pmt to not deviate	$300	$400	$160	$0	=(C-B)*(E-D)
G	Inefficient Gen Profit	$0	$0	$180	$300	=(C-A)*(D-40)
H	**Pmt + Ineff. Gen Profit**	**$300**	**$400**	**$340**	**$300**	**=F+G**

In case 1 the supplier bids its true marginal costs of $30/MW. The payment to make the supplier indifferent between following dispatch or deviating from dispatch is $300. In cases 2 through 4 the supplier bids $20/MW rather than its true marginal costs. In each of these cases the supplier is better off, or at least no worse off, than if the supplier bid its true costs.

Case 2 shows the supplier bidding below its true costs but the optimization still dispatches the resource at the efficient dispatch level of 40 MW. The supplier receives more uplift payments to not deviate than if the supplier had bid its true costs.

Case 3 shows the situation of the artificially low bid resulting in the optimization dispatching the resource above the efficient dispatch but below the maximum bid MW (i.e. to 46 MW instead of 40 MW). In this case, the resource will also be better off than if it had bid its true costs due to the combination of uplift payments and profits from an inefficiently high dispatch.

Case 4 shows the situation of the artificially low bid resulting in the optimization dispatching the resource all the way up to its maximum bid MW of

50 MW. In this case, the resource would not receive PJM's proposed extra uplift payment. However, as a result of the extra profits from its inefficiently high dispatch and PJM's proposed artificially high price, the supplier will be no worse off than if the resource had bid its true costs because the supplier still gets $300 in rent, equivalent to the uplift payment it would have received if it bid its true costs.

The example assumes that the extended price does not change across the cases. It is possible that by lowering its bid enough, the supplier's dispatch could increase enough to prevent the commitment of the $60 average cost unit. For this to occur, however, the actual costs of dispatching the supplier's already committed resource to higher output levels would need to be higher than the costs of committing a new resource.

Furthermore, consider a scenario where the market operator commits a generator with a long minimum run time and significant minimum load costs. If other suppliers know that the extended price is likely to be set by this generator when it is committed, then they have an incentive to submit very low bids, even negatively priced bids. By submitting low bids, the suppliers can receive either inflated uplift payments or increased rents from inefficient dispatch for the duration of the generator's minimum run time. The PJM proposed extended pricing, along with the proposed new uplift payments, creates incentives for suppliers to submit bids understating marginal costs bids and overstating short-run fixed costs.

Finally, because load would often be forced to pay more than its bid, load would also have an incentive to both deviate from dispatch and to bid below its true willingness to pay. The PJM's proposed extra uplift payment does not alter the incentives created by PJM's extended pricing proposal for load to deviate or bid below its true willingness to pay.

Conclusion

Unlike the efficient multi-part pricing currently employed by CAISO described above, the pricing rules and extra uplift payment proposed by PJM do not support efficient market outcomes. If applied to CAISO, the pricing and uplift rules proposed by PJM would undermine CAISO's spot markets. DMM therefore recommends that the Commission not require CAISO to use pricing rules similar to the PJM proposal.

Respectfully submitted,

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Dated: November 7, 2017

CERTIFICATE OF SERVICE

I hereby certify that I have served the foregoing document upon the parties listed on the official service lists in the above-referenced proceedings, in accordance with the requirements of Rule 2010 of the Commission's Rules of Practice and Procedure (18 C.F.R. § 385.2010).

Dated at Folsom, California this 7th day of November, 2017.

/s/ Grace Clark

Grace Clark