UNITED STATES OF AMERICA
BEFORE THE
FEDERAL ENERGY REGULATORY COMMISSION

New York Independent System Operator, Inc.	)	Docket No. EL18-33-000

COMMENTS OF THE
NEW YORK ISO'S MARKET MONITORING UNIT

Potomac Economics moves to file comments concerning the Commission's investigation that was instituted on December 21, 2017 pursuant to the above-captioned proceeding. The order instituting the investigation ("the December 21 Order") identified elements of the NYISO's practices related to the pricing of fast-start resources that may be unjust and unreasonable, and the order proposed revisions to address its concerns. [1] Potomac Economics supports most of the Commission's proposed revisions and opposes one proposed revision.

Potomac Economics is the Market Monitoring Unit ("MMU") for the NYISO and is responsible for monitoring the market and evaluating potential changes that impact the market. Potomac Economics filed a motion to intervene in this proceeding on January 18, 2018.

I. NOTICE AND COMMUNICATIONS

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[1] See *Order instituting section 206 proceeding and commencing paper hearing procedures and establishing refund effective date*, 161 FERC ¶ 61,294, (2017).

II. BACKGROUND AND SUMMARY

This proceeding involves the NYISO's fast-start pricing rules, which allow block-loaded fast-start units that are committed by the Real Time Scheduling ("RTS") software to set real-time LBMPs. Without this specialized set of rules, only units dispatched within their flexible operating range would be able to set clearing prices. Hence, the fast-start pricing rules are designed to allow the commitment costs of units deployed in real-time to be considered in the clearing price when such units are the marginal source of supply.

The December 21 Order identified elements of the NYISO's fast-start pricing practices related to online and offline fast-start resources that "may be unjust and unreasonable because the practices do not allow prices to reflect the marginal cost of serving load."[2] As we explain in these comments, we agree with and support the changes proposed by the Commission for online fast-start resources, but oppose the changes proposed by the Commission for offline fast-start resources. It is important to recognize that online fast-start pricing and offline fast-start pricing are completely independent of each other and address two different issues:

- Online fast-start pricing is designed to allow RTOs' real-time markets to reflect the true marginal cost of the system. Real-time pricing fails to do so when inflexible high-cost fast-start resources are not recognized as the marginal source of supply even though they are online and needed to satisfy the system's needs.
- Offline fast-start pricing allows resources that are not being utilized, but theoretically could have been, to set prices in the real-time market. This is only arguably justified when offline resources to set the price only when a) they are feasible (can be started quickly), and b) they are economic for addressing the shortage. However, when units that are either not feasible or not economic to start are allowed to set energy prices, the resulting prices will be inefficiently low.

2 See December 21 Order at P. 1.

Online Fast-Start Pricing. The Commission initiated an investigation into whether the NYISO should be required to "A) Modify pricing logic to allow the start-up costs of fast-start resources to be reflected in prices; and B) Relax the economic minimum operating limit of all dispatchable fast-start resources by up to 100 percent for the purpose of setting prices."[3] As the MMU for the NYISO, we agree that the current online fast-start pricing rules are not optimal and the online pricing changes proposed by the Commission would significantly improve NYISO's price formation.

Offline Fast-Start Pricing. In a footnote to the December 21 Order, the Commission also proposed conforming changes that would expand the use of offline fast-start pricing: "we propose that NYISO also be required to extend its current offline pricing practices, including the use of commitment costs in setting prices, to any resources that are provided fast-start pricing treatment."[4] As we have discussed in previous filings, we have serious reservations about the current practice of offline fast-start pricing and have recommended that it be phased-out in the NYISO.[5] Offline fast-start resources that set prices are not feasible to start quickly enough to address the system need in the five-minute dispatch horizon. In these cases, the offline fast-start pricing can result in less efficient real-time prices and cause NYISO to fail to price some ancillary services shortages and transmission constraint violations. Additionally, the use of offline pricing leads to significant inconsistencies between real-time schedules and the actual output of generators. The problems associated with offline fast-start pricing would become much more serious if it was applied to more units as proposed in the December 21 Order.

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[3] See December 21 Order at P. 15.

[4] See December 21 Order at Footnote 40.

[5] See Comments of Potomac Economics on the Commission's NOPR regarding Fast-Start Pricing, pages 16 to 17, Docket RM17-3-000, dated March 1, 2017.

This comments in this filing is organized as follows. Section III provides our supportive comments on the Commission's proposal to include start-up costs in the online fast-start pricing, discusses how start-up costs should be amortized in the price-setting logic, and provides our support for expanding fast-start pricing to include dispatchable fast-start units (and not just fixed-block fast start units). Section IV describes our concern that the current offline fast-start pricing logic depresses real-time prices during shortage conditions and discusses our opposition to the proposed expansion of offline fast-start pricing. In Section V discusses several additional issues related to fast-start pricing that we recommend be evaluated in this proceeding. Section VI provides our conclusions and recommendations.

III. COMMENTS ON ONLINE FAST-START PRICING

A. Including Start-Up Costs in the Fast-Start Pricing Logic

The December 21 Order proposed that the start-up costs of the fast-start resources be embedded in the real-time pricing.[6] We agree with this proposed change because it is fully consistent with the economic principle that the competitive price for any good should reflect the marginal cost of supplying the good. Hence, well-designed fast-start pricing rules allow real-time prices to include the cost of committing and running peaking units when they are the marginal source of energy. To understand why this is the case, one must recognize that the commitment of fast-start units is a fundamentally different action than the commitment of other resources.

The NYISO dispatches its real-time market on a time interval of 5 minutes, but its model optimizes multiple intervals extending out one hour. In this time horizon, altering the output of online generation is the primary supply action that can be taken by the market to balance supply and demand and manage congestion. However, there is one class of resources that may be

6 See December 21 Order at P. 15.

started in this time horizon as an alternative to ramping up online resources – fast-starting peaking resources. The costs of utilizing these resources should be reflected in real-time prices because they are marginal costs. Indeed, the Commission has opined "that given the unique operating characteristics of fast-start resources, their commitment costs, i.e., start-up and no-load costs, should be viewed as marginal costs and, as such, should be included in prices."[7]

This concept is confusing to some because the commitment costs of most resources are not marginal costs. One can define marginal costs as *the additional cost incurred to produce additional output*. Most units are committed well in advance, particularly baseload units that may be been started many days in advance of the current real-time interval. Therefore, these units' start-up and minimum generation costs are sunk and are not marginal for providing additional energy. Therefore, only their incremental energy costs can be marginal when they are dispatched between their minimum and maximum output levels.

However, offline resources that can be started quickly (e.g., within 10 minutes) are different. The start-up and minimum generation costs of these resources have not been incurred when they are offline. As load grows or a constraint begins binding, an NYISO may incur these costs in the real-time horizon (5 to 15 minutes) as an alternative to ramping up online resources. Therefore, the commitment costs of these resources <u>do</u> constitute the marginal costs of satisfying the system's demand, which is the economic rationale for the fast-start pricing that has been implemented by a number of RTOs. This pricing innovation is particularly important because gas turbines constitute most of the resources at the high-priced end of the supply curve – when they do not set price, the prices are often set by a much lower-cost unit. If the portfolio of higher-cost resources included a mixture of flexible and inflexible units, this pricing concern

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[7] *Fast-Start Pricing in Markets Operated by Regional Transmission Organizations and Independent System Operators, Notice of Proposed Rulemaking*, FERC Stats.&Regs. ¶ 96,391 (2016).("Fast Start Pricing NOPR"), p. 51.

would not be as large because one could expect high-cost flexible units to set prices when the inflexible units could not. Unfortunately, the high-cost supply is not sufficiently diverse.

Failure to reflect these costs in real-time prices results in the need to make guarantee payments to these resources to cover their costs, which must be collected from NYISO's customers through uplift charges. Additionally, the resulting understatement of the real-time prices results in lower day-ahead prices, causing some economic resources to not be scheduled in the day-ahead market and increasing the need to continue to rely on high-cost fast-starting peaking resources in real-time.

In summary, including the start-up costs of fast-start units during their initial commitment period in the price-setting logic would allow the NYISO's real-time energy prices to reflect the full cost that a resource incurs as a result of being deployed in economic merit order to satisfy the system's real-time demand for energy and ancillary services. It would also help ensure that fast-start units that are economic recover their costs through real-time market revenues rather than through make whole payments. The frequent use of make whole payments undermines the incentives for generators to offer efficiently in markets with location-based marginal cost pricing. This proposed fast-start pricing enhancement would not only improve the incentives of fast-start units, but more importantly, it would provide better incentives for investment in *all* flexible resources that can respond to system needs when fast-start units are being deployed.

B. Amortizing Start-Up Costs in the Pricing Logic

Ideally, start-up costs and other costs incurred as a result of the initial one-hour commitment of a fast-start unit should be amortized in accordance with the value of the unit to the system over the hour. Therefore, if a fast-start unit is committed primarily for a transient need during the hour, a larger share of its costs should be allocated to that portion of the hour. This would provide better market incentives for flexible resources that respond to system needs during that portion of the hour. Based on our analysis of 2017 market results presented in this section, we conclude that start-up costs should be distributed in a manner that is skewed toward the early portion of the initial commitment period.

In the NYISO, most fast-start units are committed in merit order based on the results of the real-time commitment (RTC) model, which optimizes scheduling of online generation, fast-start generation, and external transactions over a 150-minute time horizon. When the RTC model starts-up a fast-start unit, it also produces advisory clearing prices that are based on the marginal cost of serving energy that is forecasted by RTC. These advisory prices reflect the expected marginal cost of resources that will be displaced by the fast-start unit's energy over each 15-minute portion of its commitment period.

For example, if RTC starts a 20 MW unit with an incremental energy cost offer of $80/MWh and a start-up cost of $400, it will cost an average of $100/MWh over the first hour of operation.[8] Suppose the unit is started when the RTC LBMP is $125/MWh for the first 30 minutes and $75/MWh for the second 30 minutes. In this case, we could infer that the unit was started primarily because of its value over the first half of the hour, while it had less value to the system in the latter half of the hour.

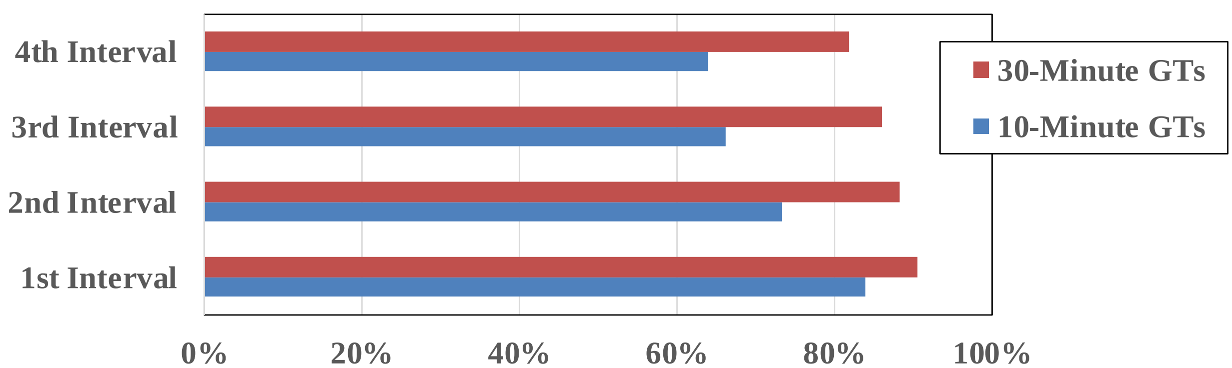
Ideally, a fast-start unit should set prices that reflect its value to the system. In the example above, setting an LBMP of $100/MWh for the first 30 minutes would likely be inefficiently low, since the fast-start unit was committed with the expectation that it would displace resources with a cost of $125/MWh, while setting an LBMP of $100/MWh in the second half of the hour would likely be higher than the efficient level, since the unit was committed with the expectation that it would displace resources with a cost of $75/MWh. As illustrated in this example, it would appropriate to amortize the costs of the fast-start unit in

8 $80/MWh + $400 start ÷ 20 MWh = $100/MWh.

accordance with the expected value of its output to the system over the initial commitment period.

The following figure evaluates the advisory prices forecasted by RTC over the initial commitment period of fast-start units in 2017 (when they were instructed to start by RTC). The figure summarizes how frequently the fast-start units' incremental energy cost was forecasted by RTC to be inframarginal or on the margin in each 15-minute segment of the initial 1-hour commitment period in 2017. The figure shows this information separately for 10-minute and 30-minute fast-start units.

Figure 1: Frequency of Fast-Start Unit Being Forecasted by RTC to Displace More Expensive Resource, 2017



The figure shows that when a 10-minute fast-start unit was committed in 2017, RTC forecasted the LBMP in the first 15-minute interval would be greater than or equal to its incremental energy offer 84 percent of the time, while RTC forecasted this frequency would fall to 64 percent in the fourth 15-minute interval. The figure shows the same general pattern for 30-minute fast-start units as well. Although we don't have estimates of the forecasted value of the fast-start units in each interval of the initial commitment period, this figure strongly suggests that these units have the greatest value early in the commitment period.

We recommend that the start-up costs be amortized in a front-loaded manner in the pricing logic. Ideally, the commitment costs of each fast-start unit could be amortized in proportion to the value of its energy forecasted by RTC over the initial commitment period for units started by RTC in the pricing logic. Hence, we recommend that the NYISO evaluate the feasibility and cost of such an approach. However, if the cost and complexity of such a dynamic approach is relatively large, we recommend the NYISO adopt a static amortization schedule that is front-loaded in the pricing logic based on a historic evaluation of RTC results.[9]

C. Application of Fast-Start Pricing to Dispatchable Fast-Start Units

We support the Commission's proposal for all units that are capable of being started in 10 minutes with a minimum run time of one hour to be included in the NYISO's fast-start pricing logic. The NYISO currently only includes fast-start units if they are fully block-loaded (i.e., if their minimum generation MW level is lower than their upper operating limit). There is no economic rationale for excluding those fast-start resources that are not block loaded. The economic principles underlying fast-start pricing that are described earlier in these comments apply with equal force to fast-start resources that are block loaded and not block loaded.

NYISO has approximately 1.7 GW of fast-start resources that are not block loaded that are started daily to satisfy demand for energy and ancillary services. When the commitment of such generation is the marginal source of supply, it is appropriate to consider their start-up costs and minimum generation costs in the pricing logic, regardless of whether they are dispatched above their minimum generation MW level. Excluding these units from the fast-start pricing logic leads to frequent circumstances when real-time prices do not cover the unit's as-bid costs and results in make-whole payments, even when the units are committed economically.

IV. COMMENTS ON FAST-START PRICING FOR OFFLINE UNITS

We are concerned that the NYISO's current practice of *offline* fast-start pricing depresses real-time prices below efficient levels and prevents the real-time market from recognizing some

9 In any case, a static amortization schedule will be necessary for fast-start units committed in ways other than by RTC such as an operator instruction or reserve pick-up.

shortage conditions. This is because NYISO's offline units frequently cannot actually start quickly enough to address the transitory need that causes them to appear economic. Hence, allowing them to set prices in these cases will lead to prices that do not accurately reflect system conditions. The December 21 Order proposed to expand offline fast-start pricing by applying it to all resources that are included in the fast-start pricing for online units. Expanding offline fast-start pricing to include all 10-minute and 30-minute start units would greatly exacerbate the market inefficiencies that result from offline fast-start pricing. Hence, we recommend against expanding the application of offline fast-start pricing.

Subsection A provides a high-level description of offline fast-start pricing. Subsection B discusses our concerns with the current application of offline fast-start pricing and the proposed expansion.

A. High-Level Description of Offline Fast-Start Pricing

This sub-section describes the key features of the NYISO's fast-start pricing logic for offline units. The Real-Time Dispatch model ("RTD") performs an optimization using offers, demand, transmission constraints, and other operational data to set physical schedules for each resource and clearing prices at every location every five minutes. RTD also forecasts conditions over the subsequent hour, setting advisory schedules and advisory clearing prices at 15-minute intervals.[10] Since RTD optimizes the five-minute dispatch interval while considering the subsequent intervals in the hour, it may dispatch units up or down in the five-minute interval to help satisfy forecasted system needs in the advisory timeframe.

When real-time system conditions tighten rapidly, RTD must sometimes increase output on high-cost dispatchable units and/or make more energy available by running short of

[10] For example, the RTD that determines binding real-time schedules and prices for the five-minute interval ending at 1:35 also determines non-binding advisory schedules and prices for the four subsequent periods ending on the quarter hour (i.e., 1:45, 2:00, 2:15, and 2:30).

regulation or operating reserves. As the marginal cost of supply increases, RTD may utilize offline fast-start units to satisfy energy needs when they appear to be less costly than online resources. For example, RTD would schedule output on an offline fast-start unit at a cost of $90/MWh rather than incur a shortage of regulation with a value of $525/MWh.[11] However, since the offline fast-start unit cannot actually produce output within the five-minute interval, it is often necessary for regulation units to ramp-up to make up the shortfall.

The offline fast-start pricing logic enforces a one-hour minimum run time constraint that has significant effects on real-time pricing and scheduling outcomes. RTD assumes that if an offline fast-start unit is scheduled at a particular output level in the five-minute dispatch interval, then it cannot be ramped down during the four advisory intervals. Consequently, the marginal cost of scheduling an offline fast-start unit in the five-minute dispatch interval (and the resulting real-time LBMP) will reflect the start-up and other costs of keeping the unit online for the remainder of the hour. The importance of this minimum run time constraint is illustrated in the following example.

Suppose a fast-start unit has start-up and other commitment costs totaling $90/MWh over the initial minimum run time of one hour. If this unit is the marginal source of supply in the five-minute dispatch interval, it will frequently set an LBMP that exceeds $90/MWh. This is because the LBMP in the five-minute dispatch interval will increase to the extent that the LBMPs in the four advisory intervals are expected to be less than $90/MWh:

- If the four advisory LBMPs were expected to be $80/MWh, the LBMP in the five-minute dispatch interval would be $130/MWh,[12] while

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11 The first step of the Regulation Service Demand Curve is a 25 MW step, which has a value of $25/MWh. However, the second step has a value of $525/MWh. See NYISO Market Services Tariff Section 15.3.7.

12 $130 = {$90} x {5 time intervals represented in the optimization} – {$80} x {4 advisory intervals represented in the optimization}). Each of the five intervals has equal weight in the optimization, although the dispatch interval is five minutes while the four advisory intervals are up to 15-minutes apiece.

- If the four advisory LBMPs were expected to be $55/MWh, the LBMP in the five-minute dispatch interval would be $230/MWh.[13]

The use of the minimum run time constraint has several significant implications. First, the LBMP in the five-minute dispatch interval is typically much higher than the average commitment costs of an offline fast-start unit. Since the only units eligible for offline fast-start pricing treatment were installed before 1980, offline fast-start pricing typically occurs only during relatively high price periods. Second, the *higher* LBMPs are expected to be in the advisory intervals of RTD, the *lower* the LBMP is in the binding five-minute dispatch interval, and vice versa. Hence, when the offline fast-start unit is less economic, it tends to set a higher LBMP, while when the offline fast-start unit is more economic, it tends to set a lower LBMP. This dynamic can also lead to volatile real-time LBMPs, which is discussed further in the next subsection.

B. Problems with *Offline* Fast-Start Pricing

There are several reasons why offline fast-start pricing should be phased-out of the NYISO market design rather than expanded. First, it is only potentially efficient for an offline resource to set the real-time price when it is: a) feasible (can be started quickly enough to help), and b) economic for addressing the shortage. When offline units set the price that are either not feasible or not economic to start, the resulting price will be inefficiently low. The Commission has agreed with this principle, stating in Order 825: "…we agree with Potomac Economics that if an RTO's/ISO's pricing model allows infeasible or uneconomic units to set prices, the offline units represent an artificial increase in real-time supply that will depress real-time prices. Therefore, for the purpose of this Final Rule, RTOs/ISOs choosing to use offline resources to

13 $230 = {$90} x {5 time intervals represented in the optimization} – {$55} x {4 advisory intervals represented in the optimization}).

count towards energy and operating reserve requirements may not allow infeasible or uneconomic offline units to set prices through the real-time pricing model…"[14]

When committing an offline resource is feasible and economic, we expect the resource will typically be started by the NYISO and the resource will then be able to set the real-time price through the online fast-start pricing. However, the NYISO frequently does not start resources that set prices under the offline fast-start pricing, which allows us to infer that the operators did not believe the unit could be on in time to help address the issue and/or that the operator did not expect that the unit would be economic to operate for the remainder of its minimum runtime. Even when the resource is started, it does not produce output until well after the five-minute dispatch interval is over, so it never meets the "feasibility" criterion. Whether or not the resource is started, it is not efficient for the resource to set the real-time price.

Second, offline fast-start units are not capable of responding to a five-minute dispatch signal since they generally take at least ten minutes to start. Treating them as if they are capable of starting leads to inconsistencies between schedules and actual production. To the extent that fast-start units are scheduled but incapable of producing output, the shortfall must be made up in other ways such as with Area Control Error ("ACE") or by regulation deployment. Occasionally, it becomes necessary to initiate a reserve pick-up or bias the load forecast to offset the effects of under-generation.[15]

The inability of offline fast-start units to respond in five minutes also affects congestion management. In a congested load pocket, RTD may resolve the congestion by scheduling energy

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[14] See *Settlement Intervals and Shortage Pricing in Markets Operated by Regional Transmission Organizations and Independent System Operators* at P. 168, 155 FERC ¶ 61,276, (2016).

[15] For example, on August 22, 2017, the NYISO scheduled 830 MW of energy from offline fast-start units at interval-ending 21:00 as it was going into a Thunderstorm Alert. However, since these units could not actually respond in five minutes, the NYISO declared an alert state for ACE and initiated a reserve pick-up to make up the shortfall.

from one or more offline units, but since the units cannot respond in five minutes, the resulting transmission flows will be higher than the transmission limit used in RTD. Consequently, NYISO operators may utilize more conservative transmission limits in areas where many units are eligible for offline fast-start pricing treatment. This may be done by increasing the Constraint Reliability Margin ("CRM"), which is a parameter that provides a cushion between the RTD flow limit and the actual transfer limit of the facility. The CRM is 20 MW for most constraints, but the CRM may be increased for facilities that are more difficult to manage.

The following table summarizes the frequency and magnitude of transmission shortages that were recognized by RTD in the five-minute dispatch and the additional flows that result when offline fast-start units are scheduled to provide relief even though they are not able to produce actual output. This is shown separately for facilities that have CRM values of 20, 30, and 50 MWs.

Table 1: Transmission Constraint Violations and Effects of Offline Fast-Start Units July to December 2017[16]

CRM (MW)	Constraint Violations			
	Recognized by RTD		After Removing Relief From Offline GTs	
	# of Constraint-Intervals	# of Shortages > 20 MW	# of Constraint-Intervals	# of Shortages > 20 MW
20	2066	68	2444	156
30	446	20	1077	43
50	81	1	800	158

The table shows that transmission constraint violations rarely exceed 20 MW based on RTD schedules. For facilities with a 20-MW CRM, the removal of relief from offline GTs modestly increases the number of violations that are recognized to exceed 20 MW. However, for

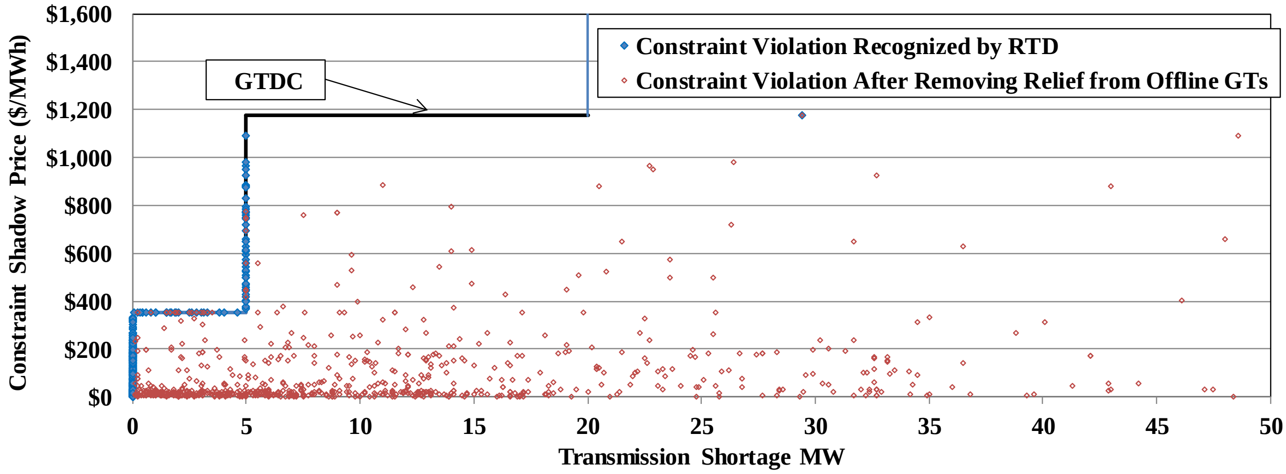
16 The table shows the July to December 2017, since this was after the last significant change to the real-time pricing logic occurred in June 2017. The table excludes transmission facilities in western and northern New York, since those areas do not have units that offline fast-start pricing is to.

facilities with a 50-MW CRM, the removal of relief from offline GTs greatly increases the number of material violations (i.e., those that exceed 20 MW). This is partly because the 50-MW CRM values are used for the 345kV circuits that import power from upstate to Long Island, where large numbers of units are eligible for offline fast-start pricing. Hence, the higher CRM value of 50 MW is more conservative so that when actual flows exceed RTD scheduled flows, it is less likely to result in actual transmission overloads.

Third, offline fast-start pricing results in volatile LBMPs that are not well-correlated with the severity of system conditions. This is illustrated by the example above in subsection A. This example shows that when it would be relatively economic to turn on a gas turbine, the turbine sets an LBMP of $130/MWh. However, when the need lasts for just five minutes because of a transitory shortage of ramp, the gas turbine sets an LBMP of $230/MWh. Hence, during shortages of ramp capability, offline fast-start pricing leads to real-time prices that do not exhibit a consistent pattern whereby the clearing price increases as the severity of the shortage increases. Rather, offline fast-start pricing can often lead to the opposite pattern where the clearing price falls as the severity of the shortage increases.

The relationship between shadow price and the severity of the violation is shown in the following scatter plot for the two 345kV circuits that import from upstate to Long Island. The scatter plot also shows the Graduated Transmission Demand Curve ("GTDC") and the blue points indicate the clear relationship between the shadow price and the violation recognized by the software. However, the red points show the shadow price and violation quantity after removing the relief scheduled by RTD from offline resources that will not occur because the resources will not actually produce output. The plot shows that the violation quantities routinely exceed the 20 MW GTDC.

Figure 2: Transmission Constraint Shadow Prices and Violations With and Without Relief from Offline Units, July to December 2017



The plot shows that the shadow prices that result from offline GT pricing are not well-correlated with the severity of the transmission constraint, leading to prices during tight operating conditions that are volatile and far below the GTDC. If the GTDC represents the cost to the system of violating the constraint, then the amount by which offline fast-start pricing causes transmission violations to be priced less than the GTDC is the size of the pricing inefficiency. Eliminating offline pricing would ensure that violations are priced at the GTDC level. We recognize that this may not be optimal in the short-run because the NYISO is currently limited in its ability to establish GTDCs that vary by constraint, but this does not justify expanding the use of offline pricing as the Commission has proposed.

The plot also illustrates that the 50 MW CRM for these facilities helps ensure that large differences between scheduled flows and actual flows do not lead to actual transmission overloads. However, the use of a conservative 50-MW CRM leads to excessive congestion costs during normal conditions because the conservative CRM usually limits flows more than necessary.

Finally, the proposed expansion of the offline fast-start pricing logic to additional units would make the inefficiencies much more severe than they are now. Currently, offline fast-start pricing is only applied to an older set of gas turbines that have relatively high heat rates and other operating costs. In 2017, offline fast-start units were utilized by RTD in 5.4 percent of intervals, and in these intervals, the average cost was $102/MWh over the initial minimum run time. These units set an average LBMP of $146/MWh, which is significantly higher than their average cost because of the effects of the intertemporal constraints explained in subsection A. Hence, while we identify significant deficiencies with the price-suppressive effects of offline fast-start pricing, these effects are limited to a small set of relatively high price periods.

If offline fast start pricing is expanded to all 10-minute and 30-minute GTs, it will be applied to relatively low-cost units, so offline fast start pricing will lead to much more frequent reductions of price below efficient levels. If offline fast start pricing was applied to these units in 2017, we estimate that it would have further reduced prices in 6.6 percent of intervals in which the average cost of the first offline unit scheduled would have been $61/MWh. This would substantially raise the pricing concerns associated with allowing offline resources to set real-time prices. Given the need to recognize the value of fast-ramping flexible resources, the proposed application of offline fast start pricing would undermine efforts to improve incentives for units to be flexible.

V. RECOMMENDED ADDITIONAL CHANGES TO EVALUATE

We recommend the Commission and the NYISO consider two additional rule-changes that might improve the efficiency of fast-start pricing. First, the NYISO should consider the potential lost opportunity costs of online units that are dispatched below their profit-maximizing output level as a result of fast-start pricing, and whether rule changes are needed to ensure that such units have efficient dispatch incentives. If an online unit is frequently ramped down below its profit-maximizing output level, the unit may have incentives to: (a) over-generate up to the profit-maximizing output level or (b) reduce its offer price below its marginal cost or self-schedule to avoid being ramped down. Whether a unit has an incentive to over-generate and/or offer below cost depends on many factors including the frequency, predictability, and magnitude of differences between its real-time schedule and its profit-maximizing output level. Hence, we recommend that the NYISO perform analysis to determine whether some units are likely to have incentives to over-generate and/or offer below cost, the extent to which these are addressed by the current settlement rules, and whether settlement rule changes to allow such resources to recover their opportunity costs are warranted.

Second, we recommend the NYISO and the Commission consider allowing Coordinated Transaction Scheduling ("CTS") transactions to set the LBMP. CTS transactions are external transactions that are evaluated and scheduled in economic merit order every 15 minutes by RTC in the same evaluation that determines whether to schedule fast-start units. CTS transactions have a 15-minute scheduling lead time, which is comparable to a fast-start unit's start-up notification time of 15 minutes, and no minimum run time. CTS transactions are treated as fixed injections and withdrawals in the five-minute dispatch of RTD, so they currently do not set price. Thus, CTS transactions have the essential characteristics of fast-start units, and there are some circumstances where CTS transactions are the marginal source of supply (or demand) in RTC, particularly in locations without much dispatchable generation. We recommend the NYISO evaluate the potential effects of allowing certain CTS transactions to set LBMP in the five-minute dispatch.

VI. CONCLUSIONS AND RECOMMENDATIONS

In recent years, the Commission, wholesale market operators, and other parties have increasingly recognized that efficient real-time prices provide incentives for suppliers to perform reliably and for investors to build and maintain resources that provide the most value to consumers and that efficient real-time pricing is particularly important during shortages and other stressed operating conditions. We strongly support the Commission's efforts to improve real-time pricing in centralized wholesale markets.

The December 21 Order identified elements of the NYISO's fast-start pricing that may not be just and reasonable, and we support the Commission's proposals to: (a) incorporate start-up costs in the fast-start pricing logic and (b) apply fast-start pricing to dispatchable fast-start units. However, we also make several specific recommendations:

1. Start-up costs should be amortized in a manner that is consistent with its value to the system in the pricing logic. Ideally, the commitment costs of each fast-start resource could be amortized in proportion to the value of its energy forecasted by RTC over the initial commitment period. However, if the cost and complexity of such a dynamic approach is relatively large, we recommend the NYISO adopt a static amortization schedule that is front-loaded toward the early intervals of the commitment period based on a historic evaluation of RTC results.
2. We oppose the proposal to expand the application of *offline* fast-start pricing because it results in inefficient price reductions and leads to significant inconsistencies between real-time schedules and the actual output of generators. Importantly, it causes RTD to fail to recognize some ancillary services shortages and transmission constraint violations, which are cases where it is extremely important to provide efficient pricing incentives to other flexible resources. The problems associated with offline fast-start pricing would become much more serious if it was applied to more units as proposed in the December 21 Order. Hence, we recommend that the NYISO phase-out (rather than expand) the use of offline fast-start pricing, although we recognize that this should be done in

conjunction with the creation of constraint-specific graduated transmission demand curves.[17]

3. The NYISO should consider whether the proposed fast-start pricing revisions could give some units incentives to over-generate and/or offer below cost and whether changes in its settlement rules to allow recovery of lost opportunity costs are warranted to address these incentives.

4. Consider allowing CTS transactions to set the LBMP, since CTS transactions have the essential characteristics of fast-start units and they are frequently the marginal source of supply (or demand) in the real-time market.

We respectfully request that the Commission consider these comments and recommendations in determining the final changes needed to NYISO's fast-start pricing to ensure that its prices are just and reasonable.

Respectfully submitted,

/s/ David B. Patton

David B. Patton
President
Potomac Economics, Ltd.

February 12, 2016

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[17] See Recommendation #2015-17 in the *2016 State of the Market Report for the New York ISO Markets*, Section XI.

CERTIFICATE OF SERVICE

I hereby certify that I have this day e-served a copy of this document upon all parties listed on the official service list compiled by the Secretary in the above-captioned proceeding, in accordance with the requirements of Rule 2010 of the Commission's Rules of Practice and Procedure (18 C.F.R. §385.2010).

Dated this 12th day of February 2018 in Fairfax, VA.

/s/ David B. Patton