UNITED STATES OF AMERICA
BEFORE THE
FEDERAL ENERGY REGULATORY COMMISSION

PJM Interconnection, L.L.C.	)	Docket No. ER15-1966-000

COMMENTS OF THE INDEPENDENT MARKET MONITOR FOR PJM

Pursuant to Rule 211 of the Commission's Rules and Regulations, Monitoring Analytics, LLC, acting in its capacity as the Independent Market Monitor for PJM ("Market Monitor"), submits these comments on the filing submitted in the above captioned proceeding by PJM Interconnection, L.L.C. ("PJM") on June 23, 2015 ("June 23rd Filing").

PJM states (at 1) that it has revised the rules for the calculation "methodologies used to credit Market Sellers of certain types of generating units for lost opportunity costs (LOC)." PJM states (at 2) that "LOC is not calculated consistently across PJM's various markets." Therefore PJM is proposing revisions to align the methodologies used to calculate LOC under certain circumstances.

The Market Monitor agrees with PJM that the current LOC calculations are not consistent across all PJM markets. The Market Monitor supports the proposal as an initial step to align all LOC calculations but also to correctly calculate LOC in PJM. The Market Monitor has long recommended reform of the energy uplift LOC calculations.[1]

The current PJM market rules governing LOC calculations ("LOC rules") fail to reflect the economic fundamentals and are inconsistent across markets without justification. PJM markets rely on accurate and consistent price signals to produce results that are just,

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1 *See* Monitoring Analytics, LLC, 2014 State of the Market Report for PJM, v. 2 at 60-61 (March 12, 2015).

reasonable and non-discriminatory. The current LOC rules do not facilitate efficient and competitive markets and create an opportunity for gaming.

The June 23rd Filing proposes a number of tariff provisions that would contribute to correcting the flaws in the existing rules. The June 23rd proposals address three rule changes that bring the LOC rules closer to reflecting the economic fundamentals and closer to being consistent across all markets but additional rule changes are required in order to completely address all LOC calculations inconsistencies. The Market Monitor supports all of the proposals included in the June 23rd Filing and urges that they be approved. The Market Monitor proposes additional corrective measures in this filing that would complete PJM's partial solution to the flaws in the current LOC rules. Accordingly, an order approving the June 23rd Filing should be conditioned on the inclusion of these additional measures.

I. BACKGROUND

A. Definition of Lost Opportunity Cost

The general definition of lost opportunity cost (LOC), for a company making a decision to use its resources in a specific way, is the benefit that a company would have received if it had used the same resources in a different way minus the benefits it actually received from using those resources.[2] For example, company X has two projects, project A and B. If the company can develop only one project, it needs to make a decision based on the net benefits from each project. Project A yields $20 million and project B yields $15 million. If company X develops project B, the company loses an opportunity to make $5 million more, and that $5 million is the company's lost opportunity cost of developing project B and not project A.

In the PJM market, when a unit's output is reduced or suspended by PJM for any reason to a level below the output level that the unit would have produced economically

[2] The term in more general use is opportunity cost, but in PJM opportunity cost has been termed lost opportunity cost. We will use the term lost opportunity cost here for consistency with PJM usage.

based on LMP and the unit's energy offer (the unit's desired output level), the LOC is the foregone profit from not generating at the desired output level. In such cases, LOC compensation provides an incentive for resources to follow PJM's dispatch instructions.

B. LOC Rules in PJM

In PJM, generating units receive LOC payments for two general reasons in the energy market: when a unit has limits on the amount of hours it can run; and when a unit's output is reduced or suspended by PJM below the output level based on LMP and the unit's energy offer (the unit's desired output level) (See Table 1).

Table 1 LOC Compensation Reasons

LOC Compensation Reason	
1. When a unit has limits on the amount of hours it can run	Environmental Non-environmental
2. When a unit's output is reduced or suspended by PJM below desired output level	Substitute products Reliability issues Dispatch decisions

For the second LOC compensation reason, Table 2 shows the markets/ancillary services, the associated detailed sources of LOC and each OATT reference.

Table 2 LOC Compensation in PJM

Reason	Market / Service	Source	OATT Reference
Substitute products	Day-Ahead Scheduling Reserve	Reduced Day Ahead to Provide Reserves	Not defined
	Regulation	Reduced / Increased Real Time to Provide Regulation	3.2.2 (d)
	Synchronized Reserve	Reduced Real Time to Provide Reserves	3.2.3A (e)
	Non-synchronized Reserve	Kept Offline to Provide Reserves	3.2.3A.001 (d)
Reliability issues	Black Start Testing	Reduced / Suspended Real Time	Not defined
		Scheduled Day Ahead and not Committed Real Time	Not defined
	Reactive Services	Reduced / Suspended Real Time	3.2.3B (c) and (d)
		Scheduled Day Ahead and not Committed Real Time	3.2.3B (c) and (d)
	Synchronous Condensing	Reduced to provide synchronous condensing	3.2.3C (b)
Dispatch decisions	Energy	Reduced / Suspended Real Time	3.2.3 (f) (f-1) (f-2) (f-3) (f-4)
		Scheduled Day Ahead and not Committed Real Time	3.2.3 (f) (f-1) (f-2) (f-3) (f-4)

The June 23rd Filing addresses only the second reason for LOC payments and only a subset of issues related to the second reason. The Market Monitor agrees that it is appropriate to address only the second reason but recommends addressing all the identified issues associated with the second reason. Table 3 shows all of these LOC compensation

issues, the issues addressed in PJM's June 23rd Filing and the issues not addressed in PJM's June 23rd Filing.

Table 3 LOC Compensation Issues

Identified Issue	Market / Service Affected Addressed by the June 23 Filing	Market / Service Affected Not Addressed by the June 23 Filing
Inconsistency of offer used	Energy and Reactive Services	Regulation
Exclusion of no load and startup costs	Energy	Day-Ahead Scheduling Reserves and Non-synchronized Reserves
Incorrect use of offer curve	Energy and Reactive Services	None
Incorrect output used	Not Addressed	Energy and Reactive Services
Discrimination by unit type	Not Addressed	Energy and Reactive Services
Lack of intra-hour LOC compensation	Not Addressed	Energy and Reactive Services
Hourly compensation	Not Addressed	Energy and Reactive Services
Lack of tariff definition	Not Addressed	Black Start Testing, Day-Ahead Scheduling Reserves, Synchronous Condensing*, Synchronized Reserves**

* Synchronous Condensing for purposes other than reactive services and synchronized reserves.

** Synchronized Reserves provided by hydro units.

C. List of Current PJM LOC Rules

There are 24 LOC calculations defined in PJM market rules for the Day-Ahead and Real-Time Energy and Ancillary Services Markets.[3] Table 4 includes the 24 LOC calculations for Energy and Ancillary Services Markets in PJM by market or service provided, the reason for each LOC, the eligibility by resource type, the OATT section reference where the LOC can be found and whether LOC is a component of the clearing price or an out of market payment.

[3] This filing does not cover opportunity cost calculated for output limitations.

Table 4 Lost Opportunity Cost Calculations in PJM

Market / Service	Reason	Resource Type	OATT Attachment K - Appendix	Calculation Type
Energy	Reduced / Suspended Real Time	All Unit Types Except Wind and Hydro Units	3.2.3 (f) and (f-1)(i)	Out of market payment
		Wind Units	3.2.3 (f-4)	Out of market payment
		Hydro Units	3.2.3 (f-2)	Out of market payment
	Scheduled Day Ahead and not Committed Real Time	CTs and Diesels	3.2.3 (f-1)(ii)	Out of market payment
Reactive Services	Reduced / Suspended Real Time	All Unit Types Except Wind and Hydro Units	3.2.3B (c) and (d)(i)	Out of market payment
		Hydro Units	3.2.3 (f-2)	Out of market payment
	Scheduled Day Ahead and not Committed Real Time	CTs and Diesels	3.2.3B (d)(ii)	Out of market payment
Regulation	Settlement Regulation LOC	All Resources	3.2.2 (b)	Out of market payment
	Regulation Price	All Unit Types Except Hydro Units	3.2.2 (d)	Clearing price component
		Hydro Units Spilling	3.2.2 (d)	Clearing price component
		Hydro Units Not Spilling with DA Scheduled Output	3.2.2 (d)	Clearing price component
		Hydro Units Not Spilling without DA Scheduled Output	3.2.2 (d)	Clearing price component
	LOC used in Settlement Regulation LOC	All Unit Types	3.2.2 (e) *	Out of market payment component
Synchronized Reserves	Settlement SR LOC	All Resource Types	3.2.3A (b)(ii)	Out of market payment
	SR Price	All Unit Types	3.2.3A (e)	Clearing price component
	LOC used in Settlement SR LOC	All Unit Types	3.2.3A (f.)	Out of market payment component
Non-synchronized Reserves	Settlement NSR LOC	All Resource Types	3.2.3A.001 (b)(ii)	Out of market payment
	NSR Price	All Unit Types	3.2.3A.001 (d)	Clearing price component
	LOC used in Settlement NSR LOC	All Unit Types	3.2.3A.001 (e)	Out of market payment component
Black Start	NA	NA	NA	Out of market payment
DASR	NA	NA	NA	Clearing price component
Synchronous Condensing	Reactive	All Unit Types	3.2.3B (i)	Out of market payment
	Post-Contingency Operation	All Unit Types	3.2.3C (b)	Out of market payment
	Not for Reactive or Synchronized Reserves	NA	NA	Out of market payment

* All units are eligible for intra-hour regulation LOC but only steam units are eligible for shoulder hour regulation LOC.

D. History of PJM LOC Rules

PJM introduced compensation for LOC in its Real-Time Energy Market on September 3, 1999.[4] With this filing, PJM created the LOC compensation of units reduced because of reactive reliability issues and units reduced because of dispatch decisions not captured by PJM's dispatch and pricing tools.

On July 17, 2003, PJM filed tariff changes at FERC regarding the situations that were not covered by the LOC rules introduced on September 3, 1999. The changes added an opportunity cost rule for combustion turbines (CT) and diesels that were scheduled in the Day-Ahead Energy Market but not committed in real time. The proposed changes also included compensating units for LOC using the higher of cost-based or price-based offer.

Table 5 shows the history of the OATT changes filed by PJM related to LOC rules.

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[4] *See* PJM Interconnection, L.L.C., 89 FERC ¶ 61,085 (1999). PJM Day-Ahead Energy Market was implemented on June 1, 2000.

Table 5 LOC Related FERC Filings

Market / Service	Date	Docket No.	Filing Topic	Description
Energy	September 3, 1999	ER99-4371-000	Lost opportunity cost compensation	Implementation of lost opportunity cost credits to units reduced or suspended because of reliability issues in the transmission system.
	July 17, 2003	ER03-186-000	Changes to LOC compensation in RT New LOC compensation to CTs because of creation of Day-Ahead Energy Market	Changes to the LOC filed in ER99-4371-000 to include a desired output and include the use of higher of price and cost-based offer. Implementation of a new LOC compensation for CTs scheduled in DA and not committed in RT.
Regulation	February 15, 2000	ER00-1630-000	Market Based Regulation Service	Creation of a market-based pricing mechanism for regulation services. The proposal created a Regulation Market Clearing Price (RMCP) that would be comprised of the regulation offer and the lost opportunity cost of the regulation marginal resource.
	October 3, 2008	ER09-13-000	Regulation Market Offer Capping	Implementation of the three pivotal supplier (TPS) test in the Regulation Market. As a compromise to achieve this change, three other changes were implemented: increase of the regulation offer adder from $7.5 to $12 per MW, no offset of regulation net revenues in the BOR credit (make whole) calculation, use of the lower of price and cost-based offer in the LOC calculation.
Reactive Services	December 31, 2003	ER04-361-000	Make whole and LOC compensation for units providing reactive services	Creation of an LOC reactive services category by copying the same LOC calculations in ER03-186-000 but allocating the costs as reactive services charges (allocated to zonal real-time load) instead of operating reserve charges (allocated to real-time deviations RTO wide).
Synchronized Reserve	September 3, 2002	ER02-2519-000	Spinning Reserve Market	Creation of a market-based pricing mechanism for spinning reserves. The proposal created a Spinning Reserve Market Clearing Price (SRMCP) that would be comprised of the spinning reserve offer and the lost opportunity cost of the spinning reserve marginal unit. The lost opportunity cost in this filing used the offer price for energy which is the offer on which the unit was committed.
	December 29, 2005	ER06-406-000	Synchronized Reserve Market	Incorporated DR into the spinning reserve market and changed the name from spinning to synchronized reserve market.
DASR	April 3, 2008	ER08-780-000	Day-Ahead Scheduling Reserve	Creation of a market for supplemental reserves called day-ahead scheduling reserves.
Non-synchronized Reserves	March 5, 2012	ER12-1240-000	Shortage Pricing	Creation of a market-based pricing mechanism for non-synchronized reserves. The proposal created a Non-Synchronized Reserve Market Clearing Price (NSRMCP) that would be comprised of the lost opportunity cost of the non-synchronized reserve market marginal unit.

II. COMMENTS

The current PJM market rules governing LOC calculations are inaccurate, create unjust and unreasonable payments, create unduly discriminatory disparities in payments, and create inappropriate price signals, all of which negatively affect the overall PJM market design. The current rules apply various methods for calculating LOC following no consistent rationale. In some cases, the definitions of LOC are unreasonable and illogical. In each case, the rules should calculate LOC accurately, consistent with the rationale applicable to the particular circumstances. The rules should have coherence, even as they appropriately differ to take account of differing circumstances. The rules unnecessarily create significant market

inefficiencies. Simple corrections are available to fix these problems. The perpetuation of these flawed rules is unjust and unreasonable, and they should be corrected. The goal is to correctly apply opportunity cost logic to each instance in the tariff where an opportunity cost calculation is required.

A. PJM's Proposed Changes to LOC Rules in June 23rd Filing.

1. LOC Calculations Should Be Performed Using the Offer on Which Units Are Scheduled in the Day-Ahead Energy Market or Committed in Real Time.

The Market Monitor agrees with PJM and recommends that all LOC calculations be performed using the offer on which units are scheduled in the Day-Ahead Energy Market and/or committed in real time by PJM. This is the only just and reasonable approach among the three approaches currently used by PJM. The Market Monitor agrees with PJM that the "higher of" rule should remain for self-scheduled resources. The offer on which self-scheduled resources are scheduled is determined solely by the generation owner and not by PJM, unlike pool-scheduled resources. In addition, the use of the higher of price or cost schedule for self-scheduled resources helps prevent potential manipulation of LOC payments through the selection of a low price-based offer.

Units in PJM must submit a cost-based energy offer and may submit a price-based energy offer.[5]

All LOC calculations include two components: the energy in MWh that would have been economic for the unit to produce but was not produced as a result of an action taken at the direction of PJM and the positive difference between the LMP and the unit's per MWh offer.

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[5] See OA Schedule 1 § 1.2, Schedule 2; PJM Manual 15, Cost Development Guidelines, Revision 21 (April 1, 2013). Note that a unit may submit multiple cost-based offers to account for multiple fuel types. In that case, only the highest cost-based offer is considered for LOC calculations. The rule is explicit in the tariff for the Regulation Market. In other markets, the rules are not explicit.

The LOC calculations are based on three different approaches to the use of cost-based and price-based energy offers ().[6]

Table 6 Offer Used in PJM LOC Rules.

Market / Service	Reason	Resource Type	Offer Used
Energy	Reduced / Suspended Real Time	All Unit Types Except Wind and Hydro Units	Higher of price or cost
		Wind Units	Higher of price or cost
		Hydro Units	Peak / off peak LMP
	Scheduled Day Ahead and not Committed Real Time	CTs and Diesels	Higher of price or cost
Reactive Services	Reduced / Suspended Real Time	All Unit Types Except Wind and Hydro Units	Higher of price or cost
		Hydro Units	Peak / off peak LMP
	Scheduled Day Ahead and not Committed Real Time	CTs and Diesels	Higher of price or cost
Regulation	Settlement Regulation LOC	All Resources	Not needed
	Regulation Price	All Unit Types Except Hydro Units	Lower of price or cost
		Hydro Units Spilling	Not needed
		Hydro Units Not Spilling with DA Scheduled Output	Peak / off peak LMP
		Hydro Units Not Spilling without DA Scheduled Output	Peak / off peak LMP
	LOC used in Settlement Regulation LOC	All Unit Types	Lower of price or cost
Synchronized Reserves	Settlement SR LOC	All Resource Types	Not needed
	SR Price	All Unit Types	Committed offer
	LOC used in Settlement SR LOC	All Unit Types	Committed offer
Non-synchronized Reserves	Settlement NSR LOC	All Resource Types	Not needed
	NSR Price	All Unit Types	Committed offer
	LOC used in Settlement NSR LOC	All Unit Types	Committed offer
Black Start	NA	NA	Not defined in tariff
DASR	NA	NA	Not defined in tariff
Synchronous Condensing	Reactive	All Unit Types	Committed offer
	Post-Contingency Operation	All Unit Types	Committed offer
	Not for Reactive or Synchronized Reserves	NA	Not defined in tariff

Under the first approach, the rules require the use of the higher of the units' cost-based and price-based offers to calculate LOC. The first approach is applied in the energy market, synchronous condensing, reactive services and black start testing.

Under the second approach, the rules require the use of the lower of the units' cost-based and price-based offers to calculate LOC. The second approach is an exception which applies only to the Regulation Market. This exception was created solely to permit a settlement among stakeholders related to the Regulation Market.

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6 Hydro units' LOC is based on LMP when these units follow a hydro schedule and do not have an energy offer.

Under the third approach, the rules require the use of the offer on which the unit was scheduled in the Day-Ahead Energy Market and/or committed in real time to calculate LOC. The third approach is applied in the Day-Ahead Scheduling Reserve Market, the Synchronized Reserve Market and the Non-Synchronized Reserve Market.

There is no reason for the rules to apply three different approaches to the calculation of LOC. The first and third approaches are internally logical, but the third approach is consistent with both the nature of unit offers and the overall PJM market design.

PJM schedules, dispatches, commits and decommits units based on their price-based offer (if submitted), unless the TPS test or commitment for black start or reactive requires use of their cost-based offer.[7] [8] [9] This means that all dispatch decisions are based on the offer on which units were scheduled in the Day-Ahead Energy Market and/or committed in real time. From the market perspective, when a unit's output is reduced to address a reliability issue or to provide an ancillary service, the cost associated with that reduction should be evaluated consistently, fairly and logically. In order to include the actual cost of reducing or not reducing a unit, the same offer must be used in all markets, otherwise the decision will be biased based on the offer selected. The appropriate offer to be used is the offer on which the unit is scheduled in the Day-Ahead Energy Market or committed in real time because that is the offer that on the basis of which PJM schedules, commits or dispatches a unit.

2. LOC Calculations Should Include Avoided No Load and Startup Costs.

The Market Monitor agrees with PJM that LOC calculations should include avoided no load and startup costs. The recommended approach would correct an algebra error which has not been contested.

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[7] Units scheduled in the Day-Ahead Energy Market or committed in real time for black start support or reactive support are automatically offer capped.

[8] See OA Schedule 1 § 6.4.

[9] A unit is offer capped if it fails the TPS test and it has a price-based offer greater than its cost-based offer.

More precisely, the Market Monitor recommends including the no load and startup costs in all LOC calculations which apply to situations where these costs are avoided. Such situations include: (i) units scheduled in the Day-Ahead Energy Market and not committed in real time, (ii) units providing day-ahead scheduling reserves while scheduled to remain offline, and (iii) units providing non-synchronized reserves.[10]

PJM's June 23rd Filing includes only item (i) from this list.

a. Energy Market

The Market Monitor agrees with PJM that the no load and startup costs should be included in LOC calculations for units scheduled in the Day-Ahead Energy Market and not committed in real time.

Under the current PJM market rules, CTs and diesels that are scheduled in the Day-Ahead Energy Market and not committed in real time receive compensation for LOC. This rule ensures that CTs and diesels that are scheduled in the Day-Ahead Energy Market are compensated for their LOC when PJM does not commit these units in real time. The units are compensated for LOC when their energy offer (currently based on the higher of cost and price-based offer) is below the real-time LMP. Units receive LOC compensation because it would be more profitable to produce energy than to buy back their day-ahead position at real-time prices.

A unit scheduled in the Day-Ahead Energy Market receives day-ahead energy revenues equal to the day-ahead scheduled output times the day-ahead LMP. If the unit runs in real time as scheduled in the Day-Ahead Energy Market then it does not receive or incur any balancing revenues or costs. The production costs of the unit would be based on the offer on which the unit was scheduled in the Day-Ahead Energy Market or committed in real

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[10] Current rules only compensate combustion turbines and diesels for LOC when these units are scheduled in the Day-Ahead Energy Market and not committed in real time. The Market Monitor also recommends making all unit types eligible for this type of LOC based on minimum run time and lead time requirements.

time.[11] If the unit does not run in real time then the unit incurs balancing costs equal to the unit's day-ahead scheduled output times the real-time LMP. When the production costs are greater than the balancing costs, the unit makes a greater profit by not running and no LOC compensation is needed, and when the production costs are lower than the balancing costs, the unit loses profit by not running.

The production cost calculation in this LOC compensation is flawed because the current market rules include only the incremental energy offer component of the offer and omit the startup and no load components. The LOC payment is equal to the LMP minus the incremental energy offer. But unit energy offers in the PJM Energy Market include three components: the incremental energy offer per MWh, the no load cost per hour and the startup cost. The no load and startup costs are costs that the unit would have had incurred if committed in real time. The actual foregone profit from not operating in real time is LMP minus incremental offer, minus no load costs, minus startup costs. By subtracting only the incremental energy offer, the current rules embed a simple algebra error. This error means that these units are overcompensated whenever they are paid LOC, by the amount of the no load and startup costs.[12]

Table 7 through Table 10 illustrate the impact of excluding no load and startup cost from the LOC calculation. This example shows a CT scheduled in the Day-Ahead Energy Market for four hours. As shown in Table 7, the unit receives $20,000 of day-ahead energy revenues.

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[11] Production cost equals total marginal cost, or the area under the offer curve at the desired output, plus startup cost.

[12] The existence of this algebra error has not been contested, although some participants argue that this overpayment should be considered compensation for certain risks taken by offering in the day-ahead market. But there is no link between the two in the market design. Any risks taken in the day-ahead market are already addressed through the energy market rules, including the opportunity to include any desired risks in the price-based offer, and through the existence of the capacity market, which requires offers in the day-ahead market as part of the definition of being a capacity resource.

Table 7 No Load and Startup Cost Example: Day-Ahead Revenues.

Hour	DA Scheduled Output (MWh)	DA LMP ($/MWh)	DA Revenues
1	100	50.00	$5,000
2	100	50.00	$5,000
3	100	50.00	$5,000
4	100	50.00	$5,000
Total	400		$20,000

In real time, the unit is not committed and therefore it must cover its day-ahead position in real time by incurring balancing charges. As shown in Table 8, the unit is charged $18,000 of balancing spot energy charges. Since the unit is a CT, scheduled in the Day-Ahead Energy Market and not committed in real time, it is eligible for LOC compensation if the unit's offer is below the RT LMP.

Table 8 No Load and Startup Cost Example: Balancing Spot Energy Charges.

Hour	RT Deviation (MW)	RT LMP ($/MWh)	Balancing Charges
1	(100)	45.00	($4,500)
2	(100)	45.00	($4,500)
3	(100)	45.00	($4,500)
4	(100)	45.00	($4,500)
Total	(400)		($18,000)

Table 9 shows that the unit had a $30 per MWh offer and that the total offer of the unit (including no load and startup costs) is $19,000.

Table 9 No Load and Startup Cost Example: Total Offer.

Hour	Energy Offer ($/MWh)	Energy Offer	No Load Cost	Startup Cost	Total Offer
1	30.00	$3,000	$500	$5,000	$8,500
2	30.00	$3,000	$500		$3,500
3	30.00	$3,000	$500		$3,500
4	30.00	$3,000	$500		$3,500
Total		$12,000	$2,000	$5,000	$19,000

Table 10 shows the LOC compensation under the current rules. The unit receives $6,000 of LOC credits. The unit is compensated for LOC because the no load and startup costs (equal to $7,000) are not taken into account. In this example the unit should not receive

LOC compensation because buying back its day-ahead position from the balancing market at real-time prices ($18,000) is less than the cost of running the unit ($19,000) and therefore there is no lost opportunity.

Table 10 No Load and Startup Cost Example: LOC Under Current Rules.

Hour	A DA Scheduled Output (MW)	B RT LMP ($/MWh)	C Energy Offer ($/MWh)	= A x (B - C) Energy Offer ($/MWh)
1	100	45.00	30.00	$1,500
2	100	45.00	30.00	$1,500
3	100	45.00	30.00	$1,500
4	100	45.00	30.00	$1,500
Total	400			$6,000

The current market rules create an incentive for gaming. The current market rules create an incentive for participants to offer their CTs and diesels in the Day-Ahead Energy Market at a price-based offer lower than their cost-based offer in order to clear the Day-Ahead Energy Market, if such units are not likely to be committed in real time. Participants learn about the likelihood of being called in real time from actual experience. If a CT or diesel is taken in the Day-Ahead Energy Market but not committed in real time, the unit will receive a profit from LOC payments greater than they could have earned from actually running because the LOC calculation omits the no load and startup costs that are required to produce energy and that would have been incurred if the unit produced energy.

b. Day-Ahead Scheduling Reserve and Non-Synchronized Reserve Markets

PJM's June 23rd Filing did not address the LOC issues associated with the Day-Ahead Scheduling Reserve and Non-Synchronized Reserve Markets. The Market Monitor recommends that the same logic applied in the energy market by PJM be applied to these markets and that the LOC calculation subtract incremental cost, no load cost and startup cost.

The Day-Ahead Scheduling Reserve and Non-Synchronized Reserve Markets include an LOC component in the market clearing price. The Day-Ahead Scheduling Reserve (DASR) Market clearing price includes the LOC of the marginal unit providing day-ahead scheduling reserves. The non-synchronized reserve clearing price includes the LOC of the marginal unit

providing non-synchronized reserve. The balance of LOC in the Non-Synchronized Reserve Market not covered by the non-synchronized reserve clearing price is collected through out of market payments.

Units are compensated for LOC in both markets when the unit's output is reduced in the Day-Ahead Energy Market from the desired output to provide day-ahead scheduling reserve, or committed off or kept offline to provide non-synchronized reserve in real time.

Just as with diesels and CTs taken in the Day-Ahead Energy Market but not committed in real time, the current rules base these LOC calculations only on the incremental energy offer component, without taking into account the avoided no load and startup costs when applicable.[13] For example, a unit that is scheduled to provide zero energy output in the Day-Ahead Energy Market in order to provide DASR, would have an LOC calculation based on the difference between the day-ahead energy price (DA LMP) and the unit's incremental offer, without taking into account that if the unit is scheduled to provide zero output, no load and startup costs are not incurred.[14] Likewise, non-synchronized reserves resources have to be offline in order to provide this type of reserve. When a unit that has an incentive to produce energy (the LMP is greater than the offer) is kept offline to provide non-synchronized reserves, an LOC is calculated. The current LOC calculation is based on the difference between the real-time energy prices (RT LMP) and the unit's incremental offer, without taking into account that if the unit is kept offline no load and startup costs are not incurred.

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[13] The inclusion of startup cost in the day-ahead scheduling reserve LOC only applies if the unit is not scheduled to start. A unit may provide DASR while offline if it complies with the DASR requirement (resources with reserve capability that can be fully converted into energy within 30 minutes).

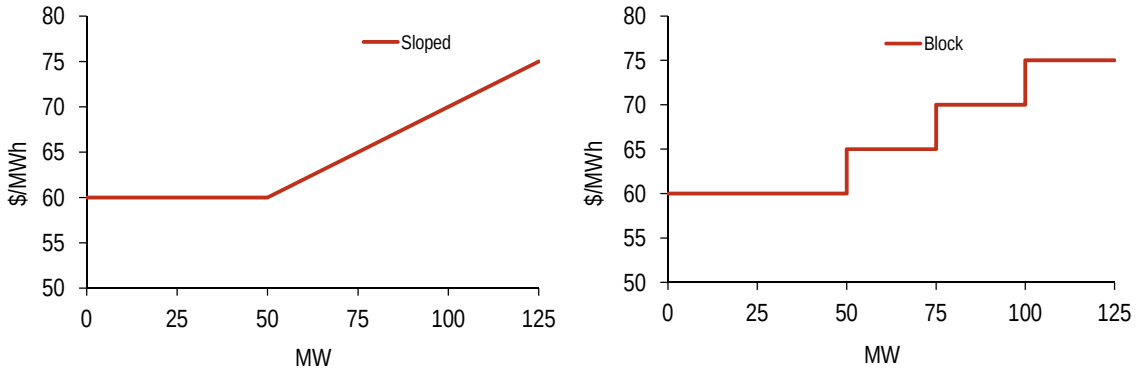
[14] The startup cost shall only be used if during the entire day the unit is not scheduled to come online.

3. Offers Used in the LOC Calculations Should Be Represented By Unit's Full Offer Curve And Not A Single Point.

The Market Monitor agrees with PJM that all out of market LOC calculations should be performed using the entire incremental offer curve, which means that LOC calculations should be performed using the area under the incremental offer curve and not a point on the incremental offer curve.

Units in PJM may submit energy offers using an incremental offer curve which may include up to ten different segments.[15] Each point on an incremental offer curve represents the marginal offer in dollars per MWh for generating at that level. The area under the incremental offer curve between zero and any point on the curve equals the total incremental offer of producing at that level. The area under the curve plus the no load offer equals the total marginal costs of producing at that level. Figure 1 shows the two different types of incremental offer curves used by participants in PJM. The current LOC calculations incorrectly assume that the point on the incremental offer curve in dollars per MWh represents the total incremental offer of the unit at that level of output.

Figure 1 Incremental Offer Curves



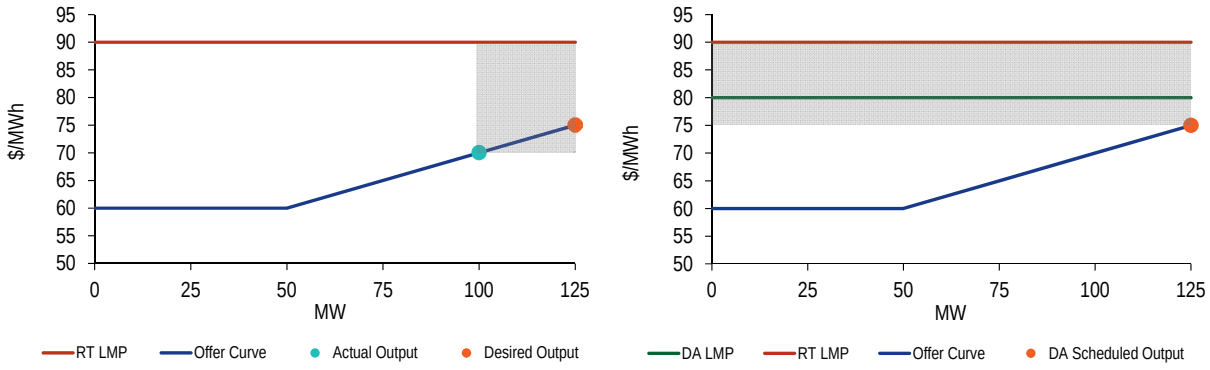
CTs and diesels scheduled in the Day-Ahead Energy Market and not committed in real time are compensated for LOC using the incremental offer at the day-ahead scheduled output level. Units reduced in real time are compensated for LOC using the incremental offer

[15] Each segment is defined by a defined MW output level and an incremental price associated with that output in dollars per MWh.

at the reduced output level. These definitions assume that the incremental offer curves are flat for all lower output levels, which is not true in most cases.[16]

Figure 2 illustrates the current LOC calculations, the left figure shows the LOC for units reduced in real time, the right figure shows the LOC for CTs and diesels scheduled in the Day-Ahead Energy Market and not committed in real time. The gray area in both figures illustrates the total LOC payment in dollars. In the left figure, the gray area below the incremental offer curve (blue line) constitutes LOC overcompensation. In the right figure, the white area below the gray area and above the incremental offer curve (blue line) constitutes LOC undercompensation.

Figure 2 Illustration of current LOC rules



B. Market Monitor's Proposed Changes to LOC Rules Not Covered in June 23rd Filing.

1. LOC Calculations Should Be Based on The Achievable Output Of The Units.

A flaw in the LOC calculations that is not addressed by PJM in the June 23rd Filing is that LOC calculations are not based on the achievable output of units. The Market Monitor recommends that units scheduled in the Day-Ahead Energy Market and not committed in real time should be compensated for LOC based on their real-time desired and achievable

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16 This statement is not true for units' submitting blocked offers instead of sloped offer curves, and the reduction occurs within the same energy block. For example, a unit operating at 150 MW with a blocked offer of 150 MW at $25 per MWh is asked to back down to 140 MW, the offer at 140 MW would be the same as the offer at 150 MW ($25 per MWh).

output, not their scheduled day-ahead output. The actual LOC is a function of the real-time desired and achievable output rather than the day-ahead scheduled output. If a unit is capable of profitably producing more or fewer MWh in real time than the day-ahead scheduled MWh, it is the actual foregone MWh in real time that define actual LOC.

This modification would correct the undercompensation of CTs and diesels scheduled in the Day-Ahead Energy Market and not committed in real time when units can economically achieve an output greater than their day-ahead output. This modification would also correct the overcompensation of CTs and diesels scheduled in the Day-Ahead Energy Market and not committed in real time when units cannot achieve the scheduled day-ahead output in real time.

CTs and diesels are compensated for LOC when scheduled in the Day-Ahead Energy Market and not committed in real time. This LOC calculation uses the day-ahead scheduled output as the achievable output for which units are entitled to receive LOC compensation. Units are paid LOC based on the difference between the real-time energy price (RT LMP) and the unit's offer times the day-ahead scheduled output. The use of the day-ahead scheduled output reduces the LOC compensation when the day-ahead scheduled output is less than what the real-time output would have been at real-time LMP based on the unit's scheduled offer curve. In real time, units may produce more or less than their day-ahead scheduled output if the real-time energy prices (RT LMP) are higher or lower than the DA LMP and the units have a dispatchable range. For example, if the RT LMP is greater than the DA LMP, it may be profitable for a unit with a dispatchable range to increase its output above its day-ahead scheduled output, if its offer at the desired output is lower than the RT LMP. This higher output level should be considered the desired real-time output. Similarly, if a unit cannot profitably produce its day-ahead scheduled output in real time, its lower output level should be considered the desired real-time output.

2. LOC Calculations Should Take Into Account Intra Hour Commitments

A flaw in the LOC calculations that is not addressed by PJM in the June 23rd Filing is that LOC calculations do not account for intra hour commitments. The Market Monitor

recommends that units scheduled in the Day-Ahead Energy Market and not committed in real time be compensated for LOC incurred within an hour.

Combustion turbines and diesels scheduled in the Day-Ahead Energy Market and not committed in real time are compensated for LOC based on their real-time hourly integrated output.

In order to compensate a unit for LOC, PJM must determine if the unit was scheduled in the Day-Ahead Energy Market and if the unit was not committed in real time. Units clear the Day-Ahead Energy Market for full hours. That means that if a unit cleared the Day-Ahead Energy Market in an hour it is expected to produce energy in real time for the entire hour. The determination by PJM of whether a unit is committed or not committed in real time is based on the unit's hourly integrated output. If the hourly integrated output is greater than zero that means the unit was committed during that hour. But in real time a unit may be committed for part of an hour. The calculation of LOC does not reflect the exact time at which the unit was turned on.

For example, a unit does not receive LOC compensation if scheduled in the Day-Ahead Energy Market for one specific hour and is committed in real time for only the last five minutes of the hour. The fact that the real-time hourly integrated output of the unit is greater than zero means that the unit was committed during that hour.

Units scheduled in the Day-Ahead Energy Market and not committed in real time should be eligible for LOC compensation when committed or decommitted within the hour.

3. LOC Calculations Should Be Performed By Segments of Multiple Hours And Not Hourly.

A flaw in the LOC calculations that is not addressed by PJM in the June 23rd Filing is that LOC calculations are done on a standalone hourly basis rather than by segments of hours as they are for other uplift payments.

The Market Monitor recommends that all energy related LOC calculations be made based on segments of multiple hours and not based on individual hours. These segments of hours should be defined by either the hours the unit was scheduled in the Day-Ahead Energy Market and, if committed, the hours the unit runs in real time.

The current rules compensate CTs and diesels for LOC on an hourly basis. This means that net losses from nonprofitable hours are not offset by net revenues from profitable hours as they are for other uplift calculations. The goal of uplift payments is to ensure that units are not required to run unprofitably at PJM's request for an entire day or for multi-hour segments of a day when the offer is based on appropriate operational parameters. To calculate uplift on an hourly basis would and does result in paying generating units uplift on days when they were profitable without uplift payments and when they would have followed PJM's request without such payments.

Units scheduled in the Day-Ahead Energy Market and not committed in real time are paid LOC when, because PJM does not dispatch them, they give up the opportunity to earn profits from operating. The same units may be dispatched later in the day by PJM and earn positive profits from operating or may not be dispatched later in the day by PJM and earn positive profits based on buying back their position at the difference between the day-ahead and the real-time LMP. These positive profits are not used to offset the LOC payments to cover negative profits in hours in which PJM did not dispatch them.

This hourly approach to LOC payments is not consistent with the way in which resources are scheduled and committed. PJM may schedule a unit for several hours of the day, based on system conditions and/or unit parameters such as minimum run time. PJM may also elect to decommit a resource because the overall operation of such resource during the scheduled hours has become noneconomic in real time. If during any of the scheduled hours, the resource had a nonprofitable hour, the unit is compensated for LOC, regardless of the net revenues that it collects from the profitable hours. In these cases, when PJM makes the correct decision to not commit a resource because it is not economic to commit the resource, an unnecessary LOC payment is made because of a faulty LOC calculation.

4. Eligibility for LOC Compensation to Units Scheduled in the Day-Ahead Energy Market and Not Committed in Real Time Should Be Based on the Unit's Technical Parameters and not the Type of Units.

A flaw in the LOC calculations that is not addressed by PJM in the June 23rd Filing is that eligibility for default LOC calculations is based on the type of unit technology rather than the operational flexibility of the units.

The Market Monitor recommends that only flexible fast start units (startup plus notification times of two hours or less) and short minimum run times (two hours or less) be eligible by default for the LOC compensation to units scheduled Day-Ahead Energy Market and not committed in real time. Other units should be eligible for LOC compensation only if PJM explicitly cancels their day-ahead commitment.

The current rules compensate only CTs and diesels for LOC when scheduled in the Day-Ahead Energy Market and not committed in real time. The reason for this difference is that other unit types have a commitment obligation when scheduled in the Day-Ahead Energy Market. For example, steam turbines and combined cycle units commitment instructions are their day-ahead schedule. Units of these types that clear the Day-Ahead Energy Market are automatically committed to be on or remain on in real time. CT and diesel commitment instructions occur in real time even if these units were committed in the Day-Ahead Energy Market. CTs and diesels are committed in real time, after PJM dispatch has a more complete knowledge of real-time conditions. The goal is to permit the dispatch of flexible units in real time based on real-time conditions as they evolve.

The reason for this special treatment of CTs and diesels is that historically, such units were usually more flexible to commit than other unit types. But that is no longer correct and should not be assumed to be correct. The threshold for default LOC payments, if any such payments are appropriate, should be based directly on metrics of unit flexibility, including short startup and notification times, short minimum run times and a higher number of maximum daily and weekly starts. The inclusion of only CTs and diesels and the exclusion of other unit types based solely on the type of unit is discriminatory.

Units should be eligible to be compensated for LOC when scheduled in the Day-Ahead Energy Market and not committed in real time based on their flexibility as indicated by their offer parameters.

5. The LOC Rules Are Not Defined For Some Markets and Services.[17]

A flaw in the LOC calculations that is not addressed by PJM in the June 23rd Filing is that a subset of LOC calculations have not been defined in PJM's tariff.

The Market Monitor recommends that this subset of LOC calculations be clearly defined in PJM's tariff.

The current rules fail to define the method and components used to calculate the LOC component of the Day-Ahead Scheduling Reserve Market clearing price and LOC compensation for black start testing, for hydro units providing synchronized reserves, and for synchronous condensing for purposes other than reactive services or synchronized reserves. LOC has a major impact on pricing, and the approach used should not be at the discretion of PJM. The rules need to explicitly state how LOC is calculated.

There is no definition of LOC in the tariff for the Day-Ahead Scheduling Reserve Market.[18] LOC calculations in the Day-Ahead Scheduling Reserve Market should be defined consistent with the Regulation, Synchronized Reserve and Non-Synchronized Reserve Markets LOC, because Day-Ahead Scheduling Reserve is an ancillary service such as Regulation, Synchronized Reserve and Non-Synchronized Reserve on which prices must reflect the lost opportunity cost of units reduced in order to provide the ancillary service.

There is no definition of LOC in the tariff for the provision of black start service.[19] LOC calculations for black start testing should be defined consistent with the energy market LOC methodology because the same scenarios that apply in the LOC compensation in the

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[17] Synchronous condensing for purposes other than reactive servicers or synchronized reserves.

[18] *See* OA Schedule 1 §§ 1.10.1A (m), 3.2.3A.01.

[19] *See* OATT Schedule 6A at "Testing".

energy market apply to units performing black start testing. These scenarios are units suspended in real time for reliability reasons or scheduled in the Day-Ahead Energy Market and not committed in real time.

There is no definition of LOC in the tariff for the provision of synchronized reserves from hydro units.[20] LOC calculations for hydro units providing synchronized reserves should be defined consistent with the Regulation Market LOC methodology used for hydro units because hydro units have the same lost opportunity cost when this type of unit is reduced to provide regulation or synchronized reserve.

There is no definition of LOC in the tariff for the provision of synchronous condensing for purposes other than synchronized reserve, reactive services or post-contingency operation.[21] LOC calculations for synchronous condensing for purposes other than synchronized reserves, reactive services or post-contingency operation should be defined consistent with the other LOC calculations for synchronous condensing defined in PJM's tariff because units operating as synchronous condensers have the same lost opportunity cost for all commitment reasons.

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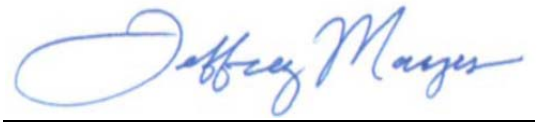
[20] *See* OA Schedule 1 § 3.2.3A.

[21] *See* OA Schedule 1 § 3.2.3 (i).

III. CONCLUSION

The Market Monitor respectfully requests that the Commission approve the tariff revisions submitted by PJM in order to end the overcompensation that has persisted since these rules were put in place. The Market Monitor also respectfully requests that the Commission afford due consideration to the additional recommendations herein as the Commission resolves the issues raised in this proceeding.

Respectfully submitted,



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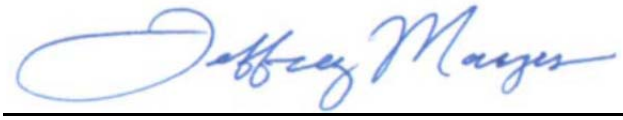
Dated: July 16, 2015

CERTIFICATE OF SERVICE

I hereby certify that I have this day served the foregoing document upon each person designated on the official service list compiled by the Secretary in this proceeding.

Dated at Eagleville, Pennsylvania,
this 16th day of July, 2015.



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