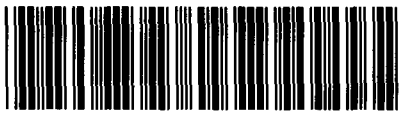

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PROJECT TO ASSESS PRICE-FORMATION RULES IN ERCOT'S ENERGY-ONLY MARKET	§ § §	**PUBLIC UTILITY COMMISSION OF TEXAS**

PUBLIC UTILITY COMMISSION FILING CLERK

REPLY COMMENTS OF POTOMAC ECONOMICS

Potomac Economics (Potomac), the Independent Market Monitor ("IMM") for the wholesale markets in the Electric Reliability Council of Texas, Inc. ("ERCOT") region, appreciates the opportunity to reply to comments filed in response to the request for comment issued by Staff ("Staff") of the Public Utility Commission of Texas ("Commission") on October 10, 2017.

I. INTRODUCTION

As the IMM for ERCOT, we strongly support the Commission's interest in assessing real-time price formation in ERCOT's current energy-only market. The importance of efficient real-time prices for both energy and ancillary services cannot be overstated.

Well-designed energy and ancillary services markets ensure that effective competition among suppliers and buyers will produce efficient real-time energy and ancillary services prices. Such prices not only facilitate efficient use of existing resources to satisfy the system's needs in the short term, but also provide economic signals that will guide participants' longer-term capital investment, retirement, and contracting decisions.

Hence, a number of our recommendations in our Annual State of the Market Reports have focused on changes that should be considered to improve real-time price formation in ERCOT.[1] Some of these changes have been discussed in this case, for which we provide comments below.

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[1] 2016 State of the Market Report for the ERCOT Electricity Markets at xxv-xxvii (May 2017).

Section II begins by discussing Real-Time Co-optimization ("RTC"), which we consider the most important price formation improvement. We also discuss incorporating marginal losses in ERCOT's dispatch and pricing, our assessment of Vistra Energy's flawed proposal to create a thermal adder, and market power mitigation and local price formation.

II. DISCUSSION

A. Real-Time Co-Optimization

Among the many market improvements recommended in this Project, including marginal losses and local reserve product, the IMM views RTC as the most vital. RTC is foundational to efficient pricing, especially in an energy-only market like ERCOT where participants rely on energy prices to facilitate short-term decisions to commit generation and long-term decisions to invest and retire. The benefits of RTC would be substantial, as supported by the results seen by others independent system operators ("ISOs") where RTC is implemented.

Substantial benefits can be achieved by implementing RTC of energy and ancillary services. In ERCOT's current market, scheduled reserves are held out of the energy market, and there is no explicit means to share the on-line flexibility optimally between energy and reserves. For example, if a resource scheduled for reserves would be more economic to produce energy (while shifting the reserves to a different unit), the savings of such tradeoffs will generally not be captured in ERCOT. The lone means to reallocate resources between products is for a qualified scheduling entity ("QSE") that has received an ancillary service schedule to reallocate that schedule among the resources in its portfolio. However, this process is far from optimal because it effectively excludes small QSEs, and no QSE has the real-time information on system conditions necessary to do this as well as ERCOT.

Jointly optimizing all products in each interval allows ancillary service responsibilities to be continually adjusted in response to changing market conditions. The efficiencies of this continual adjustment would flow to all market participants and would be greater than what can be achieved by QSEs acting individually. The continual, optimal system-wide allocation of resources between providing energy and providing reserves will lower the cost of satisfying both requirements. Additionally, the opportunity costs of any trade-off between energy and reserves will be included in the reserve price. Therefore, resources will not be harmed by being scheduled for reserves.

Real-time co-optimization is particularly important in times of reserve shortages or in cases when costly measures are taken to avoid shortages. The Operating Reserve Demand Curve ("ORDC") provides a mechanism for setting real-time energy prices that reflect the expected value of lost load. However, jointly-optimizing the energy and reserve markets would allow this shortage pricing to be more accurate. In a co-optimized system, the real-time market will determine in each five minutes whether a shortage exists and set prices accordingly. Currently, capacity providing responsive or regulating reserves are not available to be converted into energy at any price. Under a co-optimized system, a demand curve would be established for every type of reserve (potentially including locational reserve products in the future). When it is economic to release these reserves to provide energy, the value of these reserve shortages will be reflected efficiently in the energy and reserve prices. This is especially important in ERCOT because pricing during shortage conditions is key for the success of ERCOT's energy-only market.

Over time, these pricing improvements should improve the resource commitments in ERCOT and consequently reduce ERCOT's reliance on Reliability Unit Commitments ("RUCs").

In the long-term, they should also improve the economic signals that facilitate participants' investment and retirement decisions.

In addition, the IMM echoes comments submitted by ERCOT on December 7, 2017 stating that implementation of RTC would eliminate the need the Supplemental Ancillary Service Market ("SASM"), which is used for the purpose of replacing the ancillary service schedules of a provider that is unable to meet its responsibilities.[2] The SASM is a highly illiquid and unnecessarily risky mechanism for the procurement and re-assignment of ancillary service responsibilities, often resulting in prices that are substantially higher than the day-ahead prices for such services at times when there is a significant supply surplus.

The primary hesitation expressed by ERCOT market participants with regard to implementing RTC is the timing and cost of implementation. The IMM remains confident that the benefits of RTC will outweigh the implementation costs and recommends the Commission and ERCOT move forward on these changes as expeditiously as possible. The physical separation of the Texas Interconnection should not create an intellectual isolation of the ERCOT grid, precluding sound, proven market enhancements and best practices from improving the ERCOT wholesale electricity market. The benefits associated with improved incentives for desired market participant behavior are self-evident and should be available to all ERCOT market participants. Unfortunately, only some of these benefits can be quantified, such as the short-term production cost savings of improving the real-time dispatch. However, while these benefits are likely to justify the move to RTC by themselves, they do include the wider array of benefits discussed above involving improving the commitment of resources and improving investment and retirement decisions.

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2 ERCOT's Proposed Plan for Conducting Benefits Analyses at 3 (Dec. 7, 2017).

In order to estimate the quantifiable portion of the benefits of RTC, the Commissioners requested that ERCOT collaborate with Staff and the IMM to execute the joint proposed work plan to assess the benefits of the implementation of RTC in the ERCOT wholesale electricity market at the Commission's December 14, 2017 Open Meeting. This plan involves using market simulation software developed by the IMM.[3] The IMM appreciates the opportunity to work with Staff and ERCOT to further quantify and validate the benefits of RTC and report the findings back to the Commission and the market participants.

B. Marginal Losses

The IMM continues to recommend implementation of marginal losses in the ERCOT wholesale electricity market. When electricity is produced in one location and consumed at another location, the electricity flows through the transmission system and will cause transmission congestion and transmission losses, both of which should be recognized and priced. Currently, ERCOT efficiently manages and prices congestion, but effectively ignores transmission losses.

Transmission losses vary depending on the distance the electricity is traveling and the voltage of the lines it must flow over. Ideally, the real-time dispatch model should recognize the marginal losses that will result from dispatching units in different locations and set prices accordingly. Recognizing marginal losses will allow the real-time market to produce more from a higher-cost generator located electrically closer to the load, thus resulting in fewer losses. Optimizing this trade-off in the real-time dispatch lowers the overall costs of satisfying the system's needs.

The ERCOT market is unique in its treatment of transmission losses. Marginal losses are not included in ERCOT real-time energy prices and the costs of losses are collected from loads on

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[3] ERCOT's Proposed Plan for Conducting Benefits Analyses at 2-4.

an average basis. This approach may have been reasonable at the time ERCOT was implementing its initial real-time energy markets because generators were relatively close to load centers. However, as open access transmission expansion policies and other factors have led to a wider dispersion of the generation fleet, the failure to recognize marginal losses in the real-time dispatch and pricing has led to dispatch inefficiencies and price distortions. Therefore, we have been recommending that the ERCOT upgrade its real-time market to recognize marginal losses in its dispatch and prices. [4]

Accompanying this change, a revenue allocation methodology will need to be developed because marginal loss pricing results in the collection of more payments for losses than the aggregate cost of losses. This occurs because the marginal losses are always larger than the average losses (i.e., losses increase as more power flows over the transmission system). Most other regional transmission organization ("RTOs") in the U.S. recognize marginal losses and may provide examples of allocation approaches that could be used in ERCOT. We would also note that the allocation methodology could allow the Commission to mitigate some of the perceived inequities of transitioning to marginal losses at this time.

In addition to approving the work plan for the RTC benefits analysis, the Commissioners also requested a new and independent benefits assessment of marginal losses at the Commission's December 14, 2017 Open Meeting. First Solar Inc., Vistra Energy Corp., and the Wind Coalition hired the Brattle Group to perform their own independent analysis of the potential impacts of implementing a marginal loss methodology for pricing and dispatching generation in ERCOT, as proposed by NRG and Calpine in the FTI Paper,[5] and filed their findings on October 12, 2017.

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4 2016 State of the Market Report for the ERCOT Electricity Markets at xxvii.

5 Priorities for the Evolution of an Energy-Only Electricity Market Design in ERCOT at 41, FTI Consulting, Inc. (May 22, 2017) (FTI Paper).

Even that study's most conservative estimates showed that $8.6 million in annual production cost savings would likely be realized in ERCOT through implementation of a marginal loss component.[6] The IMM looks forward to supporting ERCOT's effort to conduct its own benefits analysis and expects the production costs savings to be no less than those already acknowledged by marginal losses' most fierce opponents.

Finally, the IMM views marginal losses as similar to congestion pricing. Open access to transmission does not guarantee access to the same price. Energy produced or consumed at different locations has different value because of transmission congestion and transmission losses. Not only are the physics behind a marginal loss component uncontroverted, but the Brattle Group's study shows that using marginal losses is economically justified because the production costs savings offset the costs of the project.[7]

C. Vistra Energy's Thermal Adder Proposal

Vistra Energy urges the Commission to consider addressing the ability of Locational Marginal Prices (LMPs) to reflect the cost of traditional thermal resources needed to serve load.[8] According to Vistra Energy, pricing reform in ERCOT should address the perceived occurrence of negative and depressed prices when renewable resources are the marginal unit, even when at the same time, traditional resources are needed to serve load.[9] Vistra Energy claims that this occurs because thermal units are dispatched at minimum levels, and the low sustained limit (LSL) energy of those units does not contribute to price formation.[10] Thus, Vistra Energy argues that the LMP

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6 Analysis of Marginal Losses Proposal at 1 (Oct. 12, 2017).

7 ERCOT'S Second Report in Response to Commission Staff's Request at 4-9 (Sept. 29, 2017).

8 Vistra Energy's Comments and Alternative Proposals at 3 (Sept. 29, 2017) (Comments and Alternative Proposals).

9 *Id.* at 3-4.

10 *Id.* at 4.

is set by the offer of a renewable resource and fails to reflect the cost of the thermal unit that is operating at its minimum.[11]

To address this alleged issue, Vistra Energy proposes the creation of a price adder on the real-time price during intervals where dispatchable thermal resources are needed to serve load, but are not price-setting. Such an adder, Vistra Energy argues, would be calculated based on the highest cost traditional resource whose minimum output is needed to serve load in any affected interval. According to Vistra Energy, creating a price adder would allow the LMP to reflect those costs to serve load that today are masked by the SCED optimization that treats all LSL capacity as price taking. Vistra Energy further proposes that such an adder be paid only to those thermal resources whose LSL is needed to serve load, both to minimize the cost of the adder to loads and to avoid creating an incentive for unnecessary flexible thermal generation to stay online when it is not cost effective. Vistra Energy recommends that the adder should not be paid to renewable resources because they are already compensated in the form of their federal subsidies, and paying the adder would exacerbate, rather than address and resolve, the price distortions caused by their negative offers.[12]

Vistra Energy's alternative proposal is not just or reasonable. Rather, it is self-serving and inconsistent with the economic fundamentals underlying efficient LMP markets. As described below, Vistra Energy's proposal would: (1) subvert the foundational tenets of least-cost dispatch, (2) inappropriately embed the sunk costs of long-lead-time resources into the LMP, and (3) introduce myriad disruptive and inefficient incentives into the market, together critically undermining pricing and dispatch of the wholesale electricity markets. Hence, the IMM strongly

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11 Comments and Alternative Proposals at 4.

12 *Id.*

recommends that the Commission reject Vistra Energy's alternative proposal and focus instead on sound price formation improvements like RTC and marginal losses.

1. Vistra Energy's proposal undermines least-cost pricing and dispatch

The design of efficient wholesale electricity markets is founded on the fundamental economic principle that competitive markets will establish clearing prices that reflect the marginal cost of satisfying the system's needs. Hence, the LMP at every location in ERCOT is intended to reflect the marginal cost of serving the next increment of load at that location, given network losses and constraints. This is economically sound because it aligns the incentives of suppliers, consumers and the system operator. Vistra Energy's pricing proposal abandons this fundamental economic principle by establishing a self-serving price adder that departs from marginal costs and will provide inefficient incentives to ERCOT's generators.

2. Vistra Energy's proposal unjustly incorporates sunk costs into LMP

Marginal costs can be defined as *the additional cost incurred to produce additional output.* Most units are committed well in advance, particularly baseload units that may be been started days in advance of the current real-time interval. The start-up and minimum generation costs of these units 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. The Vistra Energy proposal disregards the difference between the marginal cost of a fast starting unit and units with longer start up times, coal units for instance. The start-up costs of fast-start units are marginal costs because they are incurred in the real-time dispatch timeframe, unlike baseload and intermediate resources that must made the decision to start long in advance of the real-time dispatch. Hence, the start-up costs for these latter classes of

generators are not marginal in any dispatch interval and it would, therefore, be inappropriate for those costs to be included in ERCOT's LMPs.

Fast-start resources that can be started quickly (e.g., within 10 minutes) are fundamentally different than most other resources. 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 RTO 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 fast starting resources do 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 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.

3. Vistra Energy's proposal creates inappropriate incentives

Finally, a thermal adder would create perverse incentives to provide inaccurate physical offer parameters, including the low sustained limit (LSL). The LSL is a parameter that unit owners determine individually, which limits ERCOT's ability to instruct resources to produce less energy. The thermal adder would likely incite unit owners to inflate their LSL levels to increase their revenues when the system is over-supplied. Contrary to Vistra Energy's assertion of the baseload energy being needed, a negative or zero price indicates that no more energy is needed and, in fact, that ERCOT needs resources to produce less energy. Hence, well-designed LMP markets set a price of zero or less than zero to provide an efficient incentive for generators to produce less

energy. The adder as proposed by Vistra Energy would disrupt this incentive by making it profitable for low-cost resources (with marginal costs less than the LMP plus the adder) to increase their output. One of the primary means to accomplish this is for a generator to inflate its LSL parameter.

For all of these reasons, we find Vistra Energy's alternative thermal adder proposal to be without merit and unreasonable. Therefore, we encourage the Commission to disregard this proposal.

D. Market Power Mitigation and Local Price Formation

The IMM is well-versed not only in the efficient operations of an energy only market, but also the subtle nuances of market power mitigation that apparently escape even some sophisticated market participants. The FTI Paper correctly points out that the objective of market power mitigation to ensure market outcomes that are "compatible with the basic efficient real-time and day-ahead wholesale markets."[13] Determining the appropriate triggers for imposing market power mitigation can be difficult, but the goal is and should always be to ensure that market power is precluded at times and in locations where competition is not robust in order to ensure that prices and other market outcomes are competitive. This is the construct under which ERCOT's current mitigation rules were established.

Hogan-Pope argue in the FTI Paper that the local market power mitigation rules interfere with the ability of the ERCOT to price shortages in transmission constrained areas. In particular, they note that units committed through the RUC are treated differently under ERCOT's mitigation rules if they are relieving a "non-competitive" constraint.[14] If they are in a competitive area, the

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13 FTI Paper at 10.

14 *Id.* at 52.

RUC unit's offer is set to $1500 in an attempt to negate the price effects of ERCOT starting the unit. If they are in a non-competitive area, the offer is mitigated to a competitive offer level. Hogan-Pope argue that this prevents the pricing of local shortages.[15] Essentially, they are arguing that if a non-competitive constraint would have been overloaded without the RUC action by ERCOT, it is efficient to set prices in the load pocket with congestion that reflects the overload. We disagree with this for two reasons.

First, the local area is not in shortage in this case. In general, these RUC commitments are efficient if they are preventing transmission overloads and, therefore, the RUC units should be reflected in the congestion and LMPs at their competitive level;

Second, were the Commission to change this mitigation rule, it would incent suppliers with local market power to withhold their resources. Today, such resources would be committed through the RUC process and mitigated, preventing such suppliers from creating artificial local shortages. Ultimately, this helps ensure that the generation owned by suppliers with local market power will be available at competitive prices, either through self-commitment or through the RUC process. Therefore, we do not believe that the mitigation measures should be relaxed for units committed to manage non-competitive constraints.

However, we do agree that there are local price formation issues that ERCOT should address over time:

- The commitment costs of fast-start units committed to manage transmission constraints in ERCOT should be reflected in ERCOT's LMPs. As discussed in our comments on the Vistra Energy proposal, the commitment costs of fast-start units are marginal costs.

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15 FTI Paper at 52.

- ERCOT should have a means to price local capacity shortages in a manner that is analogous to the pricing of system-wide shortages under the ORDC.

We have recommended that ERCOT address the first price formation issue by introducing fast-start pricing rules, sometimes referred to as extended LMP or "ELMP".[16] Other RTO's have addressed this issue by implementing such fast-start pricing models.[17] FERC has endorsed these pricing rules and proposed that all RTOs adopt them.[18] Such rules would address the Hogan-Pope concerns because they would allow the full costs of the RUC action to be reflected in LMPs to the extent that the actions were necessary. If this change is made, the IMM suggests the ability for market participants to 'Opt-Out' of RUC decisions should be evaluated for elimination.

To address the second issue, we have recommended that ERCOT evaluate the need for a local reserve product.[19] A substantial component of these economic signals is the prices and revenues generated in shortage conditions. ERCOT's ORDC establishes shortage pricing ERCOT-wide, but does not allow for shortage pricing in local areas. Therefore, ERCOT's current market design may support adequate resources in aggregate, but may not support adequate resource in some local areas.

It is common in other markets to plan and operate the system to be able to maintain reliability in a local area even after the two largest contingencies occur (transmission or generation outages). This is one of the most common reasons that a unit may be deemed needed for reliability and given a reliability must-run ("RMR") contract. In ERCOT's energy-only market, the primary means to ensure that sufficient revenues are provided to satisfy both the market-wide and local

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16 IMM Comments at 6 (Sept. 15, 2017).

17 Including ISO New England, New York ISO, and the Midcontinent ISO.

18 See the Notice of Proposed Rulemaking in RM17-3 (December 2016).

19 2016 State of the Market Report for the ERCOT Electricity Markets at xxvi.

resource adequacy needs is to strive for alignment between ERCOT's operating requirements and its planning requirements. In other words, if having sufficient resources to respond to the two largest contingencies is a reasonable planning requirement, it is also likely a reasonable operating requirement. Other RTO's include this requirement in their operating reserve markets by establishing a separate local reserve product. The advantage of defining such an ancillary service product in ERCOT is that it would allow the real-time energy and reserve markets to price local reserve shortages and provide the revenues necessary to satisfy local capacity needs. In doing so, it should eliminate the need to sign out-of-market RMR contracts. Hence, our recommendation in this area is consistent with the comparable recommendation in the FTI Paper.

III. CONCLUSION

The IMM is encouraged and strongly supports the Commission's interest in ERCOT's price formation issues. We continue to recommend RTC as the highest priority improvement for ERCOT because it would not only improve ERCOTs real-time prices, but also lower costs in the short-term commitment and dispatch of the system and over the long-term through improved investment and retirement decisions. RTC will also improve ERCOT's shortage pricing and ensure that shortages are only priced when ERCOT's resources have been fully utilized. This will be increasingly important given the eminent supply reductions.

Looking toward 2018, market conditions will likely be in stark contrast to conditions over the past few years. The surplus conditions in recent years have led to relatively low revenues for suppliers. Predictably, Luminant filed NSOs on in October 2017 stating its intent to permanently retire 4,273 MW of coal unit capacity in the first quarter of 2018. This indicates that the fundamental market design in ERCOT is working. In response to low market prices, older,

economically-distressed units should be expected to retire, moving the system toward a sustainable long-term equilibrium between supply and demand.

As the supply margins shrink,[20] the likelihood of sustained high prices will be much greater in 2018. Tighter reserves should lead to an expectation of higher prices and more frequent shortages. Confidence in the reliance on shortage pricing would be higher when reserves and energy are co-optimized because RTC will ensure that shortage pricing will only occur when the system has been dispatched optimally and cannot satisfy all of its requirements. Therefore, as the system transitions to this new equilibrium, it is an ideal time to implement key price formation improvements, including particularly RTC and marginal loss pricing. This changes will likely achieve sizable savings for ERCOT's consumers in the face of rising prices.

At the same, we recommend that the Commission reject unsound price formation proposals made by Vistra Energy and the recommendation to modify ERCOT's market power mitigation rules made by Hogan and Pope.

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[20] Capacity Demand Reserve Report (December 18, 2017).

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