Paul Hudson
Chairman

Julie Caruthers Parsley
Commissioner

Barry T. Smitherman
Commissioner

W. Lane Lanford
Executive Director

Public Utility Commission of Texas

To: Chairman Paul Hudson
Commissioner Julie Caruthers Parsley
Commissioner Barry T. Smitherman

From: Brian H. Lloyd
Special Projects Manager

Through: W. Lane Lanford
Executive Director

Date: March 12, 2007

Re: **Project No. 32125**; *Investigation by the Independent Market Monitor of the Wholesale Market Activities of TXU From June 1 to September 30, 2005*

As you will recall, the PUC Staff, in conjunction with the Independent Market Monitor ("IMM"), opened an investigation into the wholesale market activities of TXU in early September 2006. The investigation was initiated as a result of several concerns raised in the 2005 State of the Market Report for the ERCOT Wholesale Electricity Markets ("SOM Report") regarding the bidding behavior of TXU during the summer of 2005.[1] The SOM Report did not analyze the effect of TXU's activities on balancing energy market prices, and as such, did not draw definitive conclusions about whether or not TXU's behavior constituted market power abuse or any other violation of law.

The IMM has competed the more thorough and detailed investigation into the concerns that were raised in the SOM Report and has provided its final investigation report to the Commission.

The IMM's Investigation Report concludes that TXU's bidding behavior during the peak usage hours in the summer of 2005 ("the Study Period") was not competitive and increased balancing energy prices by an average of 15.5%. The IMM found that TXU's behavior increased the costs to purchasers of balancing energy by approximately $70 million during the Study Period and that TXU earned approximately $19.6 million more profit during the Study Period than TXU would have if TXU had bid in a competitive manner. Because TXU had the ability and incentive to raise prices, the IMM concluded that TXU had market power in the balancing energy market. Since TXU, in fact, raised prices in the market and profited

[1] The SOM Report had been prepared by Potomac Economics as part of a contract with the PUC for wholesale electric market monitoring services. Potomac Economics has since been retained by the PUC as the IMM for the ERCOT region pursuant to Public Utility Regulatory Act Section 39.1515.

from its activities, the IMM concluded that TXU's behavior constitutes market power abuse. The IMM also notes that TXU's behavior would tend to increase prices in other wholesale and retail markets, although those effects are not easily quantifiable.

Commission Staff has reviewed the IMM's Investigation Report and will expeditiously evaluate the appropriate penalty or other remedy for TXU's actions, including the filing of a Notice of Violation by the Executive Director to recommend the assessment of administrative penalties pursuant to PUC Procedural Rule 22.246. As you are aware, that process will provide TXU an opportunity to decide whether to accept the determination and recommended penalty or to request a hearing before the State Office of Administrative Hearings to contest the occurrence of the alleged violation, the recommended penalty, or both the occurrence of the violation and the recommended penalty. TXU also will have the option to request a settlement conference.

Because of the level of interest that this matter has generated, I believe it is in the public interest to release the report now instead of waiting for the full development of a Notice of Violation, which may take some time. Accordingly, the Staff is releasing a public version of the report that is redacted. The only information that has been redacted is certain unit-specific information concerning some of TXU's generating plants. This information is considered by TXU to be confidential trade secret information, the release of which may cause competitive harm to TXU. Staff does not believe that the withholding of this information impacts the ability of the public to review and understand the analysis presented in the report.

As you will ultimately decide whether or not you agree with the IMM's findings on the alleged violation and Commission Staff's recommendations on penalties, the Commission Staff involved in the prosecution of the Notice of Violation and the IMM will not be discussing this matter with you privately. However, should you desire a report regarding this matter at an upcoming Open Meeting, please have your staff so inform me, and I will see that it is placed on the agenda.

POTOMAC ECONOMICS

INVESTIGATION OF THE WHOLESALE MARKET ACTIVITIES OF TXU FROM JUNE 1 TO SEPTEMBER 30, 2005

POTOMAC ECONOMICS, LTD.

ERCOT Independent Market Monitor

March 2007

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

INTRODUCTION

Competitive wholesale electricity markets promise substantial benefits. Based on the results of the analysis of the ERCOT market in the annual State of the Market Reports ("SOM Reports"), the market in ERCOT has generally produced competitive results. These benefits promise to increase when the improved nodal market design is implemented in December 2008 that will provide better incentives to market participants, facilitate more efficient commitment and dispatch of generation, and improve ERCOT's operational control of the system. However, the 2005 SOM Report identified a potential competitive concern in its analysis of the competitive performance of the ERCOT market.[1]

The evaluation in the 2005 SOM Report examined the competitive structure of the ERCOT market using a pivotal supplier analysis, which indicates when a supplier may have market power because its resources are needed to satisfy the demands in the market. This analysis indicated that the two largest suppliers in ERCOT were frequently pivotal in 2005. The analysis also showed that the frequency with which a supplier was pivotal increased with the level of demand.

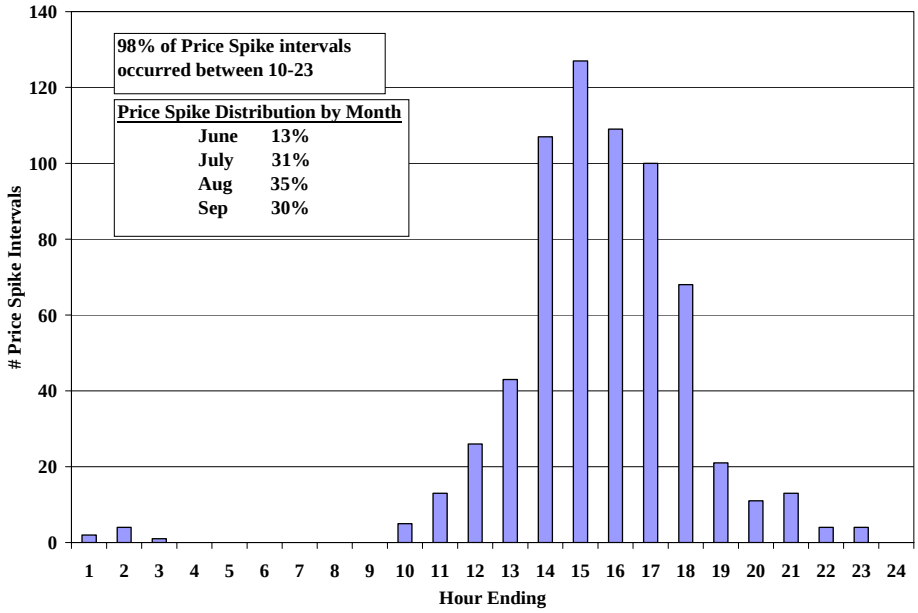
The 2005 SOM Report also analyzed the competitive performance of the market by evaluating the conduct of the suppliers to identify the potential magnitude of any physical or economic withholding. The results of the analysis of competitive performance in the 2005 SOM Report raised significant concerns regarding potential economic withholding by TXU (referred to as "Company C" in Section V of the 2005 SOM Report); however, the report did not include a full investigation of this conduct or an analysis of its impact on balancing energy prices.

At the request of the Public Utility Commission of Texas, we prepared this report to provide a more detailed assessment of whether TXU abused market power in the real-time balancing energy market during the period from June through September 2005 by raising its balancing energy offer prices.

[1] 2005 ERCOT State of the Market Report, Chapter V.

There were 657 price spike intervals from June 1 through September 30, 2005.[2] As shown in Figure 1, almost all of the price spike intervals occurred during the hours 10 to 23. Two-thirds of the price spike intervals occurred during the months of July and August. Based upon these data and the prior information presented in Chapter V of the 2005 SOM Report, the Study Period for the economic analysis in this report is defined as all hours from 10 to 23 from June 1 through September 30, 2005, which includes 6,344 15-minute operating intervals.

Figure 1 – Price Spike Intervals (June 1 – September 30, 2005)



During the Study Period, TXU offered significant quantities of Up Balancing Energy Service ("UBES") at prices well in excess of its short-run marginal cost ("SRMC").[3] TXU was a pivotal supplier in approximately 554 of the 657 (84.3%) price spike intervals from June through September 2005. A pivotal supplier is likely to have market power

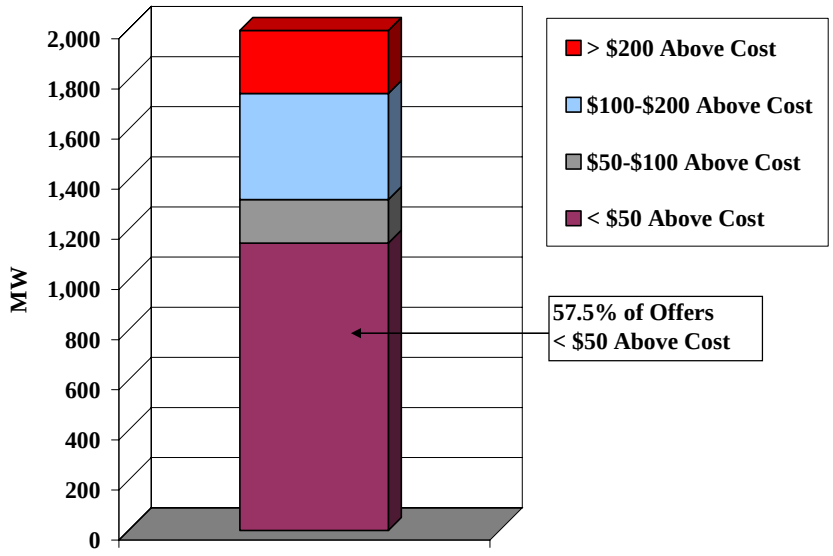
[2] For the purpose of this report, price spike intervals are defined as intervals where the Market Clearing Price of Energy (MCPE) in one or more zones exceeded 20 times the natural gas price index. We chose this level because prices higher than this level exceed the competitive offer prices of most generating resources. Although the price spike intervals are used in this report to present various summary statistics, the Study Period includes all hours from 10 to 23 from June 1 through September 30, 2005.

[3] *See* 2005 SOM Report, Figure 76. The generic costs for up balancing energy contained in the ERCOT Protocols are used as an approximation of short-run marginal cost for each generating unit.

because the demand in the wholesale market cannot be satisfied without the resources owned or controlled by the pivotal supplier.

This report focuses on the conduct of TXU due to the significant quantities of UBES offered at prices well in excess of its SRMC and the frequency with which TXU was a pivotal supplier in the balancing energy market during price spike intervals. Figure 2 shows the average quantity of the available UBES offers for TXU relative to generic marginal costs during the price spike intervals from June through September 2005. The average offer quantities are divided into price bands to illustrate the relative magnitude of the departure of TXU's balancing energy offer prices from the SRMC of its generating units.

Figure 2 – TXU Average Dispatchable Offers in Price Spike Intervals
June 1 – September 30, 2005



TXU's offer patterns during the Study Period were a continuation of an offer strategy that TXU first implemented in late 2004, which it calls its Rational Bidding Strategy (RBS). However, key differences between 2004 and 2005 are that in 2005, the RBS (i) involved a larger share of TXU's portfolio, (ii) was sustained for a longer period of time, and (iii) occurred during periods of higher systems demands. Based on our analysis of all of the intervals during the Study Period, we make the following findings in this report:

- TXU had the ability to substantially increase balancing energy prices.
  - TXU's ability to raise prices is highest when it is "pivotal", i.e., its balancing energy offers are necessary to satisfy the balancing energy demand.
  - Given the frequency with which TXU is pivotal, and the historical information available to TXU on offer patterns and deployments in the balancing energy market, TXU could foresee that economically withholding significant quantities would be likely to result in higher balancing market prices.
- TXU was a substantial net seller in the balancing energy market during the Study Period, which provided it the incentive to raise prices.
- The offers that TXU submitted under its RBS strategy were not competitive and contributed to a significant increase in balancing energy prices during the Study Period. This increase in prices was inefficient and did not reflect underlying market fundamentals.
- By replacing TXU's high-priced RBS offers with competitively-priced offers, we estimate that the increase in TXU's offer prices above competitive levels raised:
  - the average MCPE for all intervals in the Study Period by 15.5 percent; and
  - net payments by balancing energy purchasers by approximately $70 million.
- Had TXU offered its online units at competitive price levels during the Study Period, it would have generated approximately 513,000 MWh of additional energy in the balancing market at prices in excess of its short run marginal cost. Hence, TXU's use of the RBS constituted economic withholding of production.
- TXU's net balancing market profits were approximately $19.6 million greater than the profit that would have been earned had TXU not employed its RBS and, instead, offered its online units at competitive prices.

Based upon these results, we conclude that TXU's actions constituted an abuse of market power in the balancing energy market during the Study Period.

Section I of this report provides a description of the ERCOT balancing energy market. Section II defines the relevant market and provides a competitive assessment of the ERCOT market during the Study Period. Section III assesses TXU's balancing energy offers. It also quantifies the impact on the market and the profitability for TXU associated with TXU's conduct during the Study Period. Section IV summarizes the findings in the report and provides our conclusions regarding the abuse of market power by TXU during the Study Period.

I. DESCRIPTION OF THE BALANCING ENERGY MARKET

Wholesale market participants within the ERCOT footprint with obligations to serve retail load arrange approximately 95 percent of their energy needs outside ERCOT's balancing energy market on average. However, balancing energy often serves greater than 10 percent of aggregate demand, particularly during periods of peak demand. Market participants either self-supply from their own generation assets or engage in bilateral contracts to purchase energy to serve their load. Based on these arrangements, participants submit generation and load schedules to ERCOT, which runs a balancing energy auction every 15 minutes to ensure that actual generation and load are balanced in real-time. When real-time demand exceeds energy scheduled prior to the auction, the difference is satisfied in the balancing energy market as additional supply is purchased at the market clearing price to serve the remaining demand. Conversely, when energy scheduled prior to the auction exceeds real-time demand, the system is balanced by allowing suppliers to purchase back a portion of their energy schedule at the market clearing price.

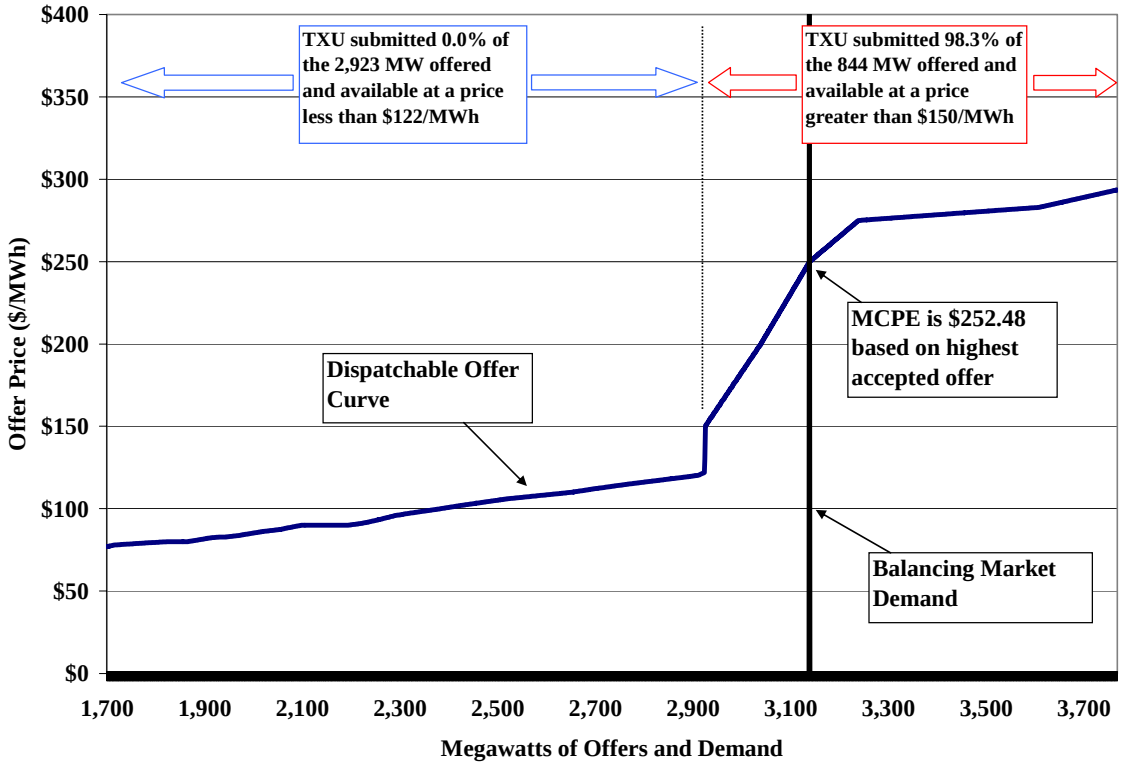
Prior to the balancing energy market auction, suppliers submit offers to increase or decrease production relative to their energy schedules. For instance, a supplier may offer to increase production 30 MW relative to its energy schedule if the price is at or above $60/MWh and decrease 50 MW if the price is at or below $40/MWh. Balancing energy market demand is equal to forecasted real-time load minus energy scheduled prior to real-time.[4] ERCOT clears the auction by determining the lowest-priced supply offers necessary to meet balancing energy market demand and manage interzonal congestion. Through this process, the balancing energy market governs real-time dispatch of generation. The Market Clearing Price for Energy ("MCPE") in the balancing energy market, absent congestion, is equal to the most expensive accepted offer price. All purchases and sales in the balancing energy market settle at the MCPE. Although a relatively small share of all energy in ERCOT is settled through the balancing energy

[4] ERCOT can adjust the real-time load forecast to account for certain factors, such as the deviations between generators' scheduled output and actual output.

market, balancing energy prices provide a vital signal regarding the value of power that affects the pricing of forward electricity contracts.

Figure 3 provides an example of how the balancing energy market is cleared by taking the lowest-priced supply offers to meet balancing energy market demand. Prior to the interval-ending at 12:00 p.m. on July 11, 2005, ERCOT received 3,768 MW of dispatchable offers to serve 3,138 MW of balancing energy market demand. The supply offers are stacked in economic merit order and intersect the quantity of balancing energy market demand at 3,138 MW, as shown in Figure 3. The offer curve includes 844 MW of offers between $150/MWh and $295/MWh, all but 14 MW of which were offered by TXU. None of the over 2,900 MW of offers priced below $150/MWh were submitted by TXU.

Figure 3 – Dispatchable Offers and Balancing Energy Market Demand
Interval Ending 12:00 p.m. on July 11, 2005

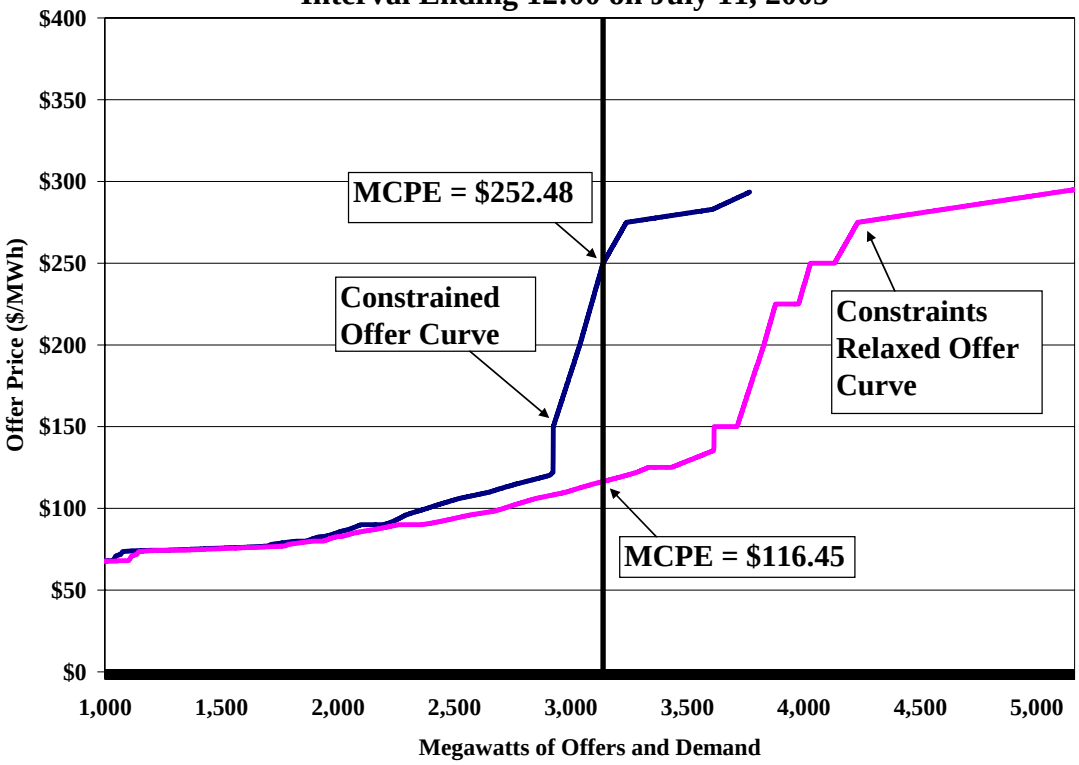


For a balancing energy offer to be dispatchable, several criteria must be met. First, the supplier must have sufficient available capacity. Available capacity includes unused capacity on on-line generators or qualified quick-start resources (as flagged in the

supplier's resource plan). Second, the available capacity must not be on generators that are constrained down due to transmission constraints. Third, the available capacity is limited by how quickly the production from the supplier's portfolio can increase or decrease, which is governed by the ramp rate submitted by the supplier. The supply stack in Figure 3 appropriately includes only dispatchable balancing energy offers. However, Figure 4 shows that ramp rate limitations and transmission constraints can have a significant impact on outcomes in the balancing energy market.

Figure 4 shows two supply stacks based on dispatchable offers for interval-ending 12:00 on July 11 with: (1) ramp rate limitations and transmission constraints included, and (2) both ramp rate limitations and transmission constraints relaxed.

Figure 4 – Impact of Ramp Rate and Transmission Constraints on Offers Interval Ending 12:00 on July 11, 2005



The supply stack comprised of dispatchable balancing energy offers is identical to the one shown in the previous figure and intersects with 3,138 MW of balancing energy market demand at an MCPE of $252/MWh. If the effect of ramp rates and transmission congestion are ignored, allowing all available offered on-line and qualified quick start

capacity to be used, more than 900 MW of less expensive offers would be available, resulting in an MCPE of $116/MWh. As this analysis demonstrates, outcomes in the balancing energy market depend on the available supply, which is diminished by operational factors that cannot be ignored, such as transmission constraints and ramp rate limitations.

II. MARKET DEFINITION AND COMPETITIVE ANALYSIS

This section provides a competitive analysis of the ERCOT market during the high-priced intervals. This includes a determination of whether the high prices during these intervals were the result of actions by TXU that would constitute market power abuses. In late 2006, the Commission adopted Substantive Rule §25.504 which provides a definition of the term "market power."[5] However, during the Study Period, no such definition existed. Because neither PURA nor the Commission's Substantive Rules defined "market power" as applied to electricity markets in Texas during the Study Period, we have chosen to begin our analysis with a definition of "market power" that is often used in antitrust analysis. For the purposes of this investigation, we define market power as the ability for a market participant to profitably raise prices significantly above competitive levels.[6]

Under this proposed definition, there are two necessary conditions for a supplier to have market power. First, the supplier must have the *ability* to substantially raise prices. Whether a price increase is substantial depends on both the magnitude and duration of the increase. The similar market power definition used by the federal antitrust agencies holds that price increases are substantial if they can be sustained "for a significant period of time".[7] As discussed later, these agencies often investigate price increases as small as 5 percent, which is considered substantial if it is sustained. However, the potential price increases in electricity spot markets are much greater than in most other product markets.[8] Therefore, large price increases for much shorter periods can result in overall price effects that are substantial.

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5 The Commission's rule also defined "market power abuse," using the same definition as provided in the Public Utility Regulatory Act §39.157(a).

6 Our market power definition is consistent with the definition used by the Federal Energy Regulatory Commission ("FERC") in granting market-based rate authority to participants in wholesale electricity markets in other regions.

7 This is very similar to the definition employed by the U.S. Department of Justice and Federal Trade Commission (the "Antitrust Agencies"): "Market power to a seller is the ability profitably to maintain prices above competitive levels for a significant period of time." U.S. Department of Justice and Federal Trade Commission, Horizontal Merger Guidelines, (Merger Guidelines) reprinted at 4 Trade Reg. Rep. (CCH) ¶13,104, April 2, 1992, Section 0.1.

8 Price increases of up to 1000 percent are not unusual in electricity markets due to the inelasticity of

Second, a supplier must have the *incentive* to raise prices (i.e., it must be able to profit by increasing prices). Typically, this profit would be earned in the relevant market that is defined for analysis. However, the reference to market power abuse in the Public Utility Regulatory Act that is applicable in Texas supports a broader view of this incentive criterion:

> ". . .market power abuses are practices by persons possessing market power that are unreasonably discriminatory or tend to unreasonably restrict, impair, or reduce the level of competition, including practices that tie unregulated products or services to regulated products or services or unreasonably discriminate in the provision of regulated services. For purposes of this section, "market power abuses" include predatory pricing, withholding of production, precluding entry, and collusion. A violation of the code of conduct provided by Subsection (d) that materially impairs the ability of a person to compete in a competitive market shall be deemed to be an abuse of market power."[9]

This legislative standard implies that an additional incentive that may lead to a market power abuse finding may be associated with reducing competition in another market. This is implied by the reference in the standard to cross-market effects of conduct in regulated and unregulated markets. Because PURA is the applicable standard, we will also recognize this source of potential incentive in making our market power findings, although we have not specifically analyzed any cross-market effects in this report.

The first step in any market power analysis is to define the relevant market, which includes the definition of the relevant product and the relevant geographic market where the product is traded. The next two subsections define the relevant market.

A. Relevant Product Market

The relevant product includes all products that are good substitutes and, thus, would discipline a supplier attempting to withhold supply.[10] Electricity is physically homogeneous, so each megawatt of electricity is interchangeable even though the

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demand and the inability to store electricity economically.

9 PURA §39.157(a).

10 *Merger Guidelines*, Section 1.11.

characteristics of the generating units that produce the electricity vary substantially (*e.g.*, electricity from a coal-fired plant is substitutable with electricity from a nuclear power plant). Despite this physical homogeneity, the definition of the relevant product market is affected by the unique characteristics of electricity. For example, it is not generally economic to store electricity, so the market operator must continuously adjust suppliers' output to satisfy the demand in real time. This limits intertemporal substitution between spot and forward electricity markets.

In defining the relevant product market, we must identify the generating capacity that can produce the relevant product, *i.e.*, possible supplier responses. In this regard, we consider three categories of capacity: (i) available capacity offered in the balancing energy market, (ii) all other on-line resources and off-line quick start resources qualified to provide balancing energy, and (iii) all other off-line capacity. Every 15 minutes, ERCOT runs an auction to balance electricity supply and demand. When real-time demand differs from the quantity of energy scheduled prior to the auction, the difference is procured in the balancing energy market. Thus, generating capacity capable of being deployed in a 15-minute timeframe is fully substitutable with other supply in the balancing energy market. Most off-line capacity takes hours to start-up and produce electricity and, therefore, cannot exercise competitive discipline in the 15-minute timeframe applicable to the balancing energy market. Therefore, we do not include off-line capacity in this competitive analysis unless it is quick-start capacity qualified to provide balancing energy service.

Most on-line capacity and off-line quick start capacity is only capable of being partially deployed in a 15-minute timeframe such that some on-line and quick start supply is not fully available in the balancing energy market for any particular 15-minute interval. Even the capacity that is offered may not be available in each interval to the extent that it is constrained by ramp rate limits. Hence, these constraints must be recognized in the determination of the supply that is available to the balancing energy market in the 15-minute timeframe.

Additionally, it has been consistently observed historically that a sizable quantity of online capacity is not offered in the balancing energy market. The quantity of online capacity not offered in the balancing market in 2005 was addressed in detail in the 2005 State of the Market Report.[11] That analysis identifies various risks and barriers that contribute to on-line resources not being available to be deployed in the balancing energy market. The fact that these patterns are sustained and relatively consistent among various types and sizes of suppliers suggests that barriers exist that limit the amount of capacity available to compete in the balancing energy market. If barriers did not exist that caused participants to not offer certain apparently available energy into the balancing energy market (which would imply that un-offered energy is the result of strategic incentives), one would expect un-offered energy levels to vary greatly with market conditions and by type or size of supplier. However, un-offered energy levels have been relatively consistent across these variables. For these reasons, we exclude un-offered capacity from online units in this competitive analysis. Hence, only on-line dispatchable resources and qualified off-line quick-start resources that are offered in the balancing energy market can respond in a timely manner by increasing output.[12]

An additional aspect in defining the relevant product market is the identification of the potential for demand substitution, or possible demand responses. In the 15-minute dispatch timeframe, the only possible response available from demand that is consuming balancing energy is to choose to curtail its consumption. This is generally a costly and disruptive measure for a customer, and limited data exist that allow the amount of potential demand response that is economic at prices close to competitive levels to be measured. However, it is highly unlikely that large quantities of economic demand response exist that would substantially change the definition of the relevant market.

One sizable advantage of defining the market in this case is that we are studying events that have already occurred rather than prospectively evaluating potential market power

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11 2005 SOM Report, at 76-84.

12 Gas turbines that are not qualified to provide balancing energy service can often be physically brought online within 30 minutes. However, ERCOT scheduling timeframes introduce at least a 1 ½ to 2 hour delay into any potential response from units that are not scheduled.

concerns, such as in the case of a merger. One area where this is especially important is in the area of what supply (and demand response) should be included in the relevant market. Our conclusion that the relevant market excludes offline resources and demand response that is not offered in the balancing energy market is bolstered by the fact that the withholding and associated high prices occurred during the Study Period of this investigation. Hence, any response from these sources that are economic would presumably already have occurred and would, therefore, be embedded in the actual market outcomes.

Additionally, some may argue that loads that consume balancing energy have the ability to substitute forward contracts in place of balancing energy consumption in response to high prices. However, shifting to forward contracts can only be done with a lag, thereby precluding the use of this alternative to avoid higher balancing energy prices in the short-term. Aside from the issue of timing, it is neither reasonable nor practical to assume that forward contracts are an effective substitute for the balancing energy market to such a degree that the relevant product market definition should be expanded to include both. Retail Electric Providers do not have the ability to accurately predict the real-time consumption of their customers. Reasons for this include, but are not limited to, uncertainty in customer counts and types, load profiling applied by ERCOT, the allocation of unaccounted for energy, and uncertainty in consumption due to other unpredictable factors such as weather. Furthermore, the forward markets generally trade 25 to 50 MW block on-peak or off-peak products that do not allow one to accurately match the pattern of actual demand, thereby further hindering the ability to substitute between these products. Typically, approximately 90 to 95 percent of the demand is served through forward contracts. However, the remaining 5 to 10 percent of demand represents a significant portion of the total demand for which barriers exist for substituting between forward contracts and the balancing energy market. Lastly, the actual market outcomes also indicate that this substitution is not effective because loads continued to buy energy in the balancing market even after very high prices occurred during the Study Period.

For these reasons, we conclude that the balancing energy market is the relevant market for this investigation. On the supply side, this includes capacity that is offered in the balancing energy market from online resources, as well as energy that can be produced from qualified offline gas turbines that can be started quickly. On the demand side, this includes energy that is purchased in the balancing energy market.

B. Relevant Geographic Market

The second dimension of a market that must be defined is the geographic area in which suppliers compete to sell the relevant product, referred to as the relevant geographic market. In electricity markets, the relevant geographic market is generally defined by the transmission network constraints. In 2005, ERCOT was made up of five congestion management zones. When there are no limiting inter-zonal constraints, power can be freely transferred from sellers in one zone to buyers in another zone and the relevant geographic market is all of ERCOT.

When an inter-zonal constraint is binding, however, there are limits on the extent to which power can flow between zones. In these situations, a supplier with market power may face more limited competition from suppliers in other zones. During the Study Period that is the subject of this report, the South to Houston constraint was binding most frequently, followed by the South to North and North to Houston constraints. When any of these zonal constraints are binding, lower-cost resources in one or more areas are prevented from serving incremental load in other areas. For example, when the South to North constraint is binding, low-cost resources in the South and Houston zones are prevented from serving incremental load in the West, North, and Northeast zones.

To relieve local congestion, the market operator may reduce the output from resources that tend to overload the constrained transmission facility. This reduction will reduce the amount of capacity that can be offered in the balancing energy market. It is common that one or more resources are constrained down to relieve congestion on a local (intra-zonal) interface in a given operating interval. During periods with transmission constraints, the relevant geographic market includes only those regions where supply is not restricted from serving demand by either local or inter-zonal transmission limits.

C. Competitive Conditions in the Balancing Energy Market

In the prior two subsections, we define the relevant product as balancing energy and define the relevant geographic markets to include the generation located in areas that can serve load given any binding local or inter-zonal transmission constraints in each interval. These definitions will be relied upon in the analysis in the balance of this report.[13] This subsection of the report evaluates the competitive conditions during the Study Period. In particular, it assesses whether TXU had the ability to abuse market power in the balancing energy market during this period.

For other types of products, competitive evaluations rely heavily on analyses of market concentration, generally measured by the Herfindahl-Hirschman Index ("HHI"), which is used to measure market concentration. The HHI is calculated by summing the square of each participant's market share. Economists use this statistic to assess the overall competitive structure of the market, because highly concentrated markets tend to perform less competitively and are more vulnerable to market power abuses. The U.S. Department of Justice and the Federal Trade Commission evaluate the competitive impact of mergers by measuring the change in the HHI in the relevant market caused by the merger.

Although HHI statistics can provide reliable competitive inferences for many types of products, this is not generally the case in spot electricity markets such as the balancing energy market.[14] The HHI's usefulness is limited by the fact that it reflects only the supply-side, ignoring demand-side factors that affect the competitiveness of the market. The most important demand-side factor is the level of demand. Since electricity cannot

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[13] For convenience, we will refer to the defined market as the "balancing energy market" in the remainder of this report.

[14] It is true that the DOJ and FTC evaluate the *change* in HHI as part of a merger analysis. However, this is only a preliminary analysis that would typically be followed by a more rigorous simulation of the likely price effects of the merger. It is also important to note the HHI analysis employed by the Antitrust Agencies is not intended to determine whether a supplier has market power. Also, for an explanation regarding why HHI statistics may not provide reliable indications of market power in electricity markets, see Severin Borenstein, James B. Bushnell, and Christopher R. Knittel, "Market Power in Electricity Markets: Beyond Concentration Measures," *Energy Journal* 20(4), 1999, pp. 65-88.

be stored economically, production must match demand on a real-time basis. When demand rises, an increasing quantity of generating capacity is utilized to satisfy the demand, leaving less capacity that can respond by increasing output if a large supplier withholds resources. Hence, markets with higher resource margins tend to be more competitive, which is not recognized by the HHI statistics. In addition, the scope of the geographic market can change hour to hour as the loadings on the transmission network change. Hence, the competitiveness of the market is more dynamic than can be reflected in HHI statistics.

A more reliable means to evaluate the competitiveness of spot electricity markets and to recognize the dynamic nature of market power in these markets is to identify when one or more suppliers are "pivotal". A supplier is pivotal when the output of some of its resources is needed to meet demand in the market. A pivotal supplier has the ability to unilaterally raise the balancing energy market prices to arbitrarily high levels by offering its energy at a very high price level. Hence, the market may be subject to substantial market power abuse when one or more suppliers are pivotal and they have the incentive to take advantage of their position to raise prices. FERC has adopted a form of pivotal supplier test as an initial screen for market power in granting market-based rates.[15]

Even small suppliers can be pivotal for brief periods. For example, all suppliers are pivotal during periods of shortage. This does not mean that all suppliers should be deemed to have market power. As described above, suppliers must have both the *ability* and *incentive* to raise prices to be deemed to have market power. For a supplier to have the ability to substantially raise the balancing energy prices, it must be able to anticipate that it will likely be pivotal. In general, the more frequently a supplier is pivotal, the easier it will be for it to foresee circumstances when it can raise the clearing price. In addition, for its ability to raise prices to be considered substantial, the supplier must be pivotal frequently enough that the price increases in these periods will result in significantly higher average prices overall.

[15] The FERC test is called the "Supply Margin Assessment". For a description, see: Order On Rehearing And Modifying Interim Generation Market Power Analysis And Mitigation Policy, 107 FERC ¶ 61,018, April 14, 2004.

In the balancing energy market, only suppliers offering dispatchable on-line or qualified quick start capacity that is not already scheduled to provide energy or ancillary services can exercise competitive discipline on a supplier attempting to raise prices by withholding resources. Thus, the extent of competition depends on how much of the demand in the balancing energy market can be served by dispatchable offers from suppliers other than the largest suppliers.

To better understand TXU's pivotal position, Figures 5 through 8 show the balancing energy that must be served by TXU during price spike intervals in the months of June through September 2005. In these figures, the bars labeled "Residual UBES" show the total available UBES from all suppliers other than TXU, and the total amount of available UBES from TXU is labeled "TXU UBES." The line labeled "UBES Deployed" shows the total amount of UBES that ERCOT deployed to meet the market demand during each interval. TXU is pivotal in the balancing energy market in any interval when the UBES deployed is greater than Residual UBES (*i.e.*, when the UBES Deployed intersects in the portion of the TXU UBES, indicating that ERCOT was required to obtain UBES from TXU to meet the system demand).

Figure 5 – Pivotal Analysis of TXU During Price Spike Intervals (June 2005)

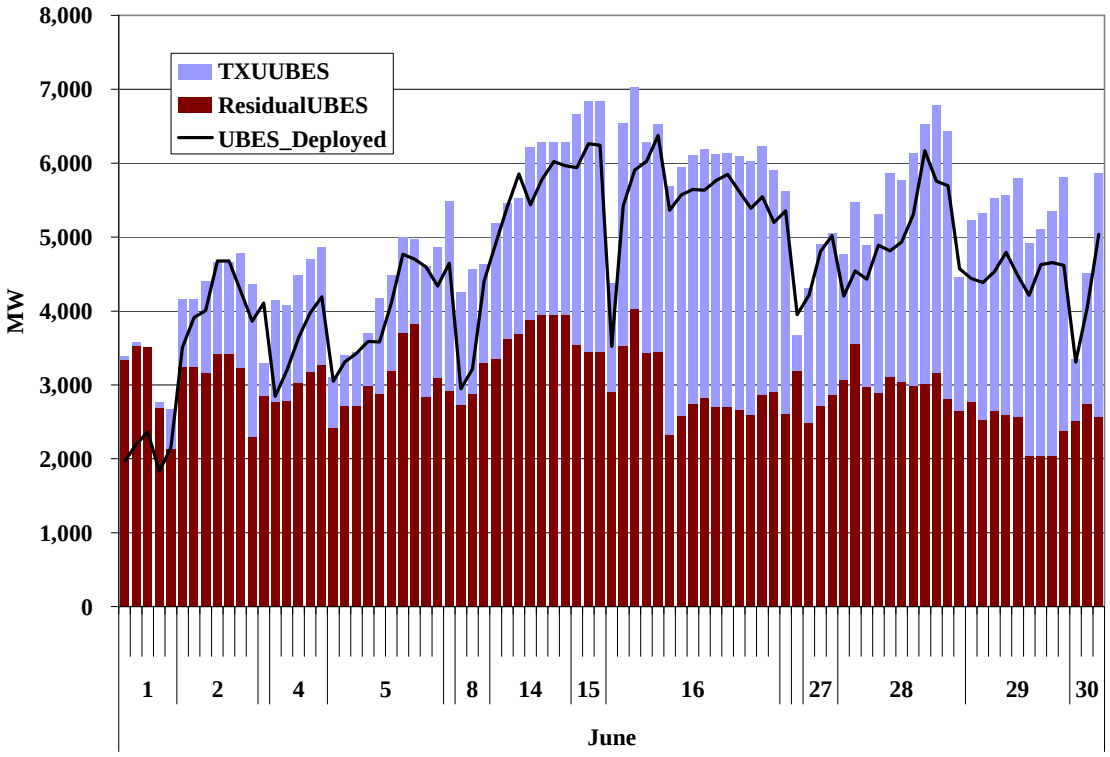


Figure 6 – Pivotal Analysis of TXU During Price Spike Intervals (July 2005)

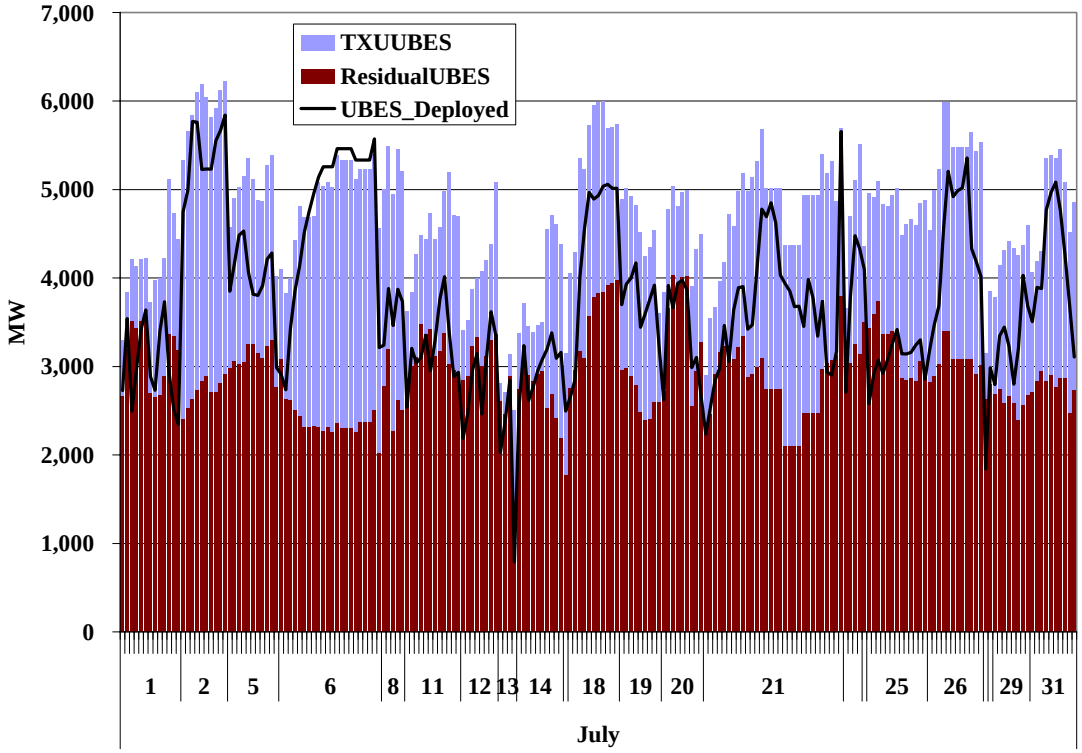


Figure 7 – Pivotal Analysis of TXU During Price Spike Intervals (Aug 2005)

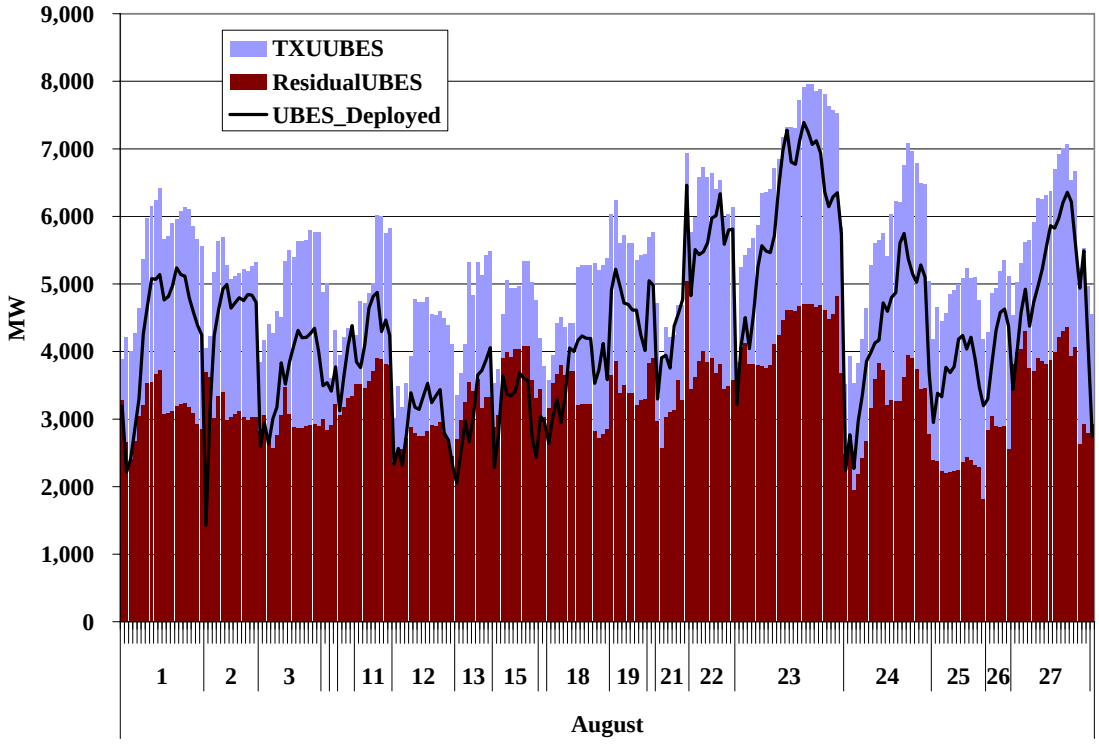
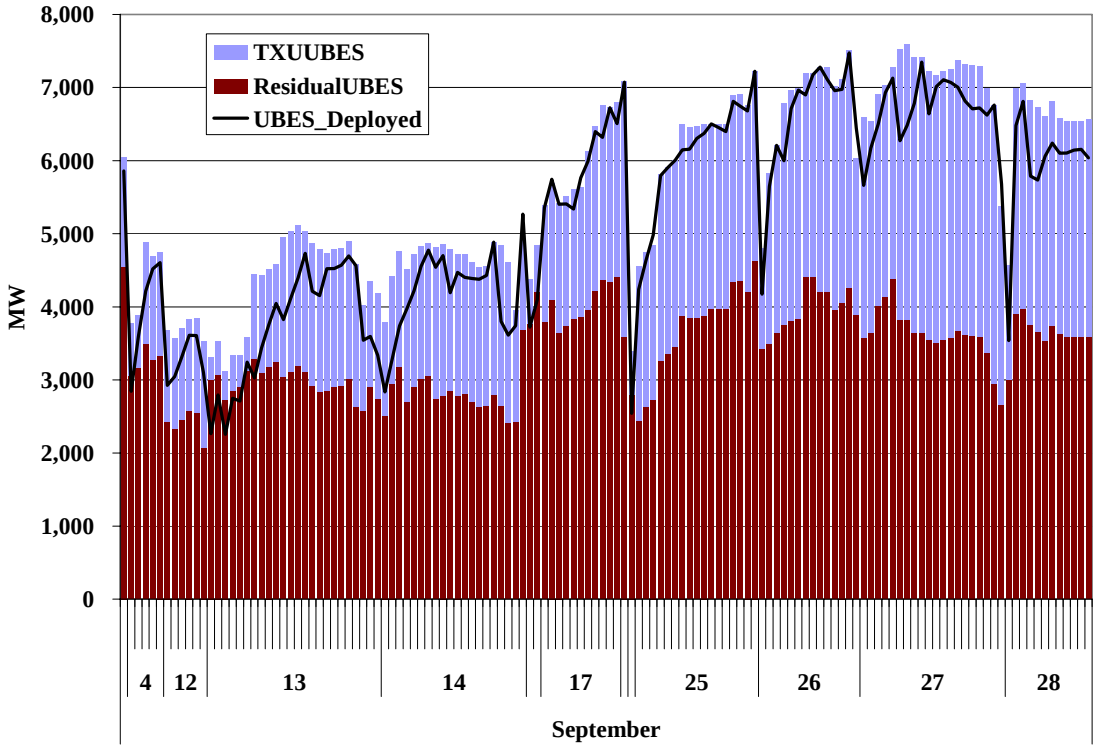


Figure 8 – Pivotal Analysis of TXU During Price Spike Intervals (Sep 2005)



While the results above do not indicate conclusively that TXU has market power, they do indicate that TXU had the *ability* to increase balancing energy prices significantly during the Study Period. In addition, this ability is foreseeable given the frequency with which TXU is pivotal and the historical information available to TXU regarding the balancing energy market demands and offers of rival suppliers. Hence, the following section provides an assessment of TXU's conduct and determines if it had the incentive to raise prices.

III. ASSESSMENT OF TXU OFFERS

This section of the report examines whether TXU's behavior during the Study Period is consistent with an attempt to exercise market power. Specifically, this section:

- Assesses whether TXU raised its balancing energy offer prices for its online resources above short-run marginal costs and whether there is a competitive justification for doing so.
- Investigates whether TXU withheld on-line capacity in a manner consistent with an exercise of market power.
- Measures the impact to consumers from these actions by TXU.
- Investigates whether TXU profited from actions that appear to be anticompetitive.

A. TXU's Balancing Energy Offers

This subsection of the report describes how a supplier without market power would offer its resources into the balancing energy market and assesses whether TXU has offered capacity to the balancing energy market in a competitive manner. We find that TXU's "Rational Bidding Strategy" is not consistent with competition, i.e., it would not be rational for a supplier without market power to engage in such a "Rational Bidding Strategy".

The Rational Bidding Strategy ("RBS") is a strategy which TXU claims results in "offer prices [that] are capped based on the lesser of a self-imposed regulatory offer cap or the full costs of owning, operating, and maintaining the generating units expected to be needed to satisfy the forecasted load."[16] This includes the initial investment costs and other fixed costs such as leasing arrangements for the gas turbines. While such reasoning may be appropriate in a cost-based regulated rate proceeding, it is incongruous with competition. In a competitive market, costs that have been incurred and cannot be reduced prospectively are "sunk" and should have no effect on the offers to produce energy from a resource. Both the investment costs and the costs associated with a leasing

[16] TXU response to Request for Information #1.

arrangement for a resource are sunk costs.[17] Therefore, when devising a profit-maximizing strategy for operating those units for a given period of time, there is no basis for an entity that is acting competitively to take into account sunk costs. Rather, a profit-maximizing strategy should be the same regardless of whether TXU won the units in a lottery or TXU paid a large sum to buy the units. Investment is inherently risky and not all investors recoup their initial sunk costs, but a profit-maximizing strategy is the same in the short-run regardless of whether the investment is profitable in the long-run. Thus, the sunk and other fixed costs are not relevant to the determination of a competitive offer.

ERCOT runs a uniform-price auction for balancing energy every 15 minutes where the highest priced accepted offer sets the clearing price for all transactions during each 15 minute period. In the absence of congestion, the only megawatt that directly affects the clearing price is the last one to be accepted. In this form of auction, a supplier whose offers have no effect on the market price has the incentive to submit offers at short-run marginal cost to ensure that its unit operates any time the supplier can realize market revenue that exceeds the unit's production costs. Hence, offering at marginal cost is profit-maximizing for a supplier in a perfectly competitive, well-functioning market. Raising the offer price above marginal cost, in the absence of market power, can only reduce the supplier's profits by causing the resource not to produce output when the price is higher than the incremental cost of producing the output.

In its response to discovery questions from the PUCT Staff in Project No. 30513, TXU confirms this logic when it describes circumstances where it is rational to offer gas turbines at short-run marginal cost:[18]

> In some periods, market conditions appear to make it reasonably unlikely that the units will be called upon with bids representing full costs. In these periods, it may not be economically efficient to bid at a price reflecting the full cost of owning, operating, and maintaining the unit, since no revenue at all will be received if the bid is not taken and, to some extent, any recovery of cost above short run marginal cost is better than no recovery.

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[17] The only exception would be a leasing arrangement that includes a variable cost component related to the quantity of output produced by the unit.

[18] *Staff Investigation into the Electric Wholesale Market Activities of TXU*, Project No. 30513, TXU response to request for information #1 (Dec. 22, 2004).

In other words, it is not rational for TXU to inflate its offer prices above short run marginal costs when it is likely that those inflated offers will not be struck and that the capacity will be idle, because TXU will give up profitable sales without a compensatory increase in the MCPE. Therefore, when TXU offers its capacity at well above short run marginal costs, TXU expects that its offer strategy will raise the MCPE enough to compensate it for any foregone sales. Given the frequency with which TXU is pivotal, and the historical information available to TXU on offer patterns and deployments in the balancing energy market, this is a reasonable expectation because TXU could foresee that economically withholding significant quantities would be likely to result in higher balancing market prices.

One way to show that TXU's "Rational Bidding Strategy" does not reflect a competitive offer strategy in principle is to evaluate whether this strategy would maximize profits assuming TXU's generating units were owned by many different suppliers.[19] For example, assume that each of TXUs generating units were owned and operated by a different supplier. In that example, if any one supplier had offered energy at hundreds of dollars per MWh above short-run marginal costs, the competing suppliers would undercut the supplier and it would earn no profit. Under these circumstances, each supplier would be compelled by competitive forces to offer its available energy at offer prices close to short-run marginal costs. This is consistent with TXU's statement, reported above, that "any recovery of cost above short run marginal cost is better than no recovery."

Any evaluation of TXU's RBS must include a comparative analysis of TXU's offer prices and an objective estimate of the marginal costs of its offered capacity. During the Study Period, TXU did not have any quick start combustion turbines that were qualified to provide balancing energy service while offline. Thus, TXU's balancing energy offers were exclusively from online units during the Study Period. Unlike start-up costs for offline units that are offered into the balancing energy market, the start-up costs for any unit that has already been brought online are sunk. Thus, start-up costs for units that are

[19] Typically, the competitiveness of a market increases as the number of suppliers increases so determining the profit-maximizing behavior of a hypothetical small supplier that faces competition from many other suppliers is a reasonable means for identifying competitive conduct.

online are sunk costs and not marginal costs, and should not be amortized over the run time of the unit for a competitive offer. Hence, the marginal costs for online units consists of incremental fuel cost, variable operations and maintenance costs, and reasonable and quantifiable costs related to risk and opportunity costs.

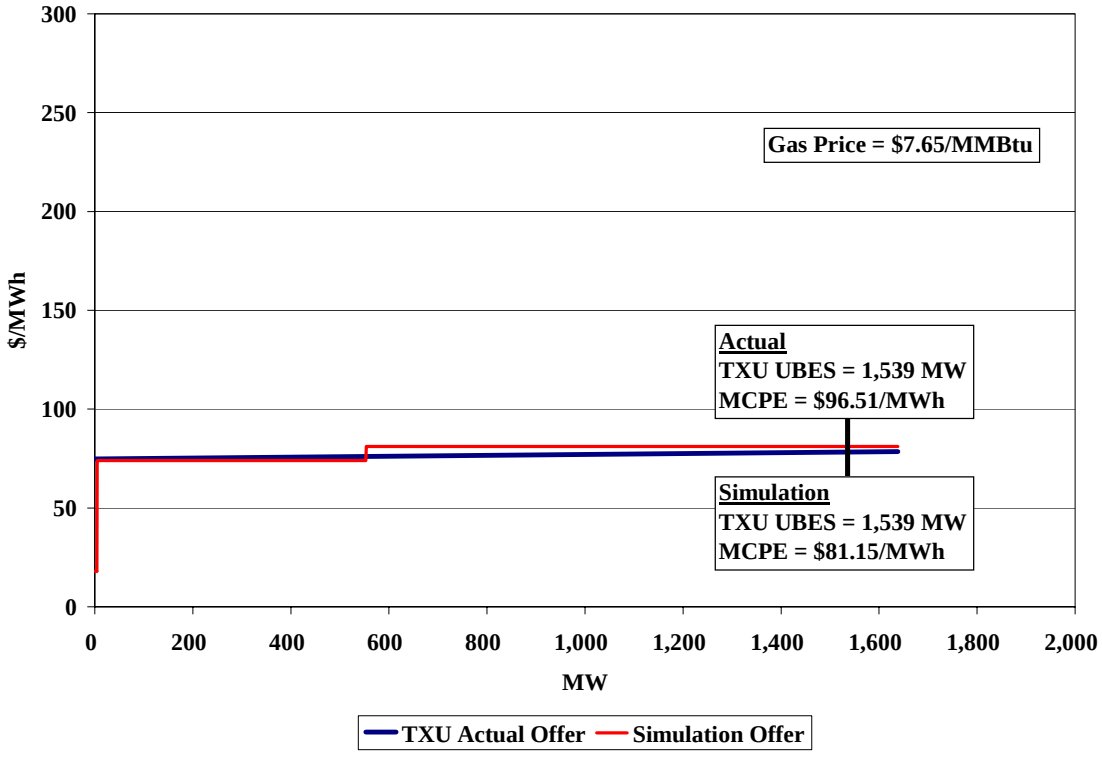
In response to a request for information that requested "a complete description of the [each] unit's operating costs above the low sustainable limit, including heat rate, fuel costs, and variable O&M, etc. from June 1 through September 30, 2005," TXU stated that it "does not maintain any historical records concerning operating costs specifically for operations above the low sustainable limit, including heat rate, fuel costs, and variable O&M for 2005." Later, in response to a subsequent request for information, TXU provided the results of the two most recent heat rate tests for each of its generating units. Because of the need to proceed with our analysis without awaiting TXU's response to our second request for information, we assumed the marginal cost of each of TXU's generating units to be equal to the generic costs in the ERCOT Protocols for each unit type under the assumption that the generic marginal costs for each unit type were conservative estimates of the SRMC of each unit.

The Appendix to this report contains charts that show the incremental heat rate for each of TXU's gas units from the test data supplied by TXU in response to our second information request as compared to the generic marginal cost data for each unit used in our study. These data indicate that the unit-specific generic cost values from the ERCOT Protocols are **[redacted]**. Further, absent any additional information from TXU regarding marginal operating costs for each unit other than fuel, we conclude that the margins in excess of fuel cost represented by using the generic cost estimates are a reasonable representation of the non-fuel marginal costs for each unit.

The two figures that follow further illustrate the relationship between the offer curves used in the simulation and TXU's actual offer curves. Figure 9 shows TXU's actual balancing energy offer curve and the energy offer curve used in the simulation in the North zone on July 19, 2005 for the interval ending at 5:30 p.m. The figure shows that the actual and the simulated offer curves are very similar for this operating interval, with

the simulated offer curve being slightly higher than TXU's actual offer curve. The quantity of UBES deployed for TXU in the North zone is the same for the actual case and the simulation.[20] These data indicate that the offer curves used in the simulation are reflective of the actual offers submitted by TXU when it was offering competitively, and support our assumption that the generic cost estimates used in the simulation are reasonable representations of the SRMC for TXU's generating units.

Figure 9 – TXU Actual and Simulated Offer Curves (July 19, 2005, 5:30 p.m.)

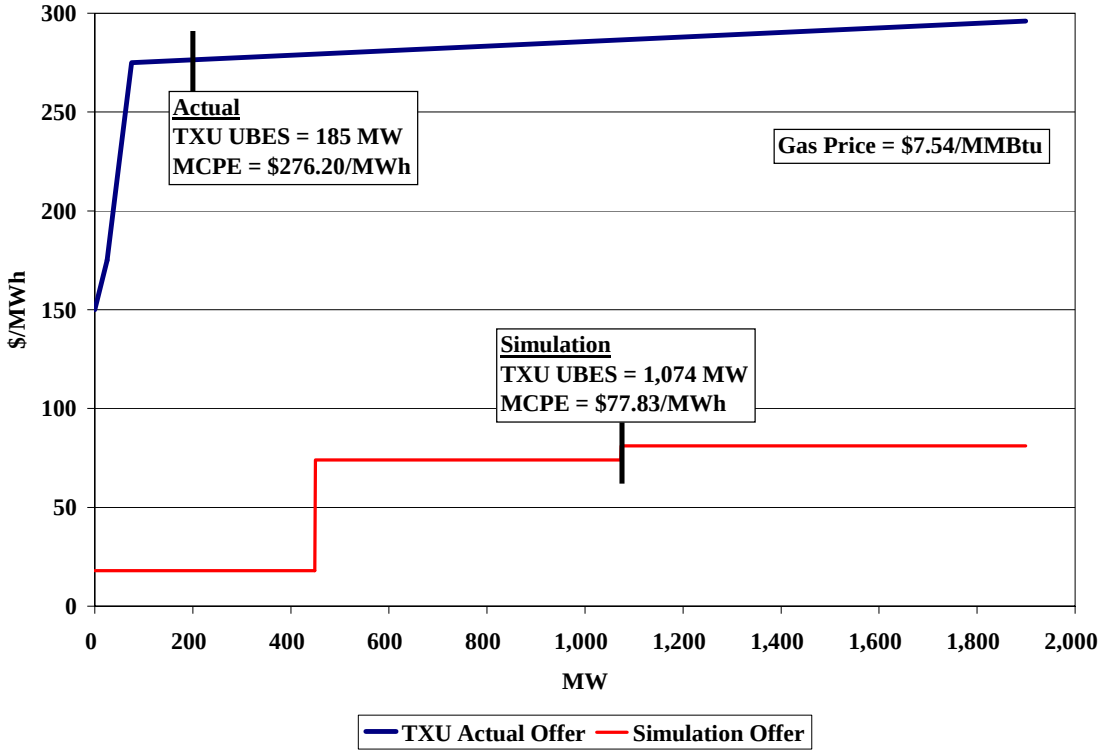


In contrast, Figure 10 shows TXU's actual balancing energy curve and the energy offer curve used in the simulation in the North zone on July 20, 2005 for the interval ending at 5:30 p.m. On July 20, TXU balancing energy offers in the North zone were from substantially the same units as on July 19, and natural gas prices were slightly lower on July 20. However, TXU's balancing energy offer prices in the North zone were significantly higher on July 20 than on July 19. Because of its high offer prices, TXU was deployed for only 185 MW of UBES in the actual case, resulting in a North zone

[20] The simulated MCPE is lower than the actual MCPE because TXU had high-priced offers in the West zone in this interval that were reduced in the simulation. Also, in both the actual and simulated cases, local congestion prevented the full deployment of TXU's offer in the North zone.

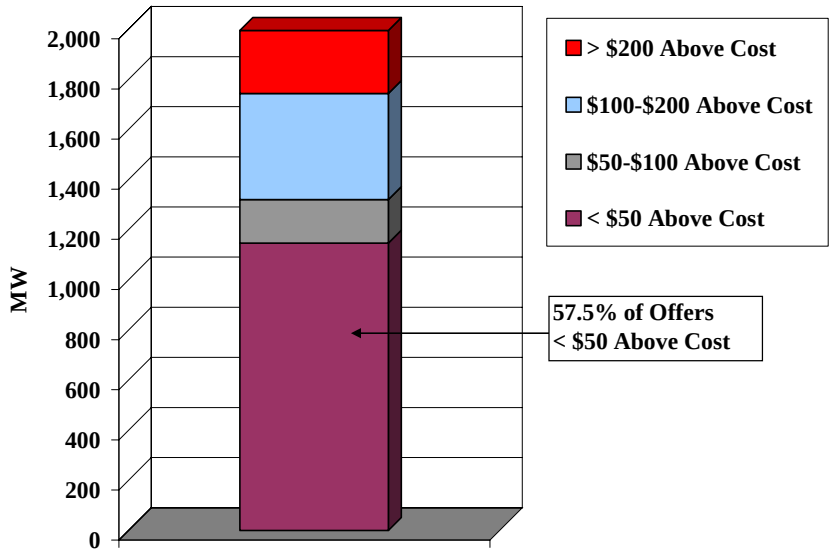
MCPE of $276.20/MWh. In the simulated case for the same interval substituting TXU's offer with the SRMC-based offer, TXU was deployed for 1,074 MW of UBES in the North zone, resulting in a North zone MCPE of $77.83/MWh.

Figure 10 – TXU Actual and Simulated Offer Curves (July 20, 2005, 5:30 p.m.)



To summarize how TXU's offers compare to competitive offers during the Study Period, Figure 11 shows the average dispatchable offers for TXU during the 657 price spike intervals in the Study Period. The average offer quantities are divided into price bands to illustrate the relative magnitude of the departure of TXU's balancing energy offer prices from the SRMC of its generating units.

Figure 11 – TXU Average Dispatchable Offers in Price Spike Intervals
June 1 – September 30, 2005



The chart shows that TXU offered only 57.5 percent of its dispatchable energy at prices within $50 of its estimated SRMC on average during these intervals in the Study Period. Overall, TXU was a pivotal supplier during 84.3 percent of the price spike intervals. When a supplier is pivotal, some portion of the balancing energy demand must be satisfied by that supplier. Hence, TXU's offers in the balancing market during the price spike intervals were often priced substantially higher than competitive levels, resulted in significantly less balancing energy from TXU being deployed and, therefore, constituted economic withholding of production.

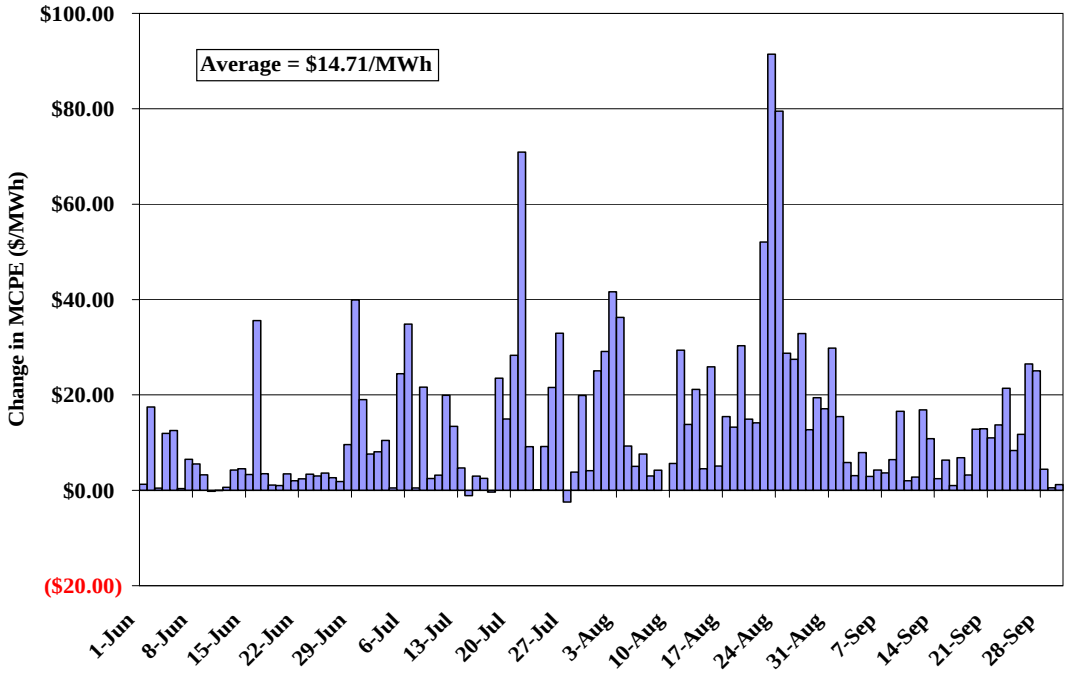
B. Impact of TXU Actions on the Balancing Energy Market

In this subsection of the report, we estimate the effects of TXU's high-priced offers on balancing energy market prices. Our analysis of TXU's RBS allows us to conclude that its offer prices for a significant portion of its online capacity were not competitive. To estimate the impact of these offers, we conducted balancing energy market simulations substituting the non-competitive offers with offers at prices that reflect our estimates of the short-run marginal costs of TXU's online generating units. We performed these simulations for each operating interval from hours 10 to 23 from June 1 to September 30, 2005, but excluded from the results those intervals in which the Modified Competitive

Solution Method (MCSM) was triggered in either the actual or the simulated cases (this excludes 57 out of 6,344 total intervals).[21]

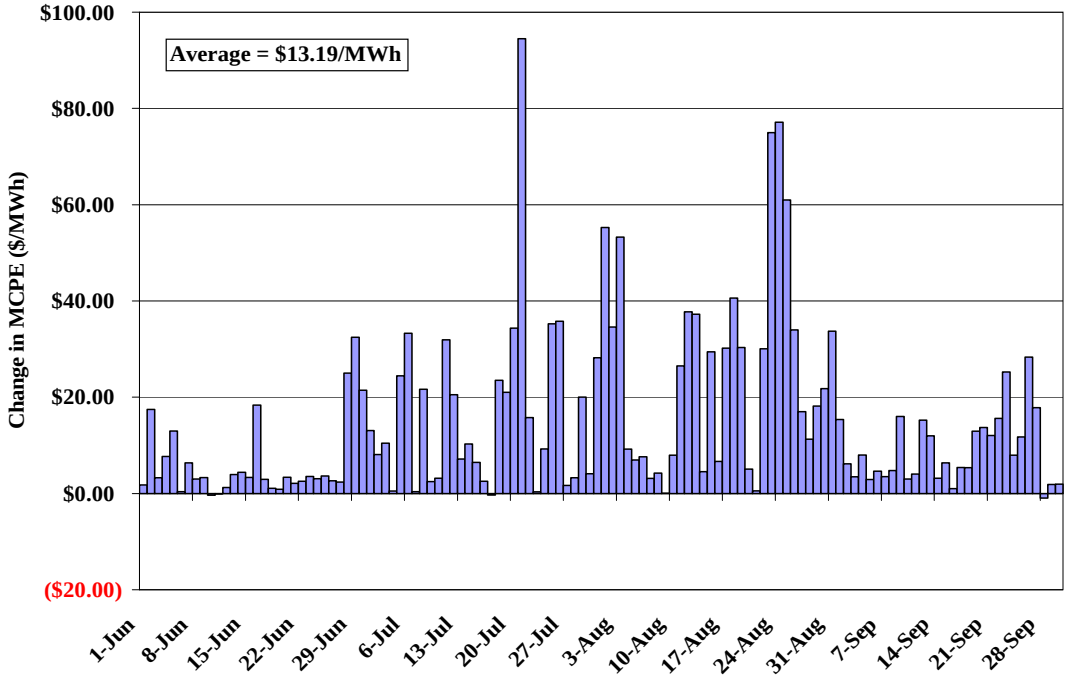
The simulations were performed using a copy of ERCOT's Scheduling, Pricing, and Dispatch ("SPD") model, which is used by ERCOT to clear the balancing energy market. Generic costs for each unit were used as proxies for short-run marginal cost for each of TXU's generating units. All other inputs to the simulations were identical to the actual inputs used to clear the balancing energy market. The new deployments for all QSEs produced by the simulation in each interval were carried over as inputs to the succeeding interval to accurately reflect constraints such as portfolio ramp rate constraints and the change in prices and congestion over the day. Figure 12 and Figure 13 show the average daily difference between actual MCPEs that occurred in the North and Houston zones, respectively, compared to the estimates from the simulations.

Figure 12 – Balancing Energy Market Simulations Replacing High Price TXU Offers (North Zone Daily Average Actual Minus Simulated MCPE)



[21] MCSM is a Commission-approved mechanism that was in effect in 2005 that provided for an *ex post* modification to the resulting market prices when all dispatchable balancing energy was exhausted. Because we have found no indication of strategic physical withholding from online resources during the Study Period (*see* 2005 SOM Report, at 81-84), the MCSM intervals are reflective of shortage conditions in the balancing energy market and are appropriately excluded from this analysis.

Figure 13 – Balancing Energy Market Simulations Replacing High Price TXU Offers (Houston Zone Daily Average Actual Minus Simulated MCPE)



The figures show that average daily MCPE differences between the actual and simulated cases ranged from zero to over $90 per MWh in the North and Houston zones, with some differences due to zonal congestion. The monthly average actual and simulated MCPEs are summarized in Figure 14.

Figure 14 – Average Monthly Actual vs. Simulated MCPEs During Study Period

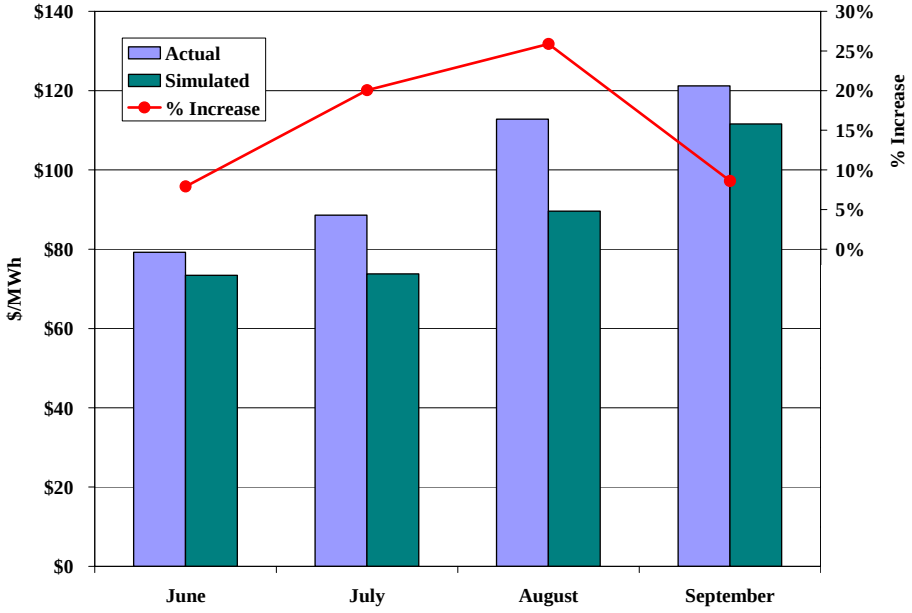


Figure 14 shows that the monthly average price increase ranged from 8 percent in June to 26 percent in August. The average actual MCPE was approximately 15.5 percent greater than the simulated MCPE over the entire Study Period.

The direct costs of increasing balancing energy prices is based on the quantity actually purchased at the elevated prices. Since loads procure most of their power through self-generation and bilateral contracts, they are not fully exposed to these price increases in the short term. However, spot market price increases affect expectations and risk, which will increase prices in the bilateral forward markets, thereby increasing the cost to retail providers that rely upon bilateral market purchases to supply their customers.

For the purpose of this report, we have quantified the net direct effects of the price increases in the balancing energy market. This analysis is presented in the following figure, which shows the additional costs incurred by purchasers of energy in the balancing energy market. We note that the entities purchasing power in the balancing energy market are not always load-serving entities; they may be suppliers that are purchasing power to serve their obligations.

Figure 15 – Net Cost Increase for Balancing Energy Market Purchases for Each Day in the Study Period

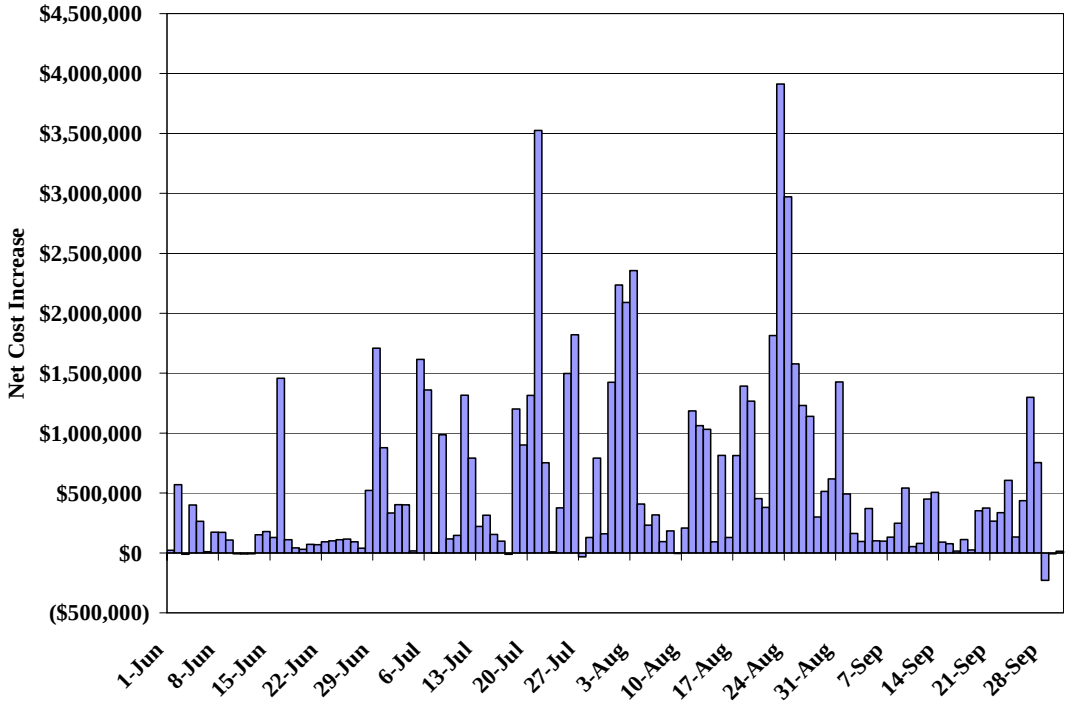


Figure 15 shows that the net direct costs on a daily basis range from close to zero to over $3.5 million. The total costs largely depend on the quantity of energy purchased through the balancing energy market, which can vary widely, and the relative price differences between the actual and the simulated outcomes. The aggregate net direct costs we estimated during the Study Period were approximately $70 million. This impact only measures the net direct cost to purchasers in the balancing energy market.

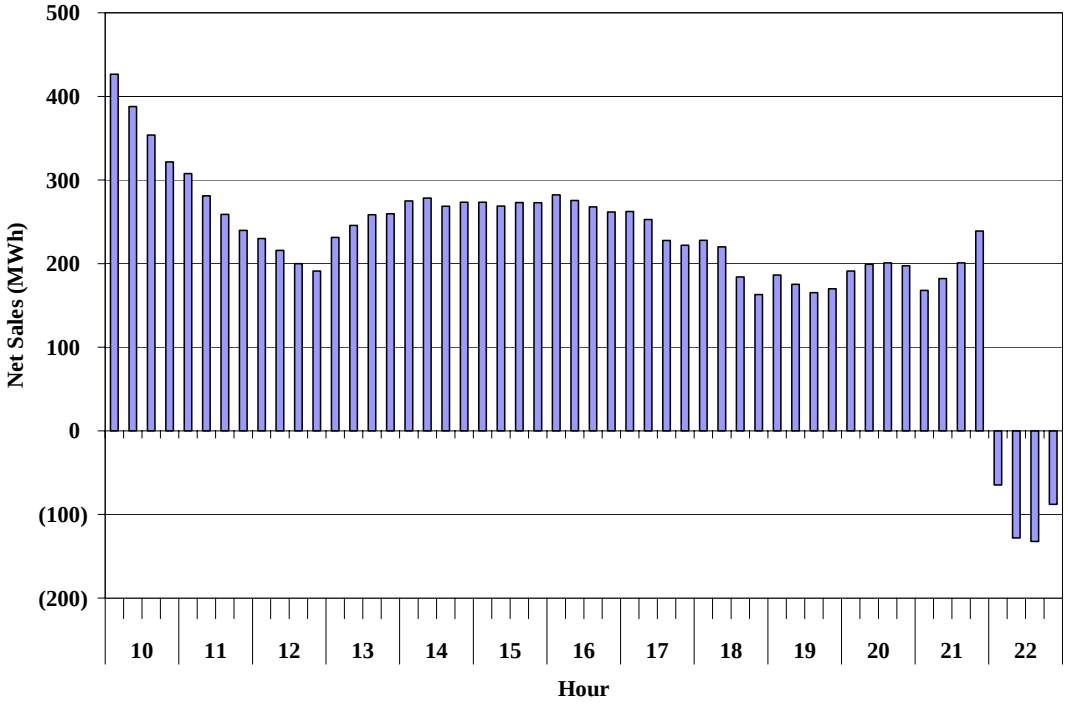
Because spot price increases will tend to increase the costs of bilateral contracts, the total cost increases to the market can be substantially higher than just the direct costs to purchases in the balancing energy market. In addition, higher balancing energy prices and wholesale bilateral contract prices will tend to diminish retail competition. Analysis of the effect TXU's conduct on the bilateral market or the retail market would involve the consideration of additional factors and is beyond the scope of this report.

C. Assessment of TXU's Net Energy Position

One important component of the definition of market power introduced at the beginning of this report is that the conduct of the supplier must potentially be profitable. Hence, the profitability of TXU's conduct is an important means to distinguish between conduct that is inefficient or manipulative, versus conduct that constitutes an abuse of market power.

The most direct means for TXU to profit from the high prices in the balancing energy market is for it to make net sales during the high priced intervals. In other words, TXU would be long in energy during these intervals. TXU's net balancing energy sales in each interval are equal to the net balancing energy market position of its resources and the net balancing energy market position of its load adjusted for load obligations and resource purchases that settle at the MCPE. Figure 16 shows that TXU was a net seller in the balancing energy market on average for every hour in the Study Period except for hour 22.

Figure 16 – Net Sales in the Balancing Energy Market by TXU
Interval Average Over Study Period



To estimate the direct effects of TXU's RBS on TXU's profits, we use the impact of TXU's RBS offers on the balancing energy prices that we estimated with the SPD simulations described in the previous subsection. To calculate TXU's change in profits, we calculate its actual balancing energy profits given its net balancing energy market position during the Study Period and compare that value to the balancing energy profits calculated in the simulated case for each 15-minute interval in the Study Period. We also include any change in transmission congestion rights ("TCR") revenues and scheduled congestion charges for TXU. The daily results of this analysis are shown in Figure 17.

Figure 17 – Direct Balancing Energy Profit Effects on TXU

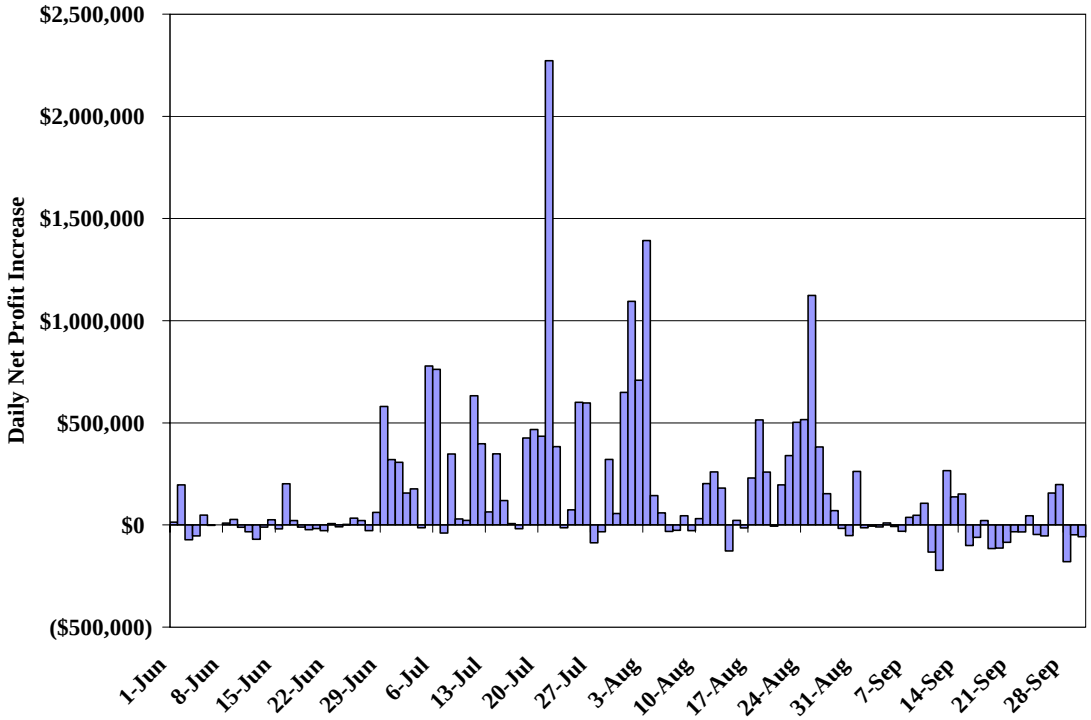


Figure 17 shows that over the entire Study Period, the RBS strategy caused TXU's actual balancing energy profits to increase by approximately $19.6 million compared to the simulated outcomes with competitive offers used in place of TXU's RBS-generated offers. Table 1 provides a summary of the balancing energy market financial position for TXU in the actual and simulated cases during the Study Period.

Table 1 – Actual vs. Simulated Balancing Energy Market Financials for TXU

	Actual ($1,000)	**Simulation ($1,000)**	**Actual – Simulation ($1,000)**
BES Generation (GWh)	1,188	1,701	(513)
Net BES Revenue	$159,031	$177,775	($18,744)
Less: BES Production Costs	$88,942	$127,712	($38,770)
Net BES Resource Profit	$70,088	$50,062	$20,026
Net BES Obligation (adjusted for MCPE sales/purchases)	($20,374)	($19,379)	($996)
Net Congestion Charges/Credits & TCR Revenues	$877	$272	$605
Subtotal	($19,497)	($19,107)	($390)
Net Balancing Market Position	**$50,591**	**$30,955**	**$19,636**

As shown in Table 1, TXU would have produced more balancing energy in the simulated case at prices that were greater than or equal to its offers had it offered its energy at competitive price levels. In other words, by using its RBS, approximately 513,000 MWh of TXU's generation that was offered as balancing energy was not dispatched in the actual case, even though it would have been profitable. This analysis demonstrates that the RBS is a strategy that results in the economic withholding of production.

While TXU's balancing energy revenues increased in the simulation, this increase in production is accompanied by increased production costs and lower average prices in the simulated case. The net result is that TXU's net profit in the balancing energy market from its resources decreases from approximately $70 million actual to $50 million in the simulated outcome. Accounting for TXU's net balancing energy obligations and congestion-related charges and credits produces an actual net balancing market position of approximately $50.6 million compared to the simulated case of approximately $31 million, for a difference of approximately $19.6 million. Hence, although TXU produced substantially less energy, the higher prices caused by its conduct made the conduct profitable.

IV. CONCLUSIONS

The 2005 ERCOT State of the Market Report raised significant concerns regarding economic withholding by TXU; however, the report did not include a further investigation of the conduct or an analysis of its impact on balancing market prices. This report provides a detailed investigation into the causes of the relatively high prices in the balancing energy market that occurred from June 1 to September 30, 2005. In particular, we evaluated whether TXU abused market power in the real-time market by raising balancing energy offers to economically withhold capacity from the balancing energy market.

A supplier may be deemed to have market power if it has both the *ability* and *incentive* to raise prices significantly above competitive levels. Our analysis revealed that TXU had the ability to raise balancing energy prices significantly, and that its use of the RBS increased prices by an average of 15.5 percent over the entire Study Period relative to the prices that would have occurred had TXU offered its online units competitively. We also found TXU to be pivotal in 84.3 percent of the 657 price spike intervals during the Study Period. These results indicate that TXU had the ability to significantly affect the balancing energy prices during this period.

Because TXU had the ability to increase balancing energy prices significantly, we also evaluated its incentive to increase prices. This analysis showed that TXU was a substantial net seller in the balancing energy market during the Study Period and that its balancing energy profits were approximately $19.6 million greater than the profit that would have been earned had TXU not employed its RBS and, instead, offered its online units at competitive prices. In summary, we make the follow findings regarding market power based on the results of the analysis in this report:

- TXU was a substantial net seller in the balancing energy market during the Study Period, which provided it the incentive to raise prices.
- The offers that TXU submitted under its RBS strategy were not competitive and contributed to a significant increase in balancing energy prices during the Study

Period. This increase in prices was inefficient and did not reflect underlying market fundamentals.

- By replacing TXU's high-priced RBS offers with competitively-priced offers, we estimate that the increase in TXU's offer prices above competitive levels raised:
  - the average MCPE for all intervals in the Study Period by 15.5 percent; and
  - payments by balancing energy purchasers by approximately $70 million.
- Had TXU offered its online units at competitive price levels during the Study Period, it would have generated approximately 513,000 MWh of additional energy in the balancing market prices in excess of its short run marginal cost. Hence, TXU's use of the RBS constituted economic withholding of production.
- TXU's net balancing market profits were approximately $19.6 million greater than the profit that would have been earned had TXU not employed its RBS and, instead, offered its online units at competitive prices.

Based upon these results, we conclude that TXU's actions constituted an abuse of market power in the balancing energy market during the Study Period.

APPENDIX

[REDACTED]