Achieving Resource Adequacy in Texas via an Energy Only Electricity Market

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I. Introduction

Assuring a reliable supply of electricity in a market-based system has been a central concern in restructured electricity markets throughout the world and the subject of an ongoing debate among academics, industry leaders and policy makers. The crucial problem is how to reconcile engineering criteria for reliability and resource adequacy with market mechanisms that will provide price signals for investment, while satisfying regulatory concerns regarding just and reasonable costs for consumers and preventing market power abuse. Currently three prevailing approaches to assuring generation adequacy exist.

The first uses energy-only markets with limited price mitigation (for example, high caps on offers into market) that rely on energy remuneration and scarcity pricing to guide investment. The second uses adequacy mechanisms based on capacity products which take two forms: (a) capacity payments to installed or operational capacity, as in Spain, Italy, Korea and several Latin American countries and (b) capacity obligations imposed on Load Serving Entities (LSEs) that can be met in several ways, such as bilateral contracting with regulatory verification, such as in California, centralized capacity markets, such as in the North Eastern US ISOs, and combinations of bilateral contracting with bulletin board trading of standardized contracts or a central capacity market. The third approach which can be viewed as a market friendly version of the traditional integrated resource planning is based on central resource procurement that can take the following forms a) competitive tendering through a request for offers (RFO) process or bilateral negotiation such as in France and some other European countries, b) strategic reserve contracts between the Independent System Operator (ISO) and critical resources, as in the Nordpool countries.

In this chapter, we examine this debate through the prism of the Texas energy-only resource adequacy mechanism. In Section II, we review the intellectual and policy debate. Section III details the political evolution of the ERCOT market, the market that supplies electricity to most of Texas. Section IV reviews the origins of the ERCOT energy-only approach. Section V presents the details of the ERCOT energy-only resource adequacy mechanism. Section VI discusses the complications of adapting the existing ERCOT market design to accommodate the implementation of the approved energy-only approach and meeting the reliability needs of the ERCOT grid operator. Section VII contains our conclusions.

II. The Resource Adequacy Debate

The debate over whether capacity mechanisms separate from energy markets are needed in restructured electricity markets, whether such capacity markets need to be centralized and if so how should they be designed, has been going on for over a decade. The proponents of capacity mechanisms argue that given the technical, political and social realities of electricity markets, energy markets need to be supplemented by some capacity mechanism that will ensure generation adequacy.[1] The primary objective of such mechanisms is to create sufficient incentives for efficient investment choices. In most cases, however, this goal is interpreted as inducing investment in generation that will

[1] See, for example, Joseph E. Bowering, "The Evolution of PJM's Capacity Market" in *Competitive Electricity Markets: Design, Implementation and Performance*, Edited by Fereidoon P. Sioshansi, (February 2008), pages 363-386

meet prescribed reliability criteria based on technical rather than economic considerations. Stabilization of generators' income streams and restoration of the so called "missing money" that are suppressed by offer caps[2] and are therefore too low to recover fixed costs, is also often viewed as a means toward achieving the efficient investment objective. Capacity remuneration is a mechanism of choice from an engineering perspective since it is a "top-down" approach that supports the setting of capacity targets through centralized integrated resource planning and remunerating the resources on a cost accounting basis rather than on a market value basis.

The need for capacity remuneration in addition to payments for energy and reserve provision in the power industry is often rationalized on the grounds that electricity is a necessity and hence commodity prices must be controlled and supply adequacy must be ensured through regulatory intervention.[3] It is also argued by proponents of the capacity approach that *reliability* of supply, which has public good characteristics similar to national security or fire protection, is a distinct product from *energy*, and thus its supply needs to be regulated and paid for through capacity remuneration.[4]

On the other hand, from an economic point of view, the notion of capacity payments as a mechanism for cost recovery and supply adequacy assurance is an anomaly, unique to the electric power industry, and it originates in the regulated monopoly legacy of that industry. In any other industry, as capital intensive as it might be, suppliers assume investment risk and have the opportunity to recover their cost and profits by selling the commodity or service at competitive market-based prices, where the customers for the service (*for example*, load serving entities, or LSEs) assume price risk. The two sides manage their mutual risk through long-term bilateral contracting between them. This "bottom-up" approach, which treats electricity as a commodity and creates markets without a centralized planning mechanism, has been adopted in Australia, Alberta, and Texas.

From a theoretical economic perspective, the crucial question that must be addressed is whether a competitive energy market without separate capacity remuneration can produce the socially efficient technology mix and total capacity level.[5] The answer to that question is affirmative provided that the market is truly competitive so that generators behave as price takers and energy prices are allowed to reflect scarcity rents when supply is short. Indeed it can be shown that when the system is at its optimum in terms of total capacity and technology mix, and it is optimally dispatched (transmission

[2] Offer caps are common in various competitive electricity markets where offer prices are required not to exceed certain thresholds. The most popular offer cap threshold in U.S. electricity markets is $1,000 per MWh or per MW per hour. ERCOT competitive electricity market currently has an offer cap of $2,250 per MWh which is scheduled to be raised to $3,000 per MWh in early 2009.

[3] Hobbs, B.F., Inon, J. and Stoft, S.E., "Installed Capacity Requirements and Price Caps: Oil on the Water, or Fuel on the Fire?" *The Electricity Journal*, 14 (June 2001), pp. 23-34

[4] Abbott, M., "Is the Security of Electricity Supply a Public Good?" *The Electricity Journal*, 14 (July 2001), PP 31-33.

[5] Oren, S. S., "Ensuring Generation Adequacy in Competitive Electricity Markets", in Griffin and Puller ed. *Electricity Deregulation: Choices and Challenges, Bush School Series in the Economics of Public Policy*, (June 2005)

constraints notwithstanding) then paying for all the energy produced at each point in time the marginal cost of the most expansive unit dispatched at that time will result in a revenue shortfall for all units which is exactly equal to the capacity cost of the peaking unit. The above assumes some explicit or implicit uniform price, one sided auction mechanism where bidders reveal their true marginal cost, that enable active demand response at the retail level procures energy to meet forecasted inelastic demand.

The shortfall resulting from marginal cost pricing based only on generation cost, can be recouped, however, without the need for capacity payments by allowing scarcity prices to be set by demand response (at the value of lost load, or VOLL) whenever generation capacity is exhausted. [6] When timely demand response is not technically feasible, then demand response can be approximated by administratively setting the uniform clearing price to an estimated VOLL whenever demand is curtailed due to insufficient supply offers in the cost based uniform price auction. Under such a scheme the amortized cost of one MW CT per hour equals VOLL per MWh times the loss of load probability (LOLP) which is the condition for socially optimal capacity in the system. Although such a scheme can be implemented even in the absence of active retail demand response it would obviously benefit from active demand participation which would provide a market based VOLL instead of an administrative estimate[7]. The central challenges in implementing such a scheme are therefore (1) assuring a workable level of competition in the market so that generators are not in a position to exert market power on a sustained basis and (2) assuring that prices will reflect scarcity conditions. Satisfying these two conditions simultaneously is not easy, since market mitigation schemes used to ensure competitive prices often tend to suppress scarcity prices. Furthermore, shortage conditions are often masked and the scarcity rents muted by the system operator's deployment of reserves and by out-of- market actions aimed at maintaining system reliability and avoiding involuntary load curtailments.

In the following sections we will describe how the Texas market design has met the conditions that make an energy only market workable in terms of controlling market power and enabling suppliers to collect legitimate scarcity rents. We will also describe some on going efforts to reduce the tension between engineering procedure focused on reliability objectives that tend to mute scarcity price signals and the market goals of providing scarcity price signals that are needed to encourage investment.

We will begin by providing an overview of the political economy background and the evolution of the energy-only approach to resource adequacy in the Electric Reliability Council of Texas (ERCOT).[8] This section will follow with a description of the adopted rule and some design details along with the economic and political rational for the adopted features.

III. The Political Evolution of the ERCOT Market

[6] See Oren, *supra* note 5.

[7] See Lynne Kiesling, "The Role of Retail Prices in Electricity Restructuring," pages 39-62 in Kleit, ed., *Electric Choices: Deregulation and the Future of Electric Power* (2007)

[8] There are regions within Texas that are not part of ERCOT, where the Federal Energy Regulatory Commission (FERC), not the Public Utility Commission of Texas exerts jurisdiction on wholesale market issues.

The resource adequacy question in Texas arises in a policy context that has resulted in more competition within the Texas electricity market. The major factors in this context are certain landmark decisions made by the Texas Legislature and the corresponding implementation actions made by the Commission through its policies and Substantive Rules. The Texas Legislature passed two major electricity restructuring bills. The passage of Senate Bill 373 (S.B. 373) by the 73rd Texas Legislative Session in 1995 opened the Texas wholesale electricity market to competition with the understanding that any existing wholesale contracts remained in tact until the end of their terms and conditions.[9] In addition, Senate Bill 7 (S.B. 7) passed by the 75th Texas Legislative Session in 1999 amended the Public Utility Regulatory Act (PURA) to allow retail competition to begin on January 1, 2002, in the areas of Texas served by investor-owned utilities within the Electric Reliability Council of Texas (ERCOT) power region. Municipal and coop utilities can choose to opt in to competition.[10]

The Commission also took several actions with significant consequences since 1995. In general, the Commission's actions could be summarized into three categories:

1. Actions taken after the passage of SB 373 in 1995 resulted in the establishment of necessary rules that created a level playing field for all market participants in the wholesale electricity market. These rules created non-discriminatory access to the transmission system, as well as defining terms and conditions for interconnection to the transmission grid by new power sources.[11] In brief, easy interconnection of generation, encouraging aggressive investment in new transmission additions, and allowing socialized payment by all loads for new transmission were the main factors contributing to significant new generation additions in the ERCOT power region, or wholesale market.

2. Actions taken after the passage of SB 7 in 1999 resulted in the establishment of necessary rules that created a level playing field for all market participants in the retail electricity market. In addition, the Public Utility Commission of Texas (PUCT) also finalized market rules to set the parameters for the operation of the wholesale electricity market within the ERCOT power region as a single control area operation. These actions included important rules to unbundle integrated electric utilities functionally, to address treatment of stranded investment, to define a code of conduct for regulated utilities, to define customer rights and protections, and to set market design parameters and protocols for the wholesale market.

3. The Commission's firm standing of discouraging the construction of any new power plants by regulated utilities that could ultimately result in ratebase treatment of such additional investments. These plants could increase the magnitude of stranded investment and discourage competitive suppliers from

[9] PURA § 39.108.
[10] See Gulen and Wood, "Laying the Groundwork for Power Competition in Texas," this volume.
[11] See Totten, "Texas Transmission Policy," this volume.

entering into the incumbent utilities' service territories, which would ultimately harm the prospects for the development of competitive market and customer choice.

These actions taken by the Commission had major impacts on competition within the Texas electricity market. As a result of these factors, competitive electricity markets have been growing within ERCOT and independent power produces (IPP) have gained significantly in their share of installed capacity within ERCOT. The ERCOT power region has had more than ten years of wholesale competition accompanied with more than five years of retail competition. Customer choice is available to all customers within traditional investor-owned utilities' service territories, and there has been no regulatory price protection as of January 1, 2007, and there seems no apparent need for such protection. The Texas market is routinely ranked among the top competitive retail electricity markets in the world, based on the switching rates by retail customers among competing providers.[12]

The increase in the IPPs' share of installed generation capacities within Texas has been a blessing. Between 1995 and November 2007 approximately 37,000 MW of new capacity have been added in Texas. IPPs and other non-utility entities such as combined heat and power producers (CHP) accounted for more than 90 percent of all new capacity added in Texas.[13] Electric cooperatives and municipal utilities, which have chosen not to be competitive at the retail level, accounted for the remaining. In terms of power regions, about 83 percent of the new capacity was built in ERCOT and 9 percent was built in SPP (the non-ERCOT portion of Texas).

IV. History of How PUCT Chose the Energy-Only Approach

In 2001 the PUCT began a rulemaking on resource adequacy. As part of the proceeding, Commission staff (Staff) and stakeholders reviewed existing resource adequacy mechanisms, including the installed capacity (ICAP) markets. Following the lead of other established electricity markets in the United States, Staff proposed a centralized capacity market in 2002. Generation owners strongly favored capacity mechanisms, while retailers and industrial consumers took the opposite view.

In 2003 with the zonal vs. nodal market design debate dominating the stakeholder process and a very large reserve margin in the energy market, the PUCT decided that it could postpone consideration of a resource adequacy mechanism. Staff and a number of stakeholders noted that postponing the decision on resource adequacy would allow the PUCT to review the outcome of Federal Energy Regulatory Commission's (FERC's) Standard Market Design process, which might provide a capacity mechanism that the PUCT could adopt.

Despite having recommended the use of a capacity approach to resource adequacy for ERCOT, Staff had a number of concerns about a resource adequacy mechanism based

[12] Paul Grey, "Texas is the Rising Star," *Sparks*, Letter #31, (July 2006); Alliance for Retail Choice (Nat Treadway), *ARC's Baseline Assessment of Choice in the U.S.*, May 2007.

[13] Public Utility Commission of Texas, *New Electric Generation Plants in Texas*, November 16, 2007 at: http://www.puc.state.tx.us/electric/maps/gentable.pdf

on capacity payments. First, peaking and baseload units had two very different payment streams which were not easily reconciled in a capacity mechanism. Second, the locational and operating characteristics of the wholesale electricity market were not easily covered in a capacity mechanism. Third, retailers and industrial customers fiercely opposed capacity markets, believing that capacity payments had not proven to be effective in adding new generation into other markets. Fourth, unlike electricity markets on the East Coast, ERCOT by 2003 had already functioned as an energy-only market and had attracted substantial new investment without capacity payments.

During the suspension of the resource adequacy rulemaking, Staff had intended, as it did with the nodal market design, to look to the existing markets in the Eastern Interconnect for a solution to the resource adequacy issue. However, the flaws in the existing ICAP markets had become increasingly apparent, and no proven, existing model was present.[14] Even worse, from the Staff's point of view, a review of a draft of the Pennsylvania-New Jersey-Maryland (PJM) reliability pricing model (RPM) showed that far from developing a market-friendly solution to resource adequacy, PJM was moving in the direction of a centralized integrated resource planning approach.[15]

About the same time, the PUCT Commissioners were still reviewing alternatives to a nodal market design. In December 2004 the PUCT held two workshops on a nodal market design and its potential alternatives.[16] After the session, with doubts still lingering about nodal, Staff reviewed two existing zonal market designs – the U.K. and Australian electricity markets. The U.K. market design was quickly dismissed as an alternative, as the design of the market allowed the grid operator to actively contract for resources to counter the position of market participants when those positions were deemed unfavorable to the market. Such an approach was completely contrary to the approach ERCOT stakeholders had taken in designing the ERCOT market, a design that relied on the grid operator maintaining system reliability without considering the impact of its actions on clearing prices

Given growth in load and the retirement and mothballing of a number of inefficient gas-fired plants caused Staff to restart the resource adequacy rulemaking. In February 2005 Staff had a lengthy conference call with the market monitors of the Australian market about the various elements of the Australian market design. While it became evident that the Australian zonal approach would not easily be transferred to the ERCOT market, Staff found in the Australian New Electricity Market (NEMMCO)

[14] The troubled evolution of the capacity market approach has been highlighted in detail in Adib, Parviz, Eric Schubert, and Shmuel Oren, "Resource Adequacy: Alternate Perspectives and Divergent Paths" in *Competitive Electricity Markets: Design, Implementation and Performance*, Edited by Fereidoon P. Sioshansi, (February 2008).
[15] Adib, Parviz, Eric Schubert, and Shmuel Oren, "Resource Adequacy: Alternate Perspectives and Divergent Paths" in *Competitive Electricity Markets: Design, Implementation and Performance*, Edited by Fereidoon P. Sioshansi, (February 2008), section titled "Energy Market Alternatives to Capacity Mechanisms, pages 346-348.
[16] See Schubert and Adib, "Evolution of Wholesale Market Design in ERCOT", this volume.

market an energy-only resource adequacy mechanism that had been working successfully for more than six years. [17]

The evidence of a working energy-only market provided the stimulus to Staff and the needed reassurance to the Commissioners to pursue such a solution. Staff began drafting a white paper later that month to explore practical alternative approaches to address resource adequacy effectively. Because Wholesale Market Oversight (WMO) group of the PUCT was hosting the semi-annual Energy Intermarket Surveillance Group in April 2005,[18] Staff decided to host a workshop after the meeting so market monitors from the United States, Alberta, and Australia could make presentations on the two competing approaches to resource adequacy: an energy-only market vs. separate energy and capacity markets.

Staff filed a whitepaper at the Commission in the week prior to the workshop,[19] explaining how an energy-only approach might work in ERCOT. Staff also took the position that an energy-only wholesale market design combined with an active retail market would accelerate adoption of potential innovations, such as market-based demand-side response as well as upcoming technologies, such as advanced metering and solar power. Concerns expressed in the paper were the need to develop market-based demand response at the retail level, the determination of the offer cap level, and distinguishing the difference between scarcity pricing and the exercise of market power.

The authors believe that the workshop in April 2005 was the watershed event in moving away from a capacity approach to resource adequacy that was being considered at other electricity markets in the United States at that time. The Australian regulator made a persuasive presentation, showing that an energy-only market with active retail competition was not only feasible but had been thriving for more than six years. The Alberta regulator also showed an energy-only approach was being successfully used in North America.

The Commissioners used a subsequent workshop to allow energy-only market and capacity market proponents (ERCOT stakeholders) to make a case for each approach. At least one Commissioner had expressed the concern that capacity payments were subsidies, that once established, would be very hard to remove.[20] The capacity market

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[17] The zonal design that NEMMCO used included a mandatory centralized pool with side arrangements to address pockets of local congestion. This approach was inconsistent, with the desires of the market participants who preferred to use the zonal market to clear only the real-time energy imbalances to physical bilateral transactions in the wholesale energy market.

[18] Energy Intermarket Surveillance Group (EISG) a voluntary organization which includes about 20 Market Monitors from all electricity markets in the U.S. and Canada as well as additional Monitors from other electricity markets across the world.

[19] Schubert, Eric (2005), "An Energy-Only Resource Adequacy Mechanism", Public Utility Commission of Texas, Rulemaking Project No. 24255, April 14. http://interchange.puc.state.tx.us/WebApp/Interchange/Documents/24255_98_475491.PDF

[20] Public Utility Commission of Texas, Project No. 24255, *Rulemaking Concerning Planning Reserve Margin Requirements,* Memo from Commissioner Barry T. Smitherman, July 15, 2005.

proponents had difficulty coalescing around a single, workable structure, which foreshadowed the great difficulties and controversies that capacity mechanisms such as PJM's RPM and ISO New England (ISO-NE) Forward Capacity Market (FCM) faced in their development and approval. Not surprisingly, owners of large generation fleets favored a capacity resource adequacy mechanism, and retailers preferred an energy-only approach. Owners of smaller generation fleets were split on the issue but were concerned that the offer cap under an energy-only resource adequacy mechanism would not be high enough to be sustainable.

By the spring and summer of 2005 the Commission was faced with a fundamental choice with respect to the evolution of the wholesale market design and the potential continued success of retail competition: the PUCT could increase reliance on markets (energy-only approach) or return to the days of integrated resource planning (capacity approach).

The energy-only approach would create the potential for higher and more volatile prices during times of scarcity. Retail load aggregators, such as load-serving entities, would need to learn the skills to manage this price risk effectively. Generators, on the other hand, would face more investment risk than any other market in the United States. The symmetrical price and investment risk, if placed into the design properly, would provide strong incentives for innovation and longer-term bilateral contracting.

Within a few months of the April 2005 workshop, the Commissioners chose the energy-only approach and put Staff in charge of drafting the details. Given the strong similarities between the Australian and ERCOT markets, and the proven success of the Australian approach, Staff based its resource adequacy rule on the Australian resource adequacy mechanism with some deviations reflecting differences between two markets.[21]

The choices on the energy-only elements for the ERCOT electricity market were based on the prevailing political realities within ERCOT. ERCOT had a unified regulatory regime in place, where the PUCT is responsible for regulation of the wholesale and retail markets as well as the transmission grid. In addition, retail competition had been highly successful in ERCOT, without any contracting requirement with a "must-offer" of contracted resources to bring those resources into the real-time market. The ERCOT market had been relying on price risk for choices in scheduling and contracting of resources.

Market power abuse, particularly through physical withholding of resources, also was a serious reliability concern because ERCOT, like the Australian market, was a medium-sized isolated interconnect with a single settlement market,[22] where the risk of

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http://interchange.puc.state.tx.us/WebApp/Interchange/Documents/24255_175_484093.PDF

[21] Public Utility Commission of Texas, Project No. 31972, *Order Adopting Amendment to Substantive Rule 25.502, New Substantive Rule 25.504, and New Substantive Rule 25.505*, August 24, 2006, page 6. http://interchange.puc.state.tx.us/WebApp/Interchange/application/dbapps/filings/pgSearch_Results.asp?TXT_CNTR_NO=31972&TXT_ITEM_NO=78

[22] ERCOT, the Australian, New Zealand, and Alberta markets, all having energy-only resource adequacy mechanisms, have financially binding scheduling near real-time. In contrast, all nodal markets in the United States have in addition a financially-binding day-ahead market, also known as a two-settlement market.

sizeable system-wide frequency deviations due to loss of power resources is large and not uncommon. As a result, the energy-only market needed to provide incentives for generators to offer freely into the real-time market to obtain scarcity pricing rather than withholding resources to obtain scarcity pricing through an administrative pricing mechanism.

The remaining challenge the PUCT faced in developing the recently adopted energy-only resource adequacy mechanism was to incorporate a complementary market power mitigation regime.[23] Market power and resource adequacy intersect on the vexing issue of scarcity pricing. Failure to address market power results in prices that are too generous for producers based on their exertion of market power, resulting in price signals that do not truly reflect demand and supply conditions. In the long run, the resulting artificially high prices resulting from the exertion of market power are unsustainable; they undermine economic efficiency, weaken public confidence in the market, and create an uncertain regulatory climate that hinders potential investors in new generation,

Similarly, too much price mitigation results in prices that are too generous for consumers, blocking a signal reflecting actual demand and supply conditions. Low prices discourage generators from developing new generation to meet growing demand for electricity and from replacing older, less efficient generation available to run the handful of hours each year to meet annual peak demand.

Both of these outcomes will result in lack of adequate investment in merchant plant development and can cause undesirable shortages in power supply. Therefore, it is important for policy makers to address both issues, market power and resource adequacy, at the same time in order to ensure that the interdependencies between these issues are adequately addressed. As a result, the PUCT combined the ongoing resource adequacy and market power rulemakings into a combined proceeding.[24]

During the deliberations on the resource adequacy rulemaking, all three Commissioners stated repeatedly that increases in the offer cap had to be accompanied by more rapid disclosure of the information that affected the operation of the ERCOT markets. The proponents of increased disclosure argued that it would help to ensure the heightened market transparency and it would discourage potential market power abuse. Increased market transparency will reassure the public that price changes they observed were the result of a properly functioning competitive market,

The interrelationship between higher offer caps and reduced mitigation with more rapid disclosure of resource-specific offers information was consistent with disclosure policies in markets in the other U.S. and foreign markets. In 2006, when the resource adequacy rule for the ERCOT market was being considered at the PUCT, FERC jurisdictional markets such as PJM and ISO-NE, released resource-specific information six months after the information was gathered by these ISOs, which might be adequate

[23] The following discussion has been taken from Schubert, Eric, David Hurlbut, Shmuel Oren, and Parviz Adib (2006), "The Texas Energy-Only Resource Adequacy Mechanism", *Electricity Journal*, Vol. 19, December, pp 39-49**.**

[24] Public Utility Commission of Texas, Project No. 24255, *Rulemaking Concerning Planning Reserve Requirements*, Memo from David Hurlbut and Eric S. Schubert, October 31, 2005. http://interchange.puc.state.tx.us/WebApp/Interchange/Documents/24255_201_494897.PDF

when individual resource offers are heavily mitigated through conduct and impact tests and offer caps are relatively low. Rapid disclosure of resource-specific information appears to provide limited benefit under these circumstances in FERC-jurisdictional electricity markets, because prices are mitigated in advance of being announced to the market, and those rare circumstances when price spikes will occur are almost known to market participants.

In contrast, an energy-only resource adequacy mechanism with lighter mitigation of resource-specific offers is less predictable and less transparent. It was therefore argued that more rapid disclosure of resource-specific offers is needed to provide market participants with the same range of information and protection found in FERC jurisdictional markets. This combination of lighter mitigation and quicker disclosure is seen in established electricity markets outside of the U.S.: the Australian electricity market discloses resource-specific offers with the names of the generators making the offers within twenty four hours; the New Zealand electricity market discloses the same information within fourteen days; the Alberta electricity market displays the output of each generator, by name, on its website in real-time. Yet, it is still debatable whether disclosure of aggregate offer curves is sufficient to support competition and whether early disclosure of more detailed information serves primarily as a means of market mitigation *de facto* creating a "shame cap," which hopes to deter the exercise of market power by exposing to the public those firms exercising that power.

V. Details of the ERCOT Energy-Only Market

A. Higher Offer Caps and Scarcity Pricing

One of the PUCT's broad policy objectives in adopting an energy-only resource adequacy mechanism was to provide greater assurance that generation companies and developers would invest in the resources needed to supply the electricity needs of customers in ERCOT by allowing prices to rise in response to scarcity of resources in the market, in particular to encourage the development of such alternatives by providing incentives for the development of new peaking capacity.

The PUCT reasoned that a $1,000 offer cap could provide sufficient incentives for market participants to build and to contract for new baseload, intermediate, and intermittent renewable generation – resources that could meet about 98 percent of the electricity needs of ERCOT. ERCOT stakeholders, PUCT staff and the Commissioners believed, however, that a $1,000 per MWh offer cap might not provide incentives for the market to support the two percent of hours when electricity demand was at its highest – late weekday afternoons in the summer. New peaking generation or demand-side resources might need the opportunity to earn more than $1,000 per MWh (that is, scarcity pricing) in the ERCOT market to cover their capital costs during the very limited number of hours they were needed to meet the annual peak demand.

Allowing scarcity pricing would provide load serving entities with the incentive to procure sufficient peaking generation or demand resources as a hedge against scarcity pricing in the ERCOT spot market during annual peak demand. Concurrently, ERCOT would need to establish the appropriate credit limits on load-serving entities to limit their ability to take a large short position in ERCOT spot markets during annual peak demand. These policies would provide strong incentives for load serving entities to bring sufficient generation and demand resources to the ERCOT spot market during annual peak demand

to maintain reliable operation of the ERCOT grid without the need for out-of-market actions by the ERCOT grid operator or a capacity resource adequacy mechanism.

Another reason the PUCT chose an offer cap higher than the prevailing $1,000 per MWh was that under an energy-only resource adequacy mechanism, it believed that ERCOT could not rely on a daily ‘‘must-offer’’ requirement or capacity payments to ensure that sufficient resources are available in those situations. A higher offer cap could provide strong incentives for investment in quick-start generation and load response to meet demand in unusual market situations. These incentives are critical in maintaining reliability in ERCOT, which is a small electrical interconnect when compared to the Eastern or Western Interconnections in the U.S.

As outlined in the approved rule, on March 1, 2007, the offer cap rose from $1,000 per MWh to $1,500 per MWh.[25] On March 1, 2008, the offer cap rose to $2,250 per MWh. Finally, two months after the market begins operation under a nodal market design (sometime in early 2009), the offer cap will increase to $3,000 per MWh. The PUCT chose a significantly lower offer cap than its counterpart in Australia, in part because the ratio of all-time peak to average summer peak demand in ERCOT is not as high as it is in Australia.[26] The PUCT has decided to phase in the increase in the offer cap over a three-year-period, rather than implementing it immediately, consistent with the three-year timeframe in the rulemaking to gradually improve market transparency.

The PUCT also decided that to make the offer caps sustainable, ERCOT needed to increase the price responsiveness of load in ERCOT spot markets. The PUCT stated that the price elasticity of demand is limited by the lack of interval metering for many loads and plans to address this shortcoming in other PUCT rulemaking projects. The PUCT is considering requiring advanced meters for residential and other small loads to provide customers and retailers with more discrete electricity usage information than monthly billings and average load profiles.[27] The PUCT is currently conducing Project No. 34610, *Implementation Project Relating to Advanced Metering*, where PUCT staff is working with ERCOT stakeholders to develop a plan to implement the back office infrastructure and settlement software to allow for fifteen minute settlement of all competitive loads using advanced meters at some date certain.

B. Publication of Resource-Specific Offers into ERCOT-Procured Markets

Effective March 1, 2007, most of the required disaggregated information in the ERCOT market is to be disclosed ninety days after the day for which the information was accumulated. This is one-half of the previous disclosure timeframe of 180 days. The rule shortens the disclosure period to sixty days, then to thirty days, on the dates when the offer cap is raised from the current $1,000 per MWh to $2,250 per MWh to $3,000 per

[25] Public Utility Commission of Texas, Project No. 31972, *Order Adopting Amendment to Substantive Rule 25.502, New Substantive Rule 25.504, and New Substantive Rule 25.505*, page146

[26] Public Utility Commission of Texas, Project No. 31972, *Order Adopting Amendment to Substantive Rule 25.502, New Substantive Rule 25.504, and New Substantive Rule 25.505*, page 42.

[27] PUCT Substantive Rule 25.130, *Advanced Metering*. http://interchange.puc.state.tx.us/WebApp/Interchange/application/dbapps/filings/pgSearch_Results.asp?TXT_CNTR_NO=31418&TXT_ITEM_NO=110

MWh. The implementation schedule for disclosure was tied to the schedule for increases to the offer cap because throughout the debate in the rulemaking, all three Commissioners emphasized that these two issues were interrelated, as the potential for higher prices required greater assurances to the public that prices were the result of a competitive market and not market manipulation.[28]

One major exception to this disclosure schedule concerns offer curves by individual resources for balancing energy and ancillary services. These two areas raise the greatest concerns about the possibility of market power abuse and other market manipulation. In order to provide greater transparency to the public and affected market participants in these areas, the PUCT stated that it is appropriate to require the disclosure of offer curves for these services on a more expedited basis. The initial disclosure provisions in the PUCT rules were contested in Court by some market participants that eventually led to a compromise balancing some market participants' concerns about disclosure of strategic business information against the greater need for public scrutiny.[29] In its final ruling on the matter the PUCT decided that, as a general rule, the offer curves should be disclosed sixty days after the day for which the information was accumulated.[30]

As part of the disclosure rules, market price setters will be identified after forty eight hours for each settlement interval. For each period that it runs a balancing energy auction or an ancillary capacity service auction, ERCOT will publicly identify the name of the supplier with the highest-priced offer accepted, along with the price of the offer. This disclosure will be unremarkable and uninformative most of the time when prices are normal. When prices run high, however, the public will quickly know whose offer caused the price to clear where it did. A supplier will still be able to price its offer however it wants (up to the prevailing offer cap), but an offer that is obviously priced significantly above marginal cost will draw public attention if it ends up setting the market clearing price. This targeted transparency is intended to deter persistent gaming through the threat of intense public scrutiny of any inappropriate market behavior without compromising a supplier's ability to offer energy or capacity at prices sufficient to cover a unit's marginal cost.

Furthermore, to assist market transparency further when significantly high prices are offered, the Commission approved an event trigger to be used to identify portions of offer curves by market participants that should be disclosed to the market after seven days. The event trigger was defined as a calculated value for each interval that is equal to fifty times the Houston Ship Channel natural gas price index for each operating day,

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[28] Public Utility Commission of Texas, Project No. 31972, *Order Adopting Amendment to Substantive Rule 25.502, New Substantive Rule 25.504, and New Substantive Rule 25.505*, pages 27-28.

[29] *Constellation Energy Commodities Group, Inc. v. Public Util. Comm'n,* No. 03-06-00552-CV (Tex. App. -Austin) and *City of Garland v. Public Utility Comm'n,* No. 03-06-00571-CV (Tex. App. - Austin).

[30] Public Utility Commission of Texas, Project No. 33490, *Order Adopting Amendment to §25.502, Pricing Safeguards In Markets Operated By the Electric Reliability Council of Texas.*

expressed in dollars per megawatt-hour (MWh) or dollars per megawatt per hour (MW/h).[31]

C. Scarcity Pricing Mechanism (SPM)

The SPM, based on the Australian model, is intended to raise offer caps to encourage resource adequacy while preventing excessive transfers of wealth from load to generation during years when reserve margins are thin. The rule relies primarily on high energy offers by generators or by demand resources to set the scarcity prices during shortage periods. While such scarcity prices are justified and necessary for cost recovery in an energy only framework, time lags in construction of new capacity and limited demand response capability may result in prolonged periods of high prices and "excessive" recovery. Allowing such excessive recovery would result in an unwarranted transfer of wealth (at least from PUCT's point of view) to generators from load, a situation that the PUCT is attempting to prevent

The SPM operates on an annual resource adequacy cycle. In the annual resource adequacy cycle, the peaker net margin (PNM) is calculated as the sum of all positive differences between the clearing price in the ERCOT real-time energy market and the estimated marginal cost of operating a generic peaker with a heat rate per MWh of 10 million British thermal units (MMBTU). At the beginning of the annual resource adequacy cycle, the system-wide offer cap is set at the offer caps listed above, which is denoted as high cap (HCAP). If the PNM exceeds $175,000 per MW during an annual resource adequacy cycle, the system-wide offer cap will be reset at a lower level, denoted as low cap (LCAP)[32], for the remainder of that annual resource adequacy cycle. The offer cap would be restored to the highest level allowed in the rule at the beginning of the next annual resource adequacy cycle.

D. Exemption on System-Wide Market Power Based on Installed Generation Capacity, or "Small Fish Swim Free"

As explained above, the success of an energy-only market hinges on competitive offers that are not inflated through sustained market power abuse and scarcity pricing that reflects shortage conditions. This desired outcome traditionally has placed U.S. economists and policymakers in a difficult quandary. Economic theory suggests that price-taking behavior results in short-run marginal-cost pricing in the real-time market. However, short-run marginal costs would not allow for sufficient inframarginal profits to support peaking gas-fired generation that needed to recover a large amount of its fixed costs in the small number of hours it operated in a given year. Unfortunately, during those hours when inframarginal profits would be needed are also the times when a number of generation suppliers could exert market power and potentially inflate market prices. In order to restrict artificially high prices resulting from the exertion of market power (both local and system-wide), U.S. electricity markets have included market

[31] For a full copy of Resource Adequacy Rule, please see http://www.puc.state.tx.us/rules/subrules/electric/25.505/25.505.pdf.

[32] The low system offer cap shall be set on a daily basis at the higher of: (i) $500 per MWh and $500 per MW per hour; or (ii) 50 times the daily Houston Ship Channel gas price index of the previous business day, expressed in dollars per MWh and dollars per MW per hour.

mitigation on offers from generators. When offers from *peaking* generation are restricted by *ex ante* mitigation to reflect the short-run competitive outcomes, as has been done in FERC-jurisdictional wholesale markets, the result is inconsistent with scarcity pricing and inframarginal profits. Thus, when exploring the possibility of using energy-only resource adequacy mechanism, economists and policymakers have struggled with the "Gordian Knot" problem that has arisen in trying to determine the conditions when scarcity pricing was a function of the exercise of market power or genuine resource scarcity.

The "bottom up" alternative that has been used in the Australian market - light or no *ex ante* mitigation of energy offers from generation - relies on transitory (but not systematic) market power of pivotal suppliers and hockey stick bidding strategies during shortage conditions, to set scarcity rents through high offer prices. Such an approach works in Australia because generation ownership is sufficiently dispersed among market participants to make the exercise of market power transitory under limited conditions that correspond very closely to conditions of genuine scarcity, such as emergency conditions, depletion of operating reserves, or hours during summer peak when air conditioning use would be at its highest.[33] Depletion of operating reserves is another common metric for scarcity conditions used by many US ISOs, but such a metric would not be useful in Australia which does not have separate markets for operating reserves.

The Australian approach is contrary to the current stance of policymakers in FERC jurisdictional markets and the theoretical frameworks of leading U.S. electricity economists (almost all of whom favor a "top down" approach to resource adequacy).[34] As a result, it has been the subject of controversy or outright dismissal as a viable alternative for needed scarcity pricing in other U.S. electricity markets. The dismissal of the Australian approach may reflect the fact that a number of preconditions underpinning its success are far from being implemented in many U.S. electricity markets. Those include; a vibrant retail competition, reduced concentration of generation ownership, and state and federal policies that encourage the development of adequate generation and transmission resources.

The leading "top down" alternative for scarcity pricing, involves administrative intervention during shortage conditions that are typically reflected by emergency states and depletion of operating reserves (which could occur during summer peak hours when electricity use is near or at its annual peak). Such an approach was adopted at Midwest ISO (MISO) which will use an administrative demand function for reserves to calculate an adder to the market clearing price for energy when operating reserves are being drawn down to meet real-time demand. The "top-down" approach is well-suited at this point in

[33] Alan Moran and Ben Skinner, "Resource Adequacy and Efficient Infrastructure Investment" in *Competitive Electricity Markets: Design, Implementation and Performance*, Edited by Fereidoon P. Sioshansi, (February 2008), page 394, Figure 11.3, "Generation ownership: Capacity by market share."

[34] See, for example, Hogan W. "On an 'energy only' electricity market design for resource adequacy", Presented at the *11th Annual POWER Research Conference on Electricity Regulation and Restructuring*, Berkeley, CA (March 2006). Joskow, P. and Tyrol, J. "Reliability and Competitive Electricity Markets", *RAND Journal of Economics*, vol. 38-1, (Spring 2007), pp 60-80.

time for the MISO wholesale market, given that none of the MISO states either has retail choice or has a retail market nearly as active as ERCOT's.

The "top down" administrative pricing approach, however, was ruled out in ERCOT on the ground that it stands in conflict with the reliability needs of ERCOT's isolated interconnect and its active retail market. It has been argued that in the absence of a must-offer provision for contracted resources, administrative scarcity pricing would provide market participants an incentive to physically withhold generation to trigger scarcity pricing. Unlike in the Eastern or Western Interconnects, physical withholding of generation in ERCOT could cause severe reliability problems that would force the grid operator to intervene administratively to keep the lights on, potentially undermining the market. A must-offer obligation is present in markets with administrative scarcity pricing, but in ERCOT, such an obligation does not exist due to the retail market's need to avoid a regulatory requirement for bilateral contracting with a "must-offer" provision.

The Gordian Knot of genuine scarcity pricing was solved by Staff in the classical way – by making a "decisive cut." The new rule therefore gives small suppliers a safe harbor; if an entity controls less than five percent of the installed capacity in ERCOT, it is deemed not to have system-wide market power and therefore need not worry about prosecution if it decides not to offer any of its capacity into the market. On the other hand, exceeding the threshold does not necessarily mean the entity has market power. It does mean that if the supplier appears to be withholding production or appears to exercise economic withholding, and prices are being affected, the first question investigators will ask is whether the entity has market power.

The "small fish swim free" approach was the result of empirical review of balancing energy data by PUCT staff, which suggested that if the two or three largest generation fleets in ERCOT behaved as price takers and allowed others to offer as they wished, the market would produce high prices when genuine scarcity resulted, as is seen in the other single-settlement, energy-only markets of Alberta, Australia, and New Zealand. However, sole reliance on high offers from market participants to set scarcity rents in the Texas market is still being questioned and the debate is by no means over. In a recent report concerning a reliability event on March 3, 2008 when ERCOT experienced a large sudden drop in wind power, the ERCOT Independent Market Monitor, concludes that: "a) relying upon the submission of high-priced offers is an unreliable means of producing scarcity prices during scarcity conditions; and b) the price formation process during shortage conditions can become distorted if it does not include mechanisms to efficiently price the value of sacrificing the reserves that are required to maintain minimum reliability requirements."[35]

The quick disclosure of individual offers curves were another "bottom up" feature of market power mitigation in that it was intended to level the playing field and clarify when prices were a product of systematic power abuse or genuine scarcity, an alternative to the heavy unit-specific mitigation seen in other U.S. markets.[36] However, quick disclosure of individual offer curves ran against the grain of prevailing academic thinking

[35] Report on the wholesale market events of March 3, 2008, ERCOT Independent Market Monitor, Potomac Economics, LTD, Commission's Central Records in Project No. 23100.

[36] Given such programs as Genscape, Staff assumed that the large and more sophisticated players generally knew the bidding strategies of their competitors.

on tacit collusion, which suggested that revealed information on individual offers facilitates tacitly collusion among suppliers and helps them sustain high prices in access of competitive levels. The classic academic literature on tacit collusion concludes that the ability of competitors to cut prices "secretly" so that they are not exposed to retaliatory actions by their rivals, is an essential element of competition[37] These theoretical concerns have not shown to be problematic in the Australian market, according to Australian market monitors who conducted an internal review of historical price data.[38] After consultation with several market power experts in academia, a number of wholesale power marketers, and careful consideration by Staff, a final decision was made to delay disclosure of various classes of information long enough to minimize any potential consequences that may exist regarding too early disclosure.[39]

ERCOT stakeholders, other market monitors, and even academics continue to express skepticism about this combined 5 percent / quick resource-specific offer curve disclosure, though the first year of operation has shown this "bottom up" approach to be workable. A few more years of operation will provide adequate empirical experience to further evaluate the effectiveness of the approach taken by the PUCT to limit mitigation to only large market players.

E. Voluntary Mitigation Plan

A supplier that is too large for the small supplier exemption may also obtain advance protection against prosecution for market power abuse. The presumption is that the supplier would submit a voluntary mitigation plan that ensures transparency in the availability of resources (to avoid physical withholding) and makes the supplier a "price taker" during times of scarcity (to avoid economic withholding). This safe harbor, however, is specific to the supplier's own circumstances and must be approved by the PUCT. The new rule allows generators to apply for a voluntary mitigation plan that, if followed, would constitute an absolute defense against a finding of market power abuse with respect to the behaviors addressed in the plan. A large supplier may forego the voluntary mitigation plan altogether if it believes it has no need for it.[40]

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[37] Se, for example, Green, Edward J & Porter, Robert H, "Noncooperative Collusion under Imperfect Price Information," Econometrica, vol. 52(1), pages 87-100, (January 1984). Stigler, G. "A Theory of Oligopoly," *Journal of Political Economy* **72**, (1964) pp. 44-61

[38] Electronic correspondence from Australian market monitors to PUCT staff, Spring 2006.

[39] In addition to communicating with Australian market monitor, Mr. Peter Adams, Staff contacted several academicians, such as Professors Shmuel Oren, Frank Wolak, and Steve Puller, who felt too early information disclosure had the potential to harm the market. Furthermore, Staff was also influenced with positions taken by the Department of Justice and Federal Trade Commission that were supportive of adequate delay in disclosure of information well beyond two days in action in Australian market. .

[40] Luminant (formerly TXU Generation Company) filed the first voluntary mitigation plan that was approved by the Commission in August 2007. Please see: Docket No. 34480, *TXU Wholesale Companies' Request for Approval of a Voluntary Mitigation Plan Pursuant to P.U.C. Substantive Rule 25.504(e)*. For a critique of this mitigation plan, see Kleit, "Market Mitigation, ERCOT Style," this volume.

VI. Challenges in the Transition to a Sustainable Energy-Only Approach

When the Australian energy-only resource adequacy mechanism was introduced, competitive retailers had a contracting requirement for the first three years of the market as a means to ensure grid reliability in the real-time market.[41] The offer cap, set at $A 5,000 initially, also provided very strong incentives for retailers to bring sufficient resources to cover their real-time positions. As such, the Australian energy-only resource adequacy mechanism appears to have worked well from its inception.

ERCOT, on the other hand, has had some challenges in making the transition to a sustainable energy-only approach. First, the energy-only resource adequacy mechanism has been added to the existing physical bilateral zonal market design, which has relied on out-of-market actions that impact real-time pricing in ways not consistent with the energy-only resource adequacy approved by the PUCT. Such out of market actions include deployment of replacement reserves when the operator anticipates the depletion of the energy balancing stack and deployment of spinning reserves for energy, or deployment of RMR resources in order to relieve intrazonal congestion and violation of voltage constraints. In the context of the newly designed nodal market, deployment of incremental resources through the reliability unit commitment (RUC) process may be viewed as an out of market action. Second, as mentioned above, competitive retailers in the ERCOT market have never had a contracting requirement that would guarantee that sufficient resources would be brought to the real-time market. Retailers and other load-serving entities likely have had a learning curve in finding the correct balance between minimizing their procurement costs and reducing the risk of being exposed to the real-time market. Third, the gradual transition of an offer cap of $1,000 per MWh to $3,000 per MWh, levels far lower than the initial offer cap in the Australian market, in some circumstances has not provided sufficient incentives in the real-time market for quick start, gas-fired generation to be available to respond to reliability events on the grid and for loads to sufficiently contract to cover their load requirements in real-time.

Responding to these circumstances, in 2007 ERCOT stakeholders and the ERCOT Independent Market Monitor (IMM) expressed concerns that some of the defensive actions, such as using conservative load forecast and procuring more responsive reserve service, taken by ERCOT in fulfilling its reliability mission were interfering with market prices and in particular with scarcity pricing. ERCOT operations staff acknowledged this problem and worked with ERCOT stakeholders to address it. Part of the blame for the "excessive" out of market actions by the system operator was attributed to poor performance in meeting their operating reserve obligations by sellers of spinning reserves who do not account for their reduced capability under adverse weather conditions and sell more reserve capacity than they can provide. ERCOT has been trying to compensate for such reduced performance of its responsive reserves by "jumping the gun" in deploying non-spinning and replacement reserves which resulted in suppression of market prices.

The chosen solution was to increase procurement of responsive (spinning) reserves and enforce stricter compliance standards, such as more frequent and random

[41] Wolak F., "An Empirical Analysis of the Impact of Hedge Contracts on Bidding Behavior in a Competitive Electricity Market", *International Economic Journal*, Vol 14, No. 2 (Summer 2000), pp 1-39.

testing, on providers of such reserves. This would give ERCOT more headroom from a reliability standpoint allowing it operators to move higher in the real-time energy bid stack than it had in 2007, giving the market a chance to clear near the top of the offer stack to set scarcity rents before ERCOT needs to take out-of-market actions.

The increase in the procurement of responsive reserves began on January 1, 2008. The ERCOT IMM, in reporting to the ERCOT Technical Advisory Committee in early February, stated that the chosen solution appears to have been successful in sharply reducing the out-of-market actions by ERCOT operations and allowing the real-time energy market to better function.[42] This increase in the levels of responsive reserves could be considered an implicit mandatory insurance requirement (which is not that different than a capacity payment embedded in a bilateral contracting requirement), as loads would bear the uplifted cost for the additional resources. A parallel effort by ERCOT to improve reliability by enlisting demand side participation through an emergency load response service (EILS) has also been implemented and further improvements along these lines are being discussed[43]

These actions should be considered temporary fixes that could be implemented quickly given the prevailing software limitations and limited price responsive demand available in the real-time market. Eventually, in a real competitive market it is load response that should set scarcity prices, and steps are being taken in ERCOT market to bring that concept into reality within the next few years.[44]

Will all of this help Texas reach the promised land of competitive electricity deregulation? ERCOT will have tight reserve margins over the next few years, so the energy-only approach will be put through its paces right out of the gate. Eighteen months have passed since the decision by the Commission to allow scarcity pricing in ERCOT spot markets, and on March 3, 2008, only two days after the cap was raised to $2,250 per MWh, balancing energy prices reached that level for three consecutive 15 minutes intervals. These prices that are far higher than allowed in any North American markets

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[42] Dan Jones, "Wholesale Market Update," Presentation to the ERCOT Technical Advisory Committee, February 7, 2008. http://www.ercot.com/meetings/tac/keydocs/2008/0207/15._20070207_TAC_Meeting_%28D_Jones%29.ppt

[43] PUCT Substantive Rule 25.507, *Electric Reliability Council of Texas (ERCOT) Emergency Interruptible Load Service (EILS).* http://www.puc.state.tx.us/rules/subrules/electric/25.507/25.507.pdf

[44] Under the upcoming nodal market design, a greater range of controllable loads will be able to participate in the operating reserves markets on par with generation resources and curtail in response to real-time energy prices. In addition, the PUCT may allow residential and small commercial loads with advanced meters to be settled on their actual usage rather than an historical average profile. The benefits of allowing all loads to be settled on their actual usage with respect to grid reliability and resource adequacy could be substantial. For a more completion discussion see PUCT Project No. 34610, *Implementation Project Related to Advanced Metering,* BP Energy Company, "Comments on Questions Related to Implementing 15-Minute Settlement for Residential and Small Commercial Customers with Advanced Meters," March 28, 2008. http://interchange.puc.state.tx.us/WebApp/Interchange/Documents/34610_42_579661.PDF

have not in themselves created a large public backlash. However, while the trends look promising, the ERCOT market has yet to provide the levels of reliability by itself (that is, without the intervention of the ERCOT operator) that are seen in the Australian market. There is no doubt that the energy only approach to resource adequacy in Texas is much closer to the economic gold standard of a commodity market than capacity mechanisms such as FCM and RPM that are currently being used in the Eastern Interconnect. However, this mechanism should be considered only provisionally successful when compared to its Australian counterpart.

VII. Conclusion: Why an Energy-Only Approach in Texas?

The framework adopted in August 2006 by the PUCT for market power and resource adequacy is unique in the U.S. It establishes an energy-only resource adequacy mechanism in the ERCOT market that raises the offer cap above the $1,000 per MWh that prevails in other North American electricity markets.[45] The rule increases the role of market forces in determining wholesale electricity prices and enhances the information available to market participants by dramatically increasing market transparency through prompt information disclosure.

So why was Texas the first U.S. market to develop an energy-only resource adequacy mechanism? The authors believe that a number of circumstances contributed to its development that, with respect to the United States, is unique to Texas. Because the PUCT was the regulator over the wholesale market, retail market, and transmission grid in ERCOT, Staff had the freedom to be creative in developing a combination of best practices with innovative adaptations that the PUCT could implement by rule. In contrast, the ISO-NE's Forward Capacity Market was a complicated solution based on a multi-party compromise among state commissions, the ISO-NE, and market participants through an administrative law proceeding.

Staff took the approach of looking for best practices, even when they were tried in non-U.S. markets and were informed by contacts with market monitors in the United States, Canada, Australia, and the Pacific Basin and with the academic and consulting community addressing resource adequacy issues worldwide. Given that the debate on nodal market design issues was taking place concurrently, Staff needed to develop a deeper understanding of the nodal market design and was able to draw insights from the nodal debate that was applied in the energy-only resource adequacy design.

In looking across the globe, there seems to be a strong correlation among energy-only wholesale market design, generation-friendly transmission and generation interconnection policies, and successful retail competition. As described in Jess Totten's chapter, transmission policy and generation interconnection policy set in the early days of wholesale market deregulation in Texas in mid 1990s allowed a flood of potential generation projects to always be available to enter the ERCOT market with enough

[45] At this writing MISO is proposing pricing mechanism that would allow energy prices to rise to $3,500 when the energy price hits its cap of $1000/MWh and the reserve penalty factor set administratively through a demand function for operating reserves reaches its $2500/MWh maximum. The MISO resource adequacy proposal has been recently approved by FERC in Order 122 FERC 61,283, Docket No. ER08-394-000 (March 26, 2008) Also see MISO Electric Tariff Filing Regarding Resource Adequacy ER07-1372 and ER08-394.

transmission available to deliver the power from generators to loads without heavy congestion. The successful retail market in ERCOT created greater pressure from retailers and industrial customers to avoid implementing a “top down” capacity resource adequacy mechanism in ERCOT than was present in other U.S. markets.

Texas has taken a different approach to address resource adequacy by allowing higher electricity prices that improves the possibility of adequate recovery of investment while imposing much higher level of market transparency compared to all markets in the United States. In addition, adequate flexibility is provided to allow refinements if desired. A few more years of operation will provide adequate empirical experience to further evaluate the effectiveness of the approach taken by Texas to address the complex issue of resource adequacy.