in the North Zone, and with transmission outages resulting in the OOME Down of coal/lignite units.

- OOMC costs in the Valley area of the South Zone increased by $5 million in 2008. This increase was associated with the more frequent need for local capacity to be online to maintain Valley import limits.
- RMR costs in the Laredo area of the South Zone decreased by $13 million in 2008. This decrease was associated with the termination of the Laredo RMR contract in October 2008.
- OOME Up costs in the San Antonio area of the South Zone decreased by $9 million in 2008, and OOMC costs in the Austin area of the South Zone decreased by $5 in 2008. These decreases were associated with the completion of transmission improvements between Austin and San Antonio.

IV. ANALYSIS OF COMPETITIVE PERFORMANCE

In this section, we evaluate competition in the ERCOT market by analyzing the market structure and the conduct of the participants during 2008. We examine market structure using a pivotal supplier analysis, which indicates that suppliers were pivotal in the balancing energy market at a frequency in 2008 that was similar to 2007, but much less than 2005 and 2006. This analysis also shows that the frequency with which a supplier was pivotal increased at higher levels of demand, which is consistent with prior years. To evaluate participant conduct we estimate measures of physical and economic withholding. We examine withholding patterns relative to the level of demand and the size of each supplier's portfolio. Based on these analyses, we find the overall performance of the ERCOT wholesale market to be competitive in 2008.

A. Structural Market Power Indicators

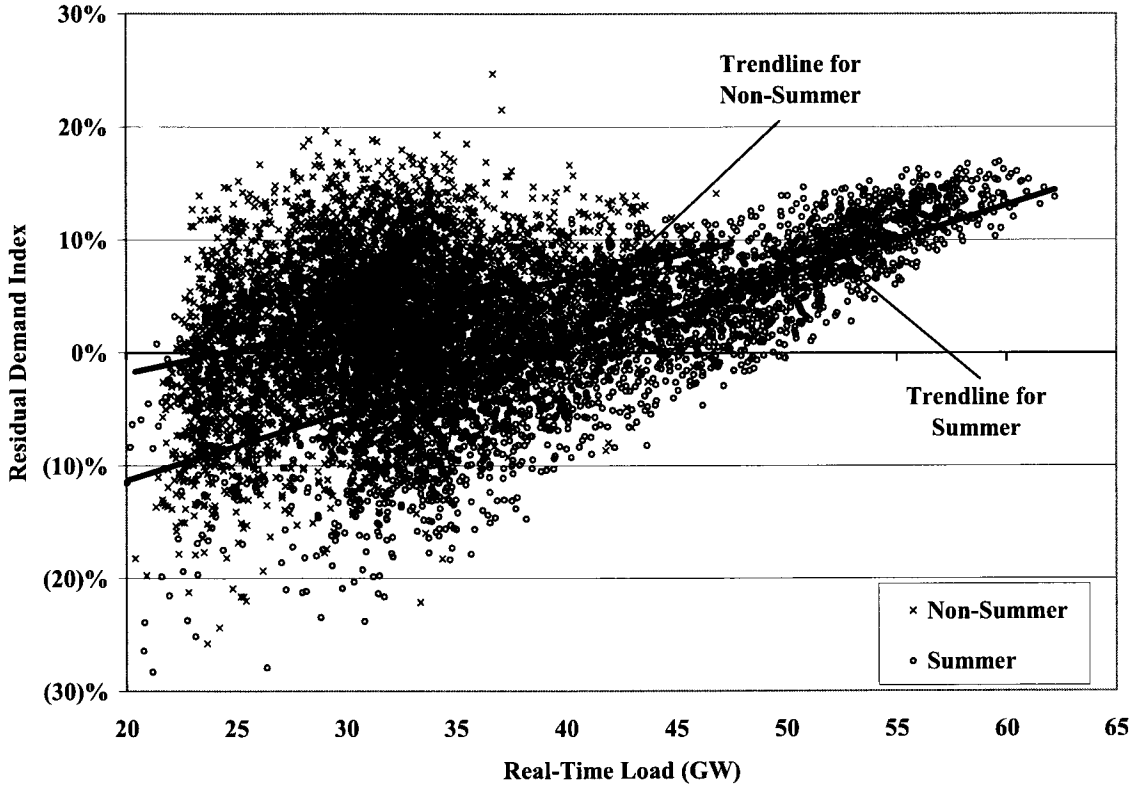
We analyze market structure using the Residual Demand Index ("RDI"), a statistic that measures the percentage of load that could not be satisfied without the resources of the largest supplier. When the RDI is greater than zero, the largest supplier is pivotal (*i.e.*, its resources are needed to satisfy the market demand). When the RDI is less than zero, no single supplier's resources are required to serve the load as long as the resources of its competitors are available.

The RDI is a useful structural indicator of potential market power, although it is important to recognize its limitations. As a structural indicator, it does not illuminate actual supplier behavior to indicate whether a supplier may have exercised market power. The RDI also does not indicate whether it would have been profitable for a pivotal supplier to exercise market power. However, it does identify conditions under which a supplier would have the *ability* to raise prices significantly by withholding resources.

Figure 63 shows the RDI relative to load for every hour in 2008. The data are divided into two groups: (i) hours during the summer months (from May to September) are shown by darker points, while (ii) hours during other months are shown by lighter points. The trend lines for each data series are also shown and indicate a strong positive relationship between load and the RDI. This analysis shown below is done at the QSE level because the largest suppliers that determine the RDI values own a large majority of the resources they are scheduling or offering. It is

possible that they also control the remaining capacity through bilateral arrangements, although we do not know whether this is the case. To the extent that the resources scheduled by the largest QSEs are not controlled or providing revenue to the QSE, the RDIs will tend to be slightly overstated.

Figure 63: Residual Demand Index

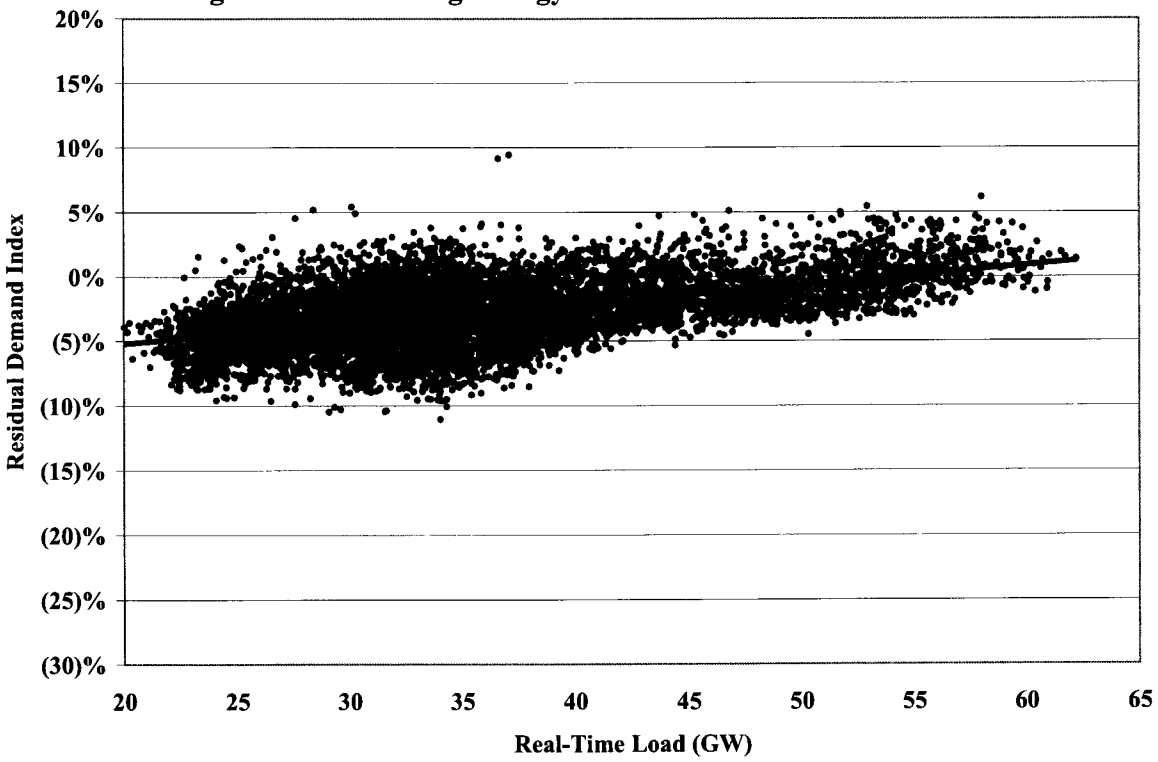


The figure shows that the RDI for the summer (i.e. May to September) was usually positive in hours when load exceeded 40 GW. During the summer, the RDI was greater than zero in approximately 60 percent of hours. The RDI was typically positive at lower load levels during the spring and fall due to the large number of generation planned outages and less commitment. Hence, although the load was lower outside the summer, our analysis shows that a QSE was pivotal in approximately 70 percent of hours during the non-summer period. It is important to recognize that inferences regarding market power cannot be made solely from this data. Retail load obligations can affect the extent of market power for large suppliers, since such obligations cause them to be much smaller net sellers into the wholesale market than the analysis above would indicate. Bilateral contract obligations can also affect a supplier's potential market power. For example, a smaller supplier selling energy in the balancing energy market and through short-

term bilateral contracts may have a much greater incentive to exercise market power than a larger supplier with substantial long-term sales contracts. The RDI measure shown in the previous figure does not consider the contractual position of the supplier, which can increase a supplier's incentive to exercise market power compared to the load-adjusted capacity assumption made in this analysis.

In addition, a supplier's ability to exercise market power in the current ERCOT balancing energy market may be higher than indicated by the standard RDI. Hence, a supplier may be pivotal in the balancing energy market when it would not have been pivotal according to the standard RDI shown above. To account for this, we developed RDI statistics for the balancing energy market. Figure 64 shows the RDI in the balancing energy market relative to the actual load level.

Figure 64: Balancing Energy Market RDI vs. Actual Load

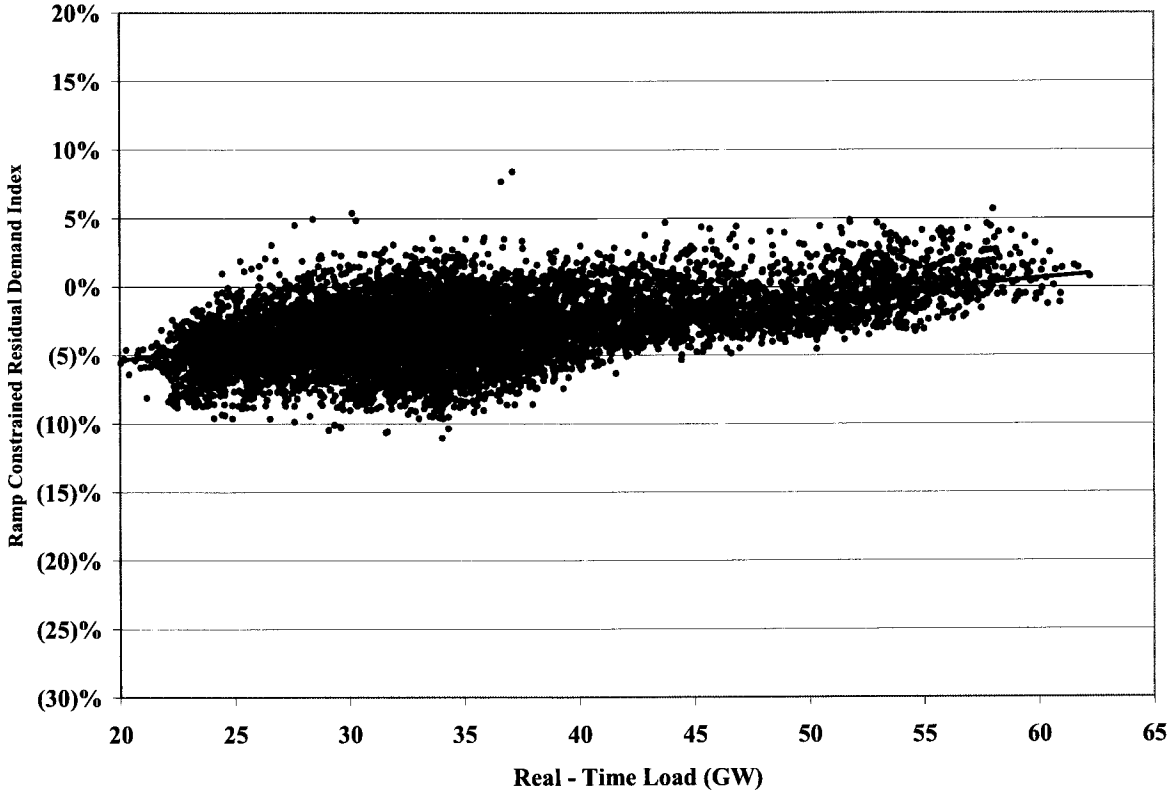


Ordinarily, the RDI is used to measure the percentage of load that cannot be served without the resources of the largest supplier, assuming that the market could call upon all committed and quick-start capacity[24] owned by other suppliers. Figure 64 limits the other supplier's capacity to

[24] For the purpose of this analysis, "quick-start" includes off-line simple cycle gas turbines that are flagged as on-line in the resource plan with a planned generation level of 0 MW that ERCOT has identified as capable

the capacity offered in the balancing energy market. When the RDI is greater than zero, the largest supplier's balancing energy offers are necessary to prevent a shortage of offers in the balancing energy market. Figure 65 shows the same data as in Figure 64 except that the balancing energy offers are further limited by portfolio ramp constraints in each interval.

Figure 65: Ramp-Constrained Balancing Energy Market RDI vs. Actual Load

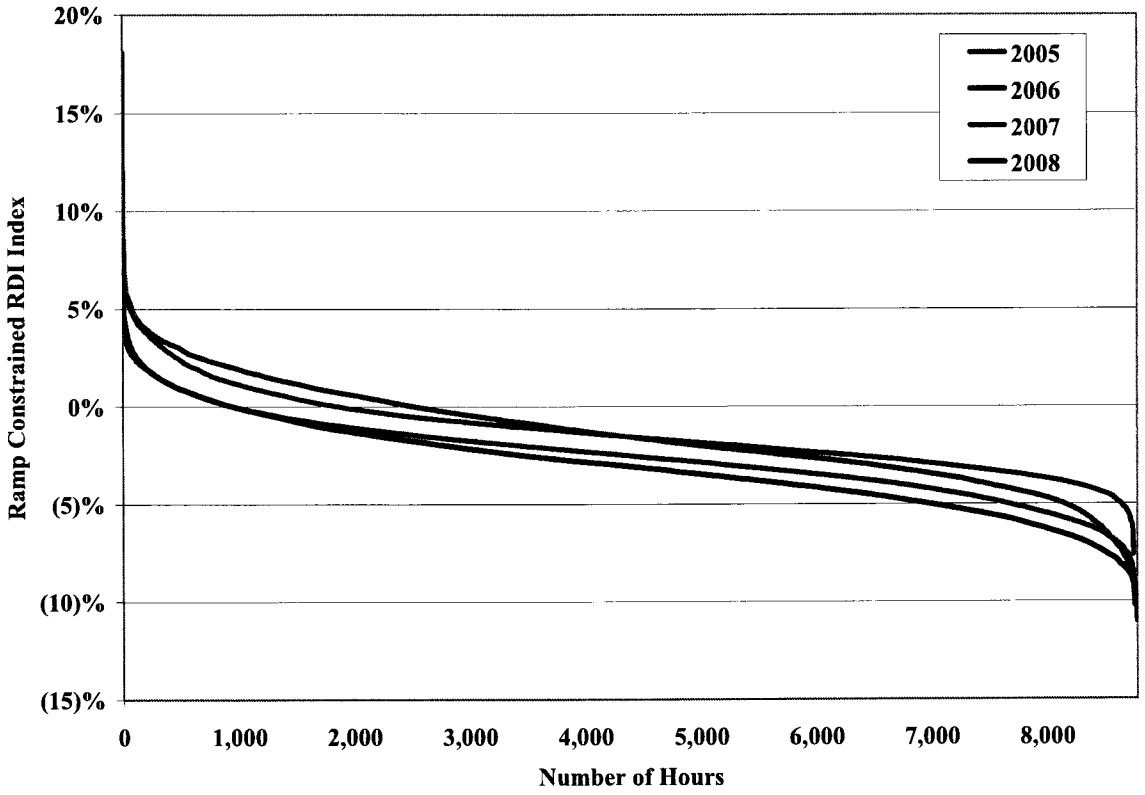


In 2008, the instances when the RDI was positive occurred over a wide range of load levels, from 26 GW to 63 GW. The RDI results for the balancing energy market shown in the preceding two figures help explain how transient price spikes can occur under mild demand while large amounts of capacity are available in ERCOT. The balancing energy market RDI data and trend line for 2008 are similar in shape to 2007. The frequency of data points that are positive in 2008 is similar to the frequency in 2007 as well, although the frequency of data points that are positive is significantly lower in 2007 and 2008 than in 2005 and 2006. This difference

of starting-up and reaching full output after receiving a deployment instruction from the balancing energy market.

is highlighted in Figure 66 which compares the balancing energy market RDI duration curves for 2005 through 2008.

Figure 66: Ramp-Constrained Balancing Energy Market RDI Duration Curve



The frequency with which at least one supplier was pivotal in the balancing energy market *(i.e.*, an RDI greater than zero) has fallen consistently from 29 percent of the hours in 2005, to 21 percent of the hours in 2006, and to less than 11 percent of the hours in 2007 and 2008. These results indicate that the structural competitiveness of the balancing energy market in 2008 maintained the improvement exhibited in 2007 compared to prior years.

B. Evaluation of Supplier Conduct

The previous sub-section presented a structural analysis that supports inferences about potential market power. In this section we evaluate actual participant conduct to assess whether market participants have attempted to exercise market power through physical or economic withholding. First, we review offer patterns in the balancing energy market. Then we examine unit deratings and forced outages to detect physical withholding and we evaluate the "output gap" to detect economic withholding.

In a single-price auction like the balancing energy market auction, suppliers may attempt to exercise market power by withholding resources. The purpose of withholding is to cause more expensive resources to set higher market clearing prices, allowing the supplier to profit on its other sales in the balancing energy market. Because forward prices will generally be highly correlated with spot prices, price increases in the balancing energy market can also increase a supplier's profits in the bilateral energy market. The strategy is profitable only if the withholding firm's incremental profit due to higher price is greater than the lost profit from the foregone sales of its withheld capacity.

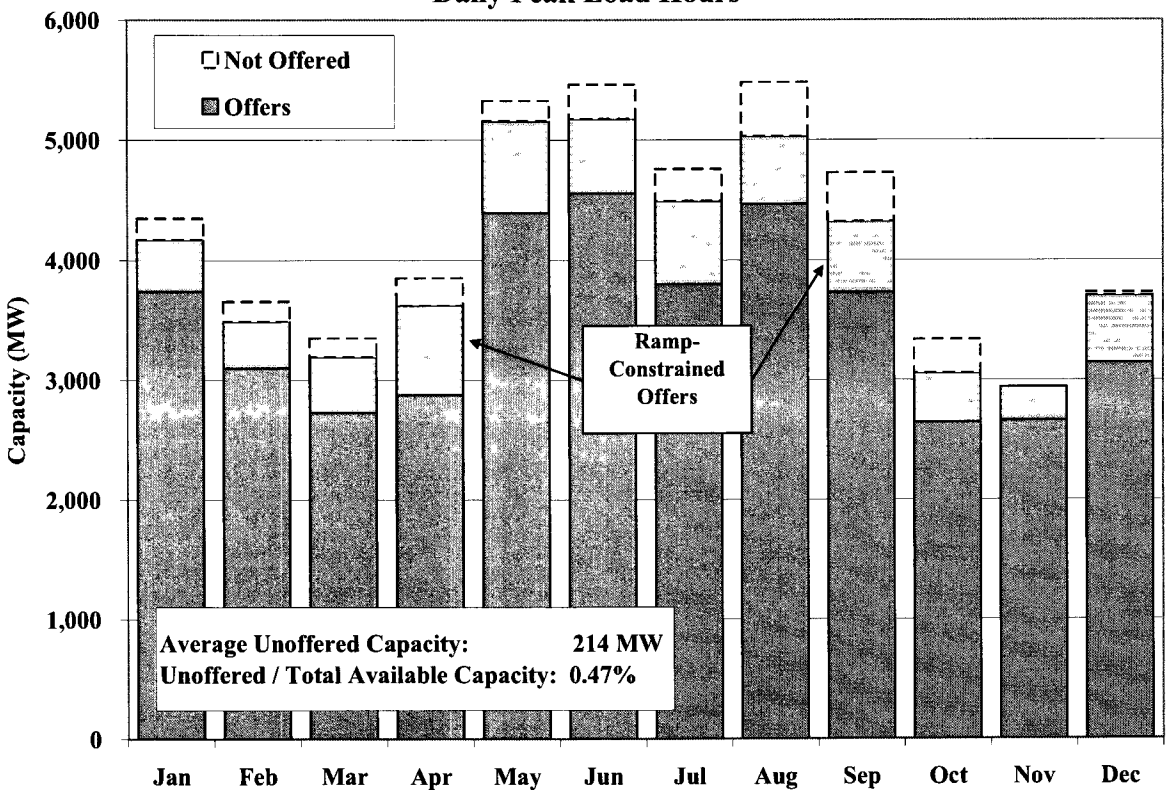
1. Balancing Energy Market Offer Patterns

In this section, we evaluate balancing energy offer patterns by analyzing the rate at which capacity is offered.[25] Figure 67 shows the average amount of capacity offered to supply up balancing service relative to all available capacity.

Figure 67 shows only slight variation in 2008 over time in quantities of energy available and offered to the balancing energy market. Up balancing offers are divided into the portion that is capable of being deployed in one interval and the portion which would take longer due to portfolio ramp rate offered by the QSE (*i.e.*, "Ramp-Constrained Offers").

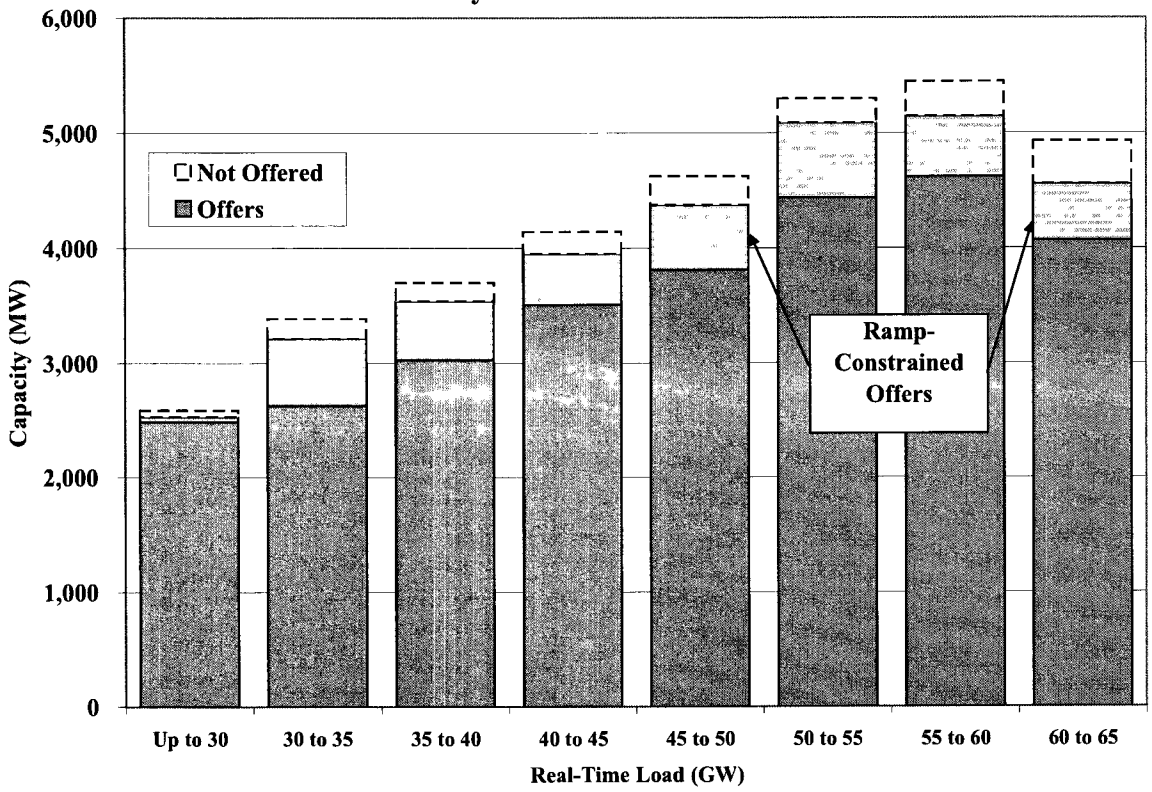
[25] The methodology for determining the quantities of un-offered capacity is detailed in the 2006 SOM Report (2006 SOM Report at 63-65).

Figure 67: Balancing Energy Offers Compared to Total Available Capacity Daily Peak Load Hours



Un-offered energy can raise competitive concerns to the extent that it reflects withholding by a dominant supplier that is attempting to exercise market power. To investigate whether this has occurred, Figure 68 shows the same data as the previous figure, but arranged by load level for daily peak hours in 2008. Because prices are most sensitive to withholding under the tight conditions that occur when load is relatively high, increases in the un-offered capacity at high load levels would raise competitive concerns.

Figure 68: Balancing Energy Offers Compared to Total Available Capacity Daily Peak Load Hours



The figure indicates that in 2008 the average amount of capacity available to the balancing market increased gradually up to 60 GW of load and then declined at higher levels. The decline in balancing energy available at higher load levels is associated with the fact that scheduled generation increases at higher load levels, thereby leaving less residual capacity available to be offered as balancing energy. As indicated in the figure, the quantity of un-offered capacity increases slightly as load levels increase, although the quantity of un-offered capacity remains relatively flat as a percentage of system demand.

The pattern of un-offered capacity shown in Figure 68 does not raise significant competitive concerns. If the capacity were being strategically withheld from the market, we would expect it to occur under market conditions most susceptible to the exercise of market power. Thus, we would expect significantly more un-offered capacity under higher load conditions. However, the figure shows that portions of the available capacity that are un-offered do not change significantly as load levels increase. Based on this analysis and the additional analyses in this

section at the supplier level, we do not find that the un-offered capacity raises potential competitive concerns.

2. Evaluation of Potential Physical Withholding

Physical withholding occurs when a participant makes resources unavailable for dispatch that are otherwise physically capable of providing energy and that are economic at prevailing market prices. This can be done either by derating a unit or declaring it as forced out of service. Because generator deratings and forced outages are unavoidable, the goal of the analysis in this section is to differentiate justifiable deratings and outages from physical withholding. We test for physical withholding by examining deratings and forced outage data to ascertain whether the data are correlated with conditions under which physical withholding would likely be most profitable.

The RDI results shown in Figure 63 through Figure 65 indicate that the potential for market power abuse rises at higher load levels as the frequency of positive RDI values increases. Hence, if physical withholding is a problem in ERCOT, we would expect to see increased deratings and forced outages at the highest load levels. Conversely, because competitive prices increase as load increases, deratings and forced outages in a market performing competitively will tend to decrease as load approaches peak levels. Suppliers that lack market power will take actions to maximize the availability of their resources since their output is generally most profitable in these peak periods.

Figure 69 shows the average relationship of short-term deratings and forced outages as a percentage of total installed capacity to real-time load level during the summer months for large and small suppliers. Portfolio size is important in determining whether individual suppliers have incentives to withhold available resources. Hence, the patterns of outages and deratings of large suppliers can be usefully evaluated by comparing them to the small suppliers' patterns.

We focus on the summer months to eliminate the effects of planned outages and other discretionary deratings that occur in off-peak periods. Long-term deratings are not included in this analysis because they are unlikely to constitute physical withholding given the cost of such withholding. Renewable and cogeneration resources are also excluded from this analysis because of the high variation in the availability of these classes of resources. The large supplier

category includes the four largest suppliers in ERCOT. The small supplier category includes the remaining suppliers (as long as the supplier controls at least 300 MW of capacity).

Figure 69: Short-Term Deratings by Load Level and Participant Size
June to August, 2008

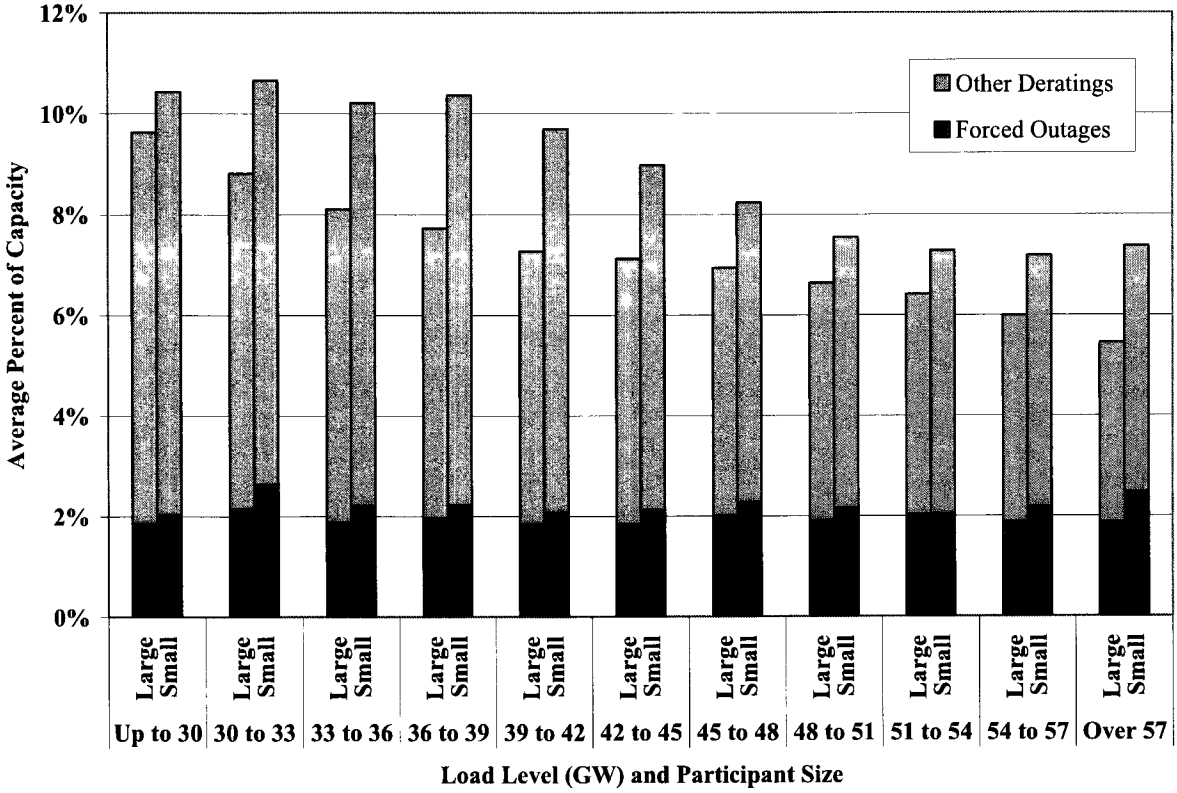


Figure 69 suggests that as electricity demand increases, both large and small market participants tend to make more capacity available to the market. For both large and small suppliers, the combined short-term derating and forced outage rates decreased from approximately 10 percent at low demand levels to about 5 and 7 percent respectively at load levels above 57 GW.

Large suppliers have derating and outage rates that are lower than those of small suppliers across the entire range of load levels. Furthermore, large suppliers' deratings and outages generally decline as load levels increase. Given that the market is more vulnerable to market power at the highest load levels, these derating patterns do not indicate physical withholding by the large suppliers.

3. Evaluation of Potential Economic Withholding

To complement the prior analysis of physical withholding, this subsection evaluates potential economic withholding by calculating an "output gap". The output gap is defined as the quantity of energy that is not being produced by in-service capacity even though the in-service capacity is economic by a substantial margin given the balancing energy price. A participant can economically withhold resources, as measured by the output gap, by raising its balancing energy offers so as not to be dispatched or by not offering unscheduled energy in the balancing energy market.

Resources can be included in the output gap when they are committed and producing at less than full output or when they are uncommitted and producing no energy. Unscheduled energy from committed resources is included in the output gap if the balancing energy price exceeds the estimated marginal production cost of energy from that resource by at least $50 per MWh. The output gap excludes capacity that is necessary for the QSE to fulfill its ancillary services obligations. Uncommitted capacity is considered to be in the output gap if the unit would have been profitable given day-ahead bilateral zonal market prices as published in *Megawatt Daily*. The resource is counted in the output gap for commitment if its net revenue (market revenues less total cost, which includes startup and operating costs) exceeds the total cost of committing and operating the resource by a margin of at least 25 percent for the standard 16-hour delivery time associated with on-peak bilateral contracts.[26]

As was the case for outages and deratings, the output gap will frequently detect conduct that can be competitively justified. Hence, it is important to evaluate the correlation of the output gap patterns to those factors that increase the potential for market power, including load levels and portfolio size. Figure 70 compares the real-time load to the average incremental output gap for all market participants as a percentage of the real-time system demand from 2005 through 2008.

[26] The operating costs and startup costs used for this analysis are the generic costs for each resource category type as specified in the ERCOT Protocols.

Figure 70: Incremental Output Gap by Load Level

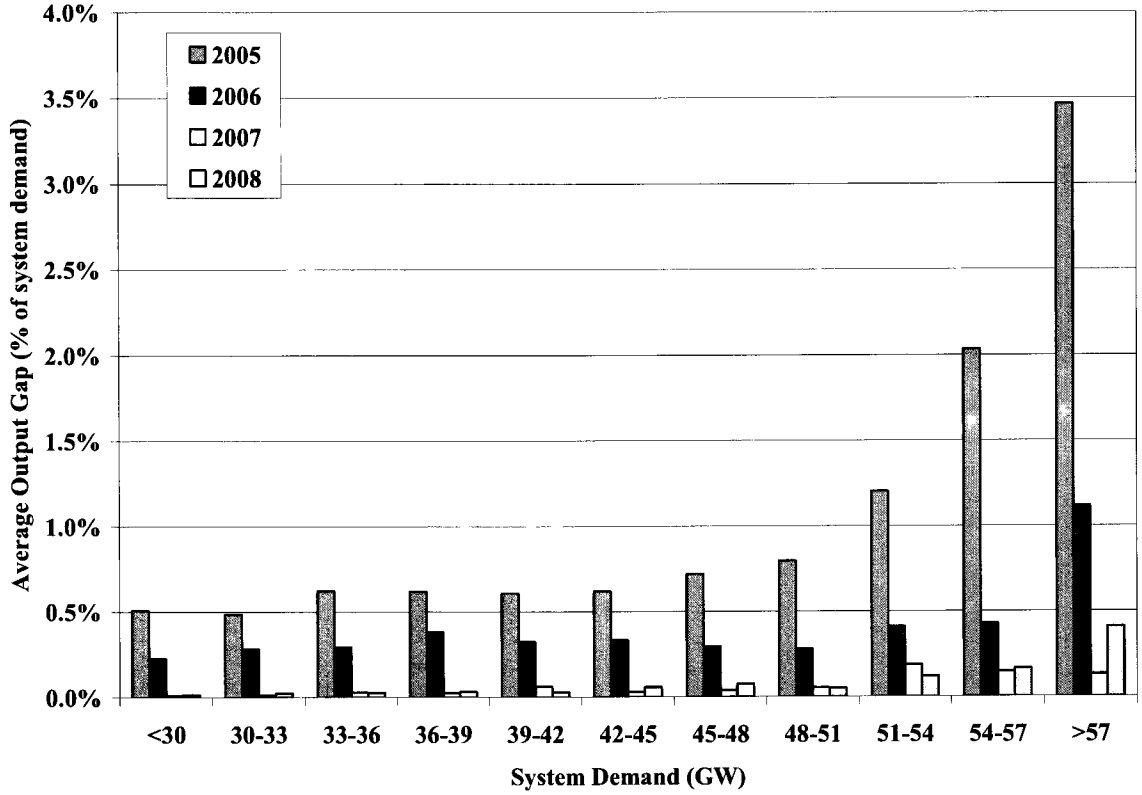


Figure 70 shows that the competitiveness of supplier offers improved considerably in 2006 compared to 2005, followed by even more substantial improvement in 2007 and 2008. Although 2008 exhibited a higher average incremental output gap at the highest load levels, the overall magnitude remains small and does not raise significant economic withholding concerns.

Figure 71 compares real-time load to the average output gap as a percentage of total installed capacity by participant size. The large supplier category includes the four largest suppliers in ERCOT, whereas the small supplier category includes the remaining suppliers that each controls more than 300 MW of capacity. The output gap is separated into (a) quantities associated with uncommitted resources and (b) quantities associated with incremental output ranges of committed resources.

Figure 71: Output Gap by Load Level and Participant Size

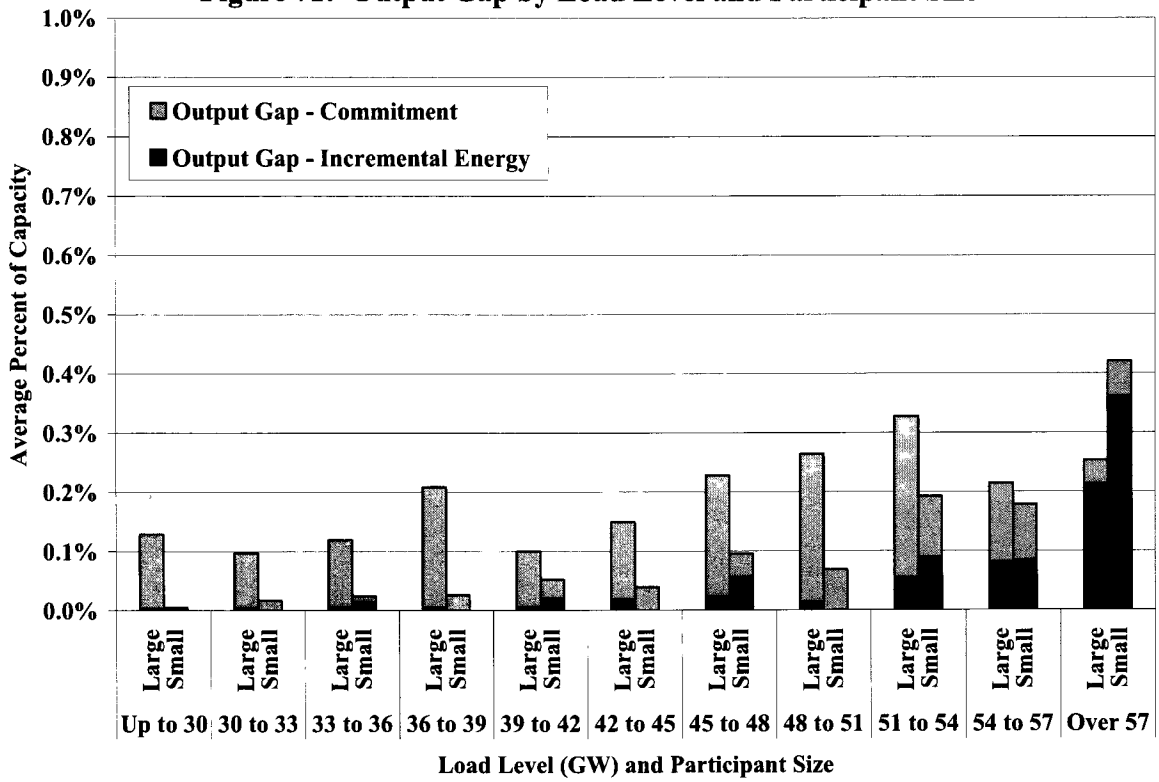


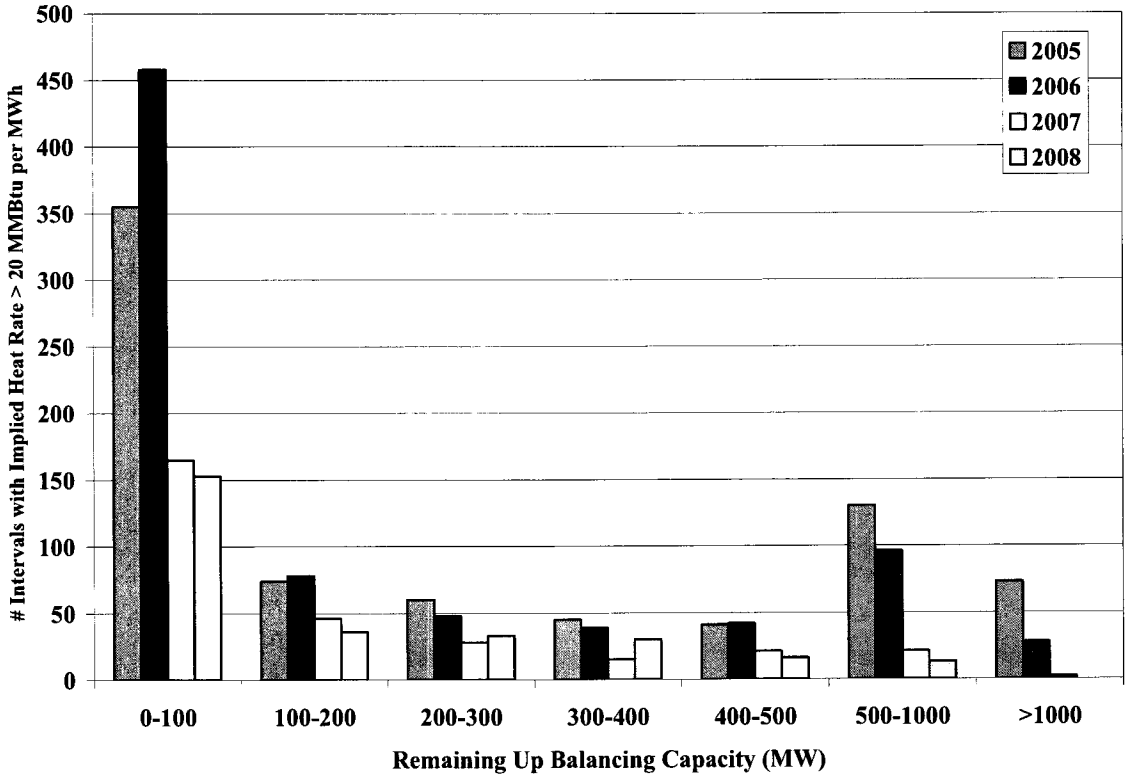
Figure 71 shows that the output gap quantities for incremental energy of large and small suppliers were very low across all load levels. Overall, the output gap measures in 2008 were comparable with the levels in 2007, with both years showing significant improvement over 2005 and 2006.[27] Figure 71 also shows that the increase in the incremental output gap for all market participants in 2008 at the highest load levels shown in Figure 70 is not only small in overall magnitude, but is higher for small participants than for large participants, and therefore does not raise competitive concerns.

A final measure used to evaluate the competitiveness of the market outcomes in 2008 analyzes the number of balancing energy market price spikes compared to the quantity of remaining Up Balancing capacity. If the market is operating competitively, price spikes should occur during shortage and near shortage conditions, and the number of price spikes should reduce significantly as the amount of available surplus capacity increases.

27 *See* 2005, 2006 and 2007 SOM Reports.

For the purpose of this analysis, a price spike is measured as an interval in which the balancing energy market price exceeded an implied heat rate of 20 MMBtu per MWh, which is greater than the marginal costs of most online generating units. However, the marginal cost of offline quick start units is often greater than this threshold. Thus, some of the price spikes in this figure are indicative of the deployment of quick start gas turbines, particularly in 2007 and 2008 when several market participants had well over 1,000 MW of quick start capability qualified to provide balancing energy. In contrast, in 2005 only one market participant had quick start unit qualified to provide balancing energy (Austin Energy; 7 units and approximately 330 MW), and in 2006 one additional market participant had qualified quick start gas turbines (CPS Energy; 4 units and approximately 200 MW).

Figure 72: Price Spikes vs. Remaining Up Balancing Capacity



The results in Figure 72 indicate very competitive market outcomes in 2008, with over 95 percent of the price spikes occurring during intervals with less than 500 MW of Up Balancing capacity remaining.[28] These results show significant improvement over 2005 and 2006 when

[28] The data in Figure 72 exclude intervals where there was zonal congestion or when non-spinning reserves were deployed.

only 74 and 84 percent, respectively, of the price spikes occurred during intervals with less than 500 MW of available Up Balancing capacity remaining.

The changes in the market outcomes from 2005 through 2008 shown in Figure 72 are consistent with expectations given the improvements in structural and supplier conduct competitiveness over this timeframe that are highlighted in Figure 66 and Figure 70.

Overall, based upon the analyses in this section, we find that the ERCOT wholesale market performed competitively in 2008.