

INVESTIGATION OF BULK POWER MARKETS

ERCOT (Texas)

November 1, 2000

The analyses and conclusions are those of the study team and do not necessarily reflect the views of other members of the Federal Energy Regulatory Commission, any individual Commissioner, or the Commission itself.

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1. Overview

The Commission has prepared this report about the Electric Reliability Council of Texas (ERCOT) region in light of its jurisdiction, though limited, over that system. FERC's jurisdiction is limited because the ERCOT system is isolated from the rest of the nation's power grid with the exception of two non-synchronous interconnections. Under Section 201(b)(1) of the Federal Power Act, the Commission does not have jurisdiction over facilities used for the generation of electric energy or over facilities used in the local distribution or only for the transmission of electric energy in intrastate commerce except as provided in other portions of the Act. One exception is provided in section 201(b)(2) of the FPA, which provides that the Commission does have jurisdiction over the connection of co-generation facilities to the grid under section 210 and over wheeling between utilities under sections 211 and 212 without regard to the limitations of Section 201(b)(1). The Commission also has jurisdiction over the two interconnects between ERCOT and the adjoining grid based on a settlement under Section 211.¹ The Commission also has limited jurisdiction over assets of holding companies that own facilities in ERCOT and outside ERCOT, and as such are subject to the Public Utility Company Holding Act of 1935 for purposes of mergers, consolidations, and the competitive aspects of corporate control. However, the Commission does not have the comprehensive jurisdiction over the ERCOT transmission grid that it does over transmission grids located in other parts of the country.

This chapter describes the bulk power system and market in the ERCOT region of Texas and has been prepared as descriptive background material for use by the Commission. The material is organized as follows: Section 2 summarizes the regulatory and institutional environment in Texas and how they developed; Section 3 evaluates the physical infrastructure of the Texas bulk power market, Section 4 analyzes the ERCOT market and key events in the market in the summers of 1999 and 2000, and Section 5 lists issues facing the ERCOT market. The data are derived from publicly available sources.

¹Central Power & Light Co., *et. al.*, 8 FERC ¶ 61,065 at 61,218-219, *reh'g denied*, 9 FERC ¶ 61,011 (1979).

2. Regulatory and Institutional Environment

A. Electric Reliability Council of Texas

Coordination of utility operations in Texas dates back to World War II when excess generation was sent to the Gulf Coast area to support the war effort. After the war, the Texas Interconnected System (TIS), as this group of electric utilities was called, realized the reliability benefits of remaining interconnected. Operating guides were formalized and security coordination functions in north and south Texas were established in the 1960s and 1970s. In 1981, TIS transferred all its operating functions to ERCOT.

Table 4-1. Texas Electric Market Milestones

| | |
|-----------|---|
| 1942 | Texas Interconnected System (TIS) established to support the war effort. |
| 1970 | Electric Reliability Council of Texas (ERCOT) formed to preserve reliability. |
| 1981 | TIS transfers its operating functions to ERCOT. |
| 1983 | Two (north and south) Security Centers were established to better coordinate interconnected operation of ERCOT control areas. |
| 1995 | Public Utility Regulatory Act passed requiring wholesale competition. |
| 1996 | ERCOT Independent System Operator (ISO) established to provide for open transmission access and takes on Security Center functions. |
| 1999 | Public Utility Regulatory Act revised requiring retail choice. |
| 2001 | Single control area becomes operational in ERCOT. |
| 2002-2004 | Retail choice program is to be implemented. |

The Electric Reliability Council of Texas was formed in 1970 as a regional council supporting the North American Electric Reliability Council. Unnecessary load shedding during severe cold weather in the winter of 1982 led to the creation of two Security Centers in 1983 that coordinated the interconnected operation of the ERCOT control areas operated by electric utilities. In 1996, ERCOT formed an Independent System Operator (ISO) to satisfy the requirements of the Public Utility Commission of Texas (PUCT) for deregulating the wholesale market in Texas. The ISO took over the functions of the two Security Centers in 1996.

B. The 1995 Texas Electricity Restructuring Statute

In 1995, the Texas legislature passed the Public Utility Regulatory Act of 1995. The Act found that utilities were in most regards monopolistic entities, but that the wholesale electric industry, through federal legislation, judicial, and administrative actions is becoming a more competitive industry that no longer lends itself to traditional electric utility regulation. The legislature therefore called for policies and regulations to address this situation. It expressly found that a more competitive wholesale electric market was consistent with the public interest.

Of particular import, the 1995 Act expressly permits utilities to price wholesale power at less than the maximum rate as long as the price exceeds the marginal cost of the power sold. Power producers who are engaged only in the wholesale power industry are exempted from regulation. The Act specifically required that all public utilities owning transmission facilities provide wholesale transmission service at rates, charges, terms of access, and conditions that are comparable to the rates, terms of access, and conditions that the utility uses for its own system. The PUCT was specifically authorized to require public utilities to provide non-discriminatory wholesale transmission to other utilities, qualifying facilities, municipal organizations, exempt wholesale generators, or marketers. It also charged the PUCT to develop a long-term strategic energy plan to assure that power sources would be adequate to meet the State's needs and empowered it to require public utilities to develop plans to meet those needs. The plans included the acquisition of additional sources of generation by the construction of utility owned generating plants, the construction of plants by affiliates outside the territory of the owning utility, and the purchase of power from facilities owned by third parties, such as exempt wholesale generators and qualifying facilities. The plans also included provisions for demand supply management.

The PUCT responded to the 1995 Act by requiring that ERCOT form an ISO. The filing approved by the PUCT, on August 21, 1996, charged the ISO with the responsibility of: (1) security of the ERCOT grid; (2) market facilitation, including the administration of the ERCOT OASIS; and (3) coordination of transmission planning in ERCOT. These duties went beyond the traditional security obligation and were expressly recognized as having a market facilitation function. The ERCOT Independent System Operator (ERCOT-ISO) began security center operations in 1996. It oversees the transmission systems of 16 transmission-owning member utilities. An ERCOT security coordinator on the job at all times in the ISO security center, is responsible for security within Texas and coordinating with other security coordinators outside Texas.

As first established, ERCOT ISO was governed by a board of 18 members consisting of 3 members for each of 6 groups: Investor-Owned Utilities, Municipals and Co-operatives owning transmission facilities, Transmission Dependent Utilities, Independent Power Producers, and Power Marketers. The ISO established staff groups to address reliability issues, the OASIS system and related issues of energy transaction scheduling and loss accounting, and supporting computer and technical services. The ISO specifically did not have any jurisdiction over the prices paid for wholesale power or the direct control of system generation or transmission, which remained under the control of

the nine control areas. Retail access was not authorized by the 1995 Act and no retail interests were included on the original ISO Board, but were added in 1999.

C. The 1999 Texas Electricity Restructuring Statute

On May 27, 1999, the Texas legislature passed S.B. No. 7. That Act provides the framework for open access transmission, the implementation of retail competition, and the reduction of air pollutants. S.B. No. 7 provides for a phased approach to developing a deregulated wholesale market and consumer choice at the retail level. The statute is based on a finding that the market for wholesale electricity is competitive and requires all incumbent utilities to provide immediately for non-discriminatory open access on their transmission facilities. The PUCT is charged with assuring that utilities comply with this obligation and guarding against market power in power generation.

No later than the effective date of retail choice, January 1, 2002, all incumbent utilities must separate their generation, transmission, and retail functions. This is to be done pursuant to plans submitted to the PUCT. The unbundling of the different functions can be accomplished through the use of affiliates and the sale of capacity to other parties. The state is to be divided into a number of power regions, and after January 1, 2002, no one generating company, including their affiliates, can own more than 20 percent of the generating capacity in any power region. A power region is conterminous with one of the nine reliability subdivisions within ERCOT or the relevant portion of a reliability region that located outside of ERCOT but within Texas. The 20-percent rule is complex, and operational or environmental factors, may result in the incumbent utility controlling more than 20 percent of capacity a single region. However, the rule itself and the PUCT's policy of preventing incumbent utilities or the affiliates from increasing their share of capacity in a single region reflects the State's concern with potential market power that can flow from concentrated supply in times of generation shortages.

Thus, incumbent utilities are generally precluded from constructing or acquiring any more generating capacity after May 27, 1999; they must develop plans to divest any capacity that would put them over the 20-percent ownership ceiling in any power region. Municipal power authorities are exempted from these provisions and from the obligation to participate in the PUCT structured open access regime. However, they must establish terms and conditions for the use of their facilities to permit open access operations at the local level. The PUCT is to review any charge of discrimination by a municipal power company to assure compliance with the statutory purposes.

S. B. No. 7 provides for the recovery of stranded costs. These include existing power purchase contracts or utility generation assets that may prove uneconomical in a more competitive environment. The amount of the stranded costs is determined by either (1) the market price of sales, (2) book value as of December 31, 2001, or (3) the projected loss of value based on a statutorily defined economic model, as implemented by the PUCT. The costs are to be recovered from all retail customers located in a utility's service territory on or after January 1, 1999, and may not be avoided by switching to another utility. The charge is billed directly to the consumer as a surcharge on the electric

bill. Utilities have the option, during the 4 years from 1999 through 2002, of shifting the depreciation their transmission and other non-generating assets to their generating units as a way of reducing the amount of total transition costs. While transition costs were originally projected to be as high as \$4.3 billion in 1998, the forecast has dropped to approximately \$700 million, much of it due to higher gas prices.²

S. B. No. 7 retains the requirement that any person, except an electric cooperative, wishing to construct generating or transmission capacity must obtain a certificate of public convenience and necessity from the PUCT. The statute does provides a limited time frame for review of the application and for accelerated review if there is a severe need for generation capacity in the area in which the facility is to be constructed. The review of applications for the installation of transmission capacity is be coordinated with the system needs of the ERCOT. Environmental review consists of water and air permits and provisions designed to provide protection to specifically enumerated shoreline areas.

The statute expressly provides that the PUCT does not have jurisdiction over the rates and prices of the wholesale market and that the PUCT's jurisdiction is related to preventing anti-competitiv behavior, discrimination in the use of transmission facilities, and the unbundling actions required by the statute. Under the open access regime, all generators, retail providers, and aggregators must be registered with the PUCT, which is required to provide standards for non-discriminatory marketing, billing practices, and service termination procedures. In addition to operating a control area and its traditional function of preserving reliability, ERCOT will ensure access to transmission services, settle accounts and register retail customers so they can switch energy suppliers quickly.

S.B. No. 7 also included an environmental enhancement program. The Texas Conservation Commission is charged with implementing a program that is designed to reduce nitrous oxide emission by 50 percent and sulfur dioxide emissions by 75 percent. Plants in existence before January 1, 1999, were not previously required to have an air quality permit. S.B. No. 7 requires all existing generating plants to obtain an air quality permit by January 1, 2004, or cease operations. The statutory scheme therefore puts considerable pressure on the owners of older facilities to shift to natural gas or to instal air pollution equipment on existing coal-fired facilities. Coal-fired generation makes up about a quarter of ERCOT current installed capacity. If a plan is in place to make the necessary changes by January 1, 2002, the utility may include the capital costs of compliance in its stranded cost calculations and surcharge. The program is reflected in the plans that the ERCOT-ISO is pursuing to upgrade transmission lines and replace capacity in the Houston/Galveston air quality non-attainment area. Similar programs are underway for the Beaumont/Port Arthur, and Dallas/Fort Worth non-attainment areas.

²Public Utility Commission of Texas on the Scope of Competition in Electric, Public Utility Commission of Texas, August 2, 2000, p. 23.

D. The New Wholesale Market and the Move Toward Retail Choice

Pursuant to Senate Bill 7, the Public Utility Commission of Texas has worked to set up a retail choice program and to establish a new wholesale market. The PUCT has adopted 15 major restructuring rules since November 1999 (Appendix A) and expects to finish 8 more major rules by February 2001. In these dockets, the PUCT has made some important decisions about the structure and operation of the new wholesale market. Texas has decided not to establish a government sanctioned power exchange. Although the PUCT has stated that the depth and liquidity of bilateral trading in the ERCOT market are inadequate for a fully functioning competitive market, the State has chosen to rely on private entities to utilize bilateral contracts for power exchanges among the distribution firms.³ The PUCT has expressly stated in its reports that forward contracting and hedging are essential in protecting against price spikes, and Texas law and regulatory policy contains no restrictions on such practices. As is discussed below, most generating capacity in the ERCOT area is sold under long-term contracts extending past 2005.

While not centralizing the market, the PUCT has decided to merge the existing nine control areas in ERCOT into a single control area operated by the ERCOT-ISO. The Texas Commission has stated that a single control area is needed to create a reliable open access transmission system. It therefore concluded that one entity should provide ancillary services, such as regulation and reserves. The solution adopted for congestion management was developed after negotiations among the various stakeholders. Since the new ERCOT control area will encompass a stand alone interconnection, the costs of generation redispatch to handle congestion can be internalized. Initially, redispatch costs will be allocated to load, assuring a uniformity of charges within each of the former ERCOT regions without regard to the transmission constraints that may exist between the regions. However, if redispatch costs reach a threshold, then a system of congestion charges and sale of transmission rights will be established that reflects the cost of redispatching power (within; among) the various zones.

Retail choice will not become effective in Texas until January 1, 2002, and a retail rate freeze is in effect for the period January 1, 1999, to December 31, 2002. The PUCT has stated that the current wholesale market is unlikely to be fully competitive until at least the end of 2002. Retail customers have the right to use level payment plans and all generating entities must offer 15 percent of their capacity as cost-based entitlements. Given these provisions, the PUCT is convinced that its retail choice program will avoid the problems California is experiencing. Generating supply should not be a problem. Between September 1995 and August 2000, about 4,700 MW of new generating capacity was installed in Texas. It is expected that between 1995 and 2002, the first year of retail choice, over 14,000 MW of new capacity will be operating. The Texas Commission attributes the willingness of non-utility generators to build in Texas to a streamlined, but fair and environmentally sound, facility approval process, a strong gas delivery system and the fact that load not generation pays for

³Public Utility Commission of Texas on the Scope of Competition in Electric, Public Utility Commission of Texas, August 2, 2000, pp. 12-13.

transmission service.⁴ Senior PUCT staff stated that a firm commitment to a greater reliance on competition, with consistent application of regulatory policies, is also recognized as contributing to a environment favorable for rapid investment in new generating capacity.

The PUCT expects a robust retail choice market with a significant number of retail customers switching suppliers. ERCOT will standardize the procedures for selecting suppliers and be the central clearinghouse for retail customer billing and supplier switching. The PUCT has also required the ISO to give consumer representatives three seats on its board. In addition, PUCT will establish a “price to beat” that avoids the error of a default retail rates so low that new retail marketers cannot compete. Traditional utility affiliates must charge the price to beat to residential and small commercial customers for 5 years or until 40 percent of their customers choose other suppliers. Despite the retail rate freeze, retail rates may rise because of rising fuel costs. The price floor (for affiliates) or ceiling (for competitive suppliers) does not apply to industrial and large commercial customers because it is believed they have sufficient access to alternatives. Under the statute municipalities and cooperatives do not have to adopt retail choice. However, if they do, they must do so under the PUCT rules.

3. The Physical Structure of the ERCOT System

This section provides an overview of the Electric Reliability Council of Texas power system. The bulk power configuration and capabilities of the transmission system are described first, followed by sections describing power generation and loads.

A. The Bulk Power Transmission System

The ERCOT Transmission System operates under the North American Electric Reliability Council (NERC) guidelines as administered by the regional reliability council: the Electric Reliability Council of Texas. The ERCOT reliability region is made up of nine control areas encompassing about 200,000 square miles or 73 percent of Texas. The balance of the state is served by portions of the Western grid (WSCC), in El Paso County and the Southwest Power Pool (SPP) serving the northwestern and the southeastern corners of the state. The ERCOT grid is separated electrically from the rest of North America. Two DC (direct current) ties link the ERCOT with SPP to the north and east.

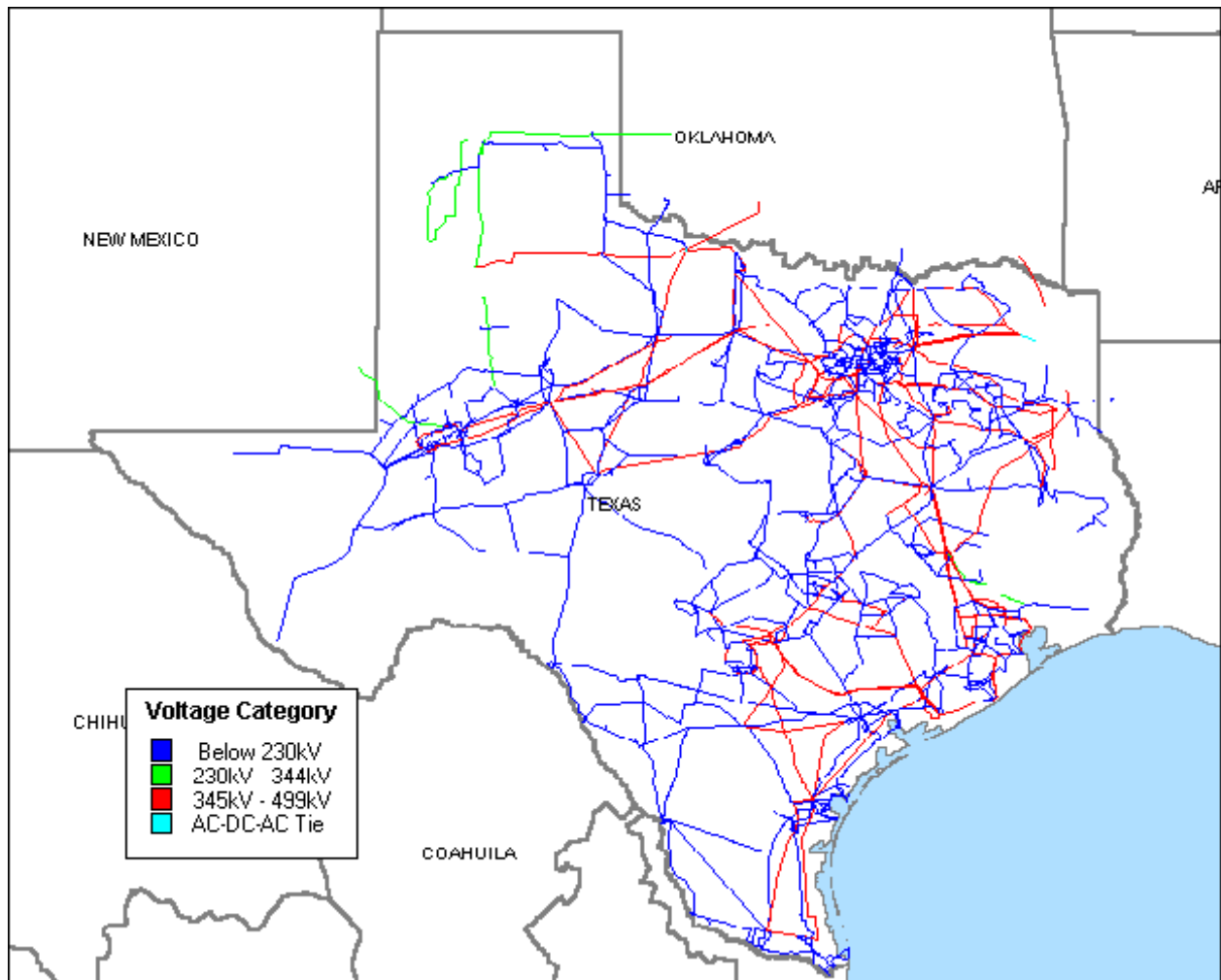
The ERCOT grid itself is a network of long-distance, high voltage transmission lines and substations that carry electricity to local utilities for distribution to 12 million customers, almost 85 percent of customer load in Texas. The transmission system stretches across approximately 7000

⁴Public Utility Commission of Texas on the Scope of Competition in Electric, Public Utility Commission of Texas, August 2, 2000, p. 35.

circuit miles. Approximately 20 percent of the existing transmission is high voltage, operated at 345 kV. Most of the rest is operated at 138 kV. Figure 4-1 shows the configuration of the Texas grid. The Texas Interconnection has limited transfer capability with other regions. The two DC ties together can transfer about 785 megawatts.

As previously noted, the ERCOT-ISO is responsible for grid reliability, coordinates regional transmission planning for future planned transactions and, ensures that expansion projects do not negatively affect the grid. ERCOT-ISO has received more than 110 requests for generation interconnection since 1997. The significant generating capacity additions under construction and planned in ERCOT are expected to put ERCOT's transmission under increased stress until such time as the grid enhancements

Figure 4-1. The ERCOT Transmission Grid (138kV and above)



Source: RDI PowerMAP Data, August 2000.

now under evaluation or construction can be completed. ERCOT and transmission service providers in Texas are working hard to address six major transmission constraints. There are seven major transmission projects supported by ERCOT and under development by transmission service providers. There are seven additional major projects that have been proposed and are recommended by ERCOT. Five regional planning groups, led by ERCOT, are considering 20 other major transmission projects. Many of these are new 345 kV lines.

To encourage investment in new generating capacity, the related transmission costs are borne by the owners of the transmission grid and included in the annual charges billed to load. As explained

by the PUCT, the theory is that the additional generating capacity benefits the system as a whole, and that this method reduces the ability of incumbent firms to discriminate against new generating capacity. ERCOT-ISO controls the terms for attaching to the grid and uses a standard connection agreement.

B. Generating Capacity

During the summer of 2000, ERCOT members had available approximately 62,000 megawatts of generation capacity. Existing and planned (as of January 1, 1999) generating capacity in ERCOT are shown in Table 4-2. Planned capacity in this table represents all new plants under construction or that have been announced.

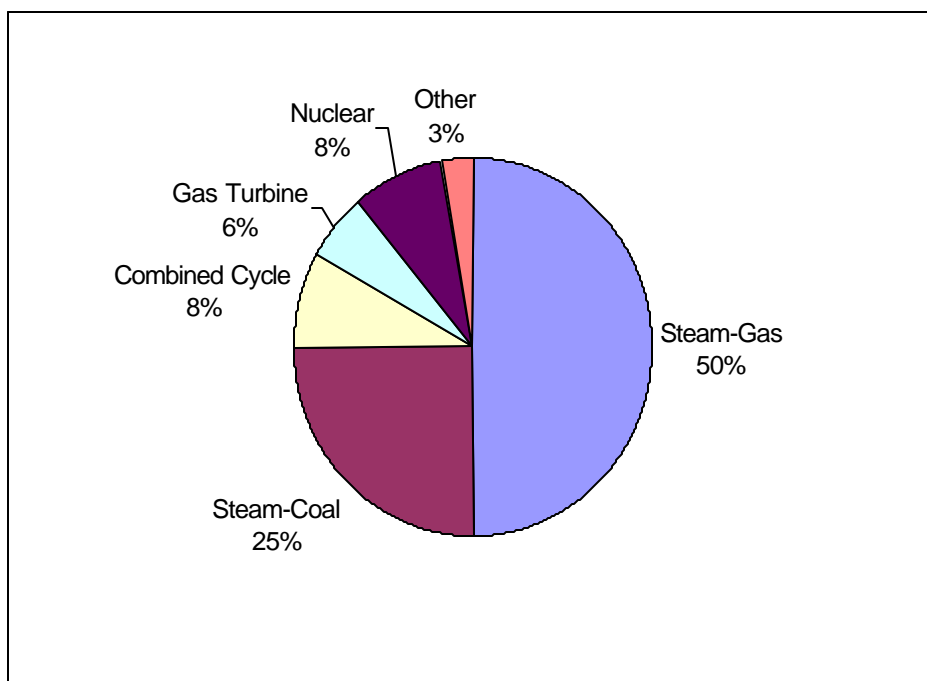
Table 4-2. Existing and Planned Generation Capacity in the ERCOT, as of January 1, 2000 (Megawatt)

| | | Planned Plants by Planned Online Year | | | |
|-------|----------|--|--------|--------|-------|
| | Existing | 2000 | 2001 | 2002 | 2003 |
| ERCOT | 60,480 | 8,243 | 10,221 | 14,582 | 5,068 |

Source: EIA-411, The ERCOT Wholesale Electric Market, Annual Report 1999.

Of the generating capacity in Texas, 90 percent is owned by traditional utilities. The other 10 percent is owned by non-utility generators. Figure 4-2 shows the various types of power plants operating in ERCOT. Over half of the total capacity is natural gas generation, which tends to be older and more expensive to operate than hydro power, coal or nuclear sources. About a quarter of the total is coal-fired capacity, including inexpensive mine-mouth lignite plants. Non-utility generation is mostly combined cycle gas plants. Almost all capacity under construction or planned in ERCOT is gas-fired, either gas turbine or combined cycle plants.

Figure 4-2. ERCOT Generating Capacity by Type, 1999



Source: RDI PowerDat data, August 2000.

C. Loads and Load Growth

Since the early 1990s, Texas has been enjoying a booming economy. Gross state product is growing at an annual rate of nearly 4 percent which is well above the national average. Personal income is growing at a 6-percent rate. The Texas Comptroller of Public Accounts expects the rapid economic growth to continue for the next several years.⁵ Another important factor in the growth in demand for electricity is population growth. It is projected that Texas' population will grow at a fairly steady rate of just under 2 percent over the next 5 years. This is about twice the national average. Several communities in Texas have seen 30 to 40 percent growth in population over the last 8 years.

Electricity consumption in ERCOT has been just short of 270,000 gigawatt-hours of electricity in 1998 and 1999. Texas ranks first in the nation in electricity consumption. ERCOT's all time peak demand was 57,731 megawatts on August 31, 2000. This was the third all time peak set during the summer of 2000. Demand growth in ERCOT has been strong over the last 5 years, as shown in Table 4-3. Over this period, the average growth in peak summer demand has been 4.12 percent in Texas. Adjusting for the abnormally hot weather in 1998 and 2000, the growth rate is slightly over 3 percent.

⁵Update on Activities in the ERCOT Wholesale Electricity Market, April-June 2000, Project 19616, Public Utility Commission of Texas, September 22, 2000, pp. 2-3.

Table 4-3. ERCOT's Actual Peak Demand and Percentage Increase
(1995-2000)

| | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 |
|-------------------------|--------|--------|--------|--------|--------|--------|
| Actual Peak Demand (MW) | 46,668 | 47,683 | 50,100 | 53,689 | 54,913 | 57,731 |
| Percentage Increase | | 2.2 | 5.1 | 7.2 | 2.3 | 5.1 |

Source: Public Utility Commission of Texas on the Scope of Competition in Electric, Public Utility Commission of Texas, August 2, 2000 and Press Release: Texas Breaks Peak Load Record for Third Time This Year, Public Utility Commission of Texas, September 1, 2000.

Peak demand levels have fluctuated over the last 3 years. These variations can be driven by many factors, but two major ones are changes in weather patterns and the surge in economic activity. Both of these factors have been present in recent years. The reduced growth in peak demand in 1999 was due to more normal summer weather than in 1998 and 2000.

Utilities in ERCOT have contracts with large customers to reduce or cut off their demand when operating reserves get tight. The ERCOT-ISO projects that about 3000 MW of interruptible load will be available during 2001 or just over 5 percent of projected peak demand.

4. Market Activities

A. Market Players

The major players in the ERCOT power market fall into the general categories found in other regions. The major players doing business in the ERCOT market are:

- *IOUs.* The four major investor-owned utility members of ERCOT are American Electric Power (which recently purchased Central and Southwest), Southwestern Electric Service Company, Reliant Energy's Houston Light & Power (HL&P), and Texas Utilities (TXU). They currently own and operate generation and transmission facilities, and provide distribution services to customers within their service territories. However, under the 1999 Texas electric restructuring statute, investor-owned utilities must unbundle their generating, transmission, and retail functions by January 1, 2002, and no one generating entity will be permitted to own more than 20 percent in any one power region in Texas. (See Section 2. D. above for more details.)
- *Municipal and other Public Owners.* Municipals, cooperatives and river authorities own

and control generation and transmission facilities and serve retail load. There are six municipal G & T (generation and transmission) and seven cooperative G & T and river authority members of ERCOT.

- *Non-Utility Generators.* Generators provide energy and ancillary services by contracting directly with buyers. They comprise 10 percent of the capacity in ERCOT. This share will grow because current Texas law effectively precludes the incumbent utilities from building and owning any more generating capacity.
- *Power Marketers.* There are 39 power marketer members of ERCOT. Marketers buy and sell energy in bilateral markets. Many power marketers operating in ERCOT also own generation.
- *ERCOT-ISO.* The ERCOT-ISO is responsible for security of the ERCOT bulk power system, facilitation of the market and coordination of transmission planning. The ISO ensures that all electricity buyers and sellers have an equal opportunity to use the transmission system, including operation of the ERCOT OASIS system. The ERCOT-ISO's role will expand as Texas implements retail choice. For example, the ERCOT-ISO will consolidate the operations of ERCOT's nine control areas into a single control area by 2002.
- *Transmission Dependent Utilities.* There are 14 transmission dependent utility members of ERCOT. Transmission dependent utilities own little or no generation and transmission facilities. They are primarily load serving entities and buy most of their power and transmission from other utilities.

B. The ERCOT Electricity Market

In many respects the ERCOT electricity market is still a traditional electric utility market dominated by vertically integrated utilities. At this time investor-owned utilities and G&T municipals and cooperative generate much of their own power to meet their retail load. Vertically integrated utilities own 90 percent of the generating capacity in ERCOT, which has a relatively thin short-term trading market. There is no central economic dispatch or power exchange.

Most transactions are on the basis of long-term contracts. Of the existing long-term wholesale contracts, one-half expire after 2015 and another one-third continue through 2004.⁶ ERCOT's short-term energy trading market accounted for just 3.3 percent of the total energy consumed in ERCOT in 1999. This contrasts with PJM's short-term market which accounts for between 10-20 percent of total

⁶Update on Activities in the ERCOT Wholesale Electricity Market, Annual Report 1999, Project 19616, Public Utility Commission of Texas, March 20, 2000, p. 8.

consumption and California's Power Exchange which accounts for around 90 percent of total consumption.

1. The Short-Term Energy Market

As stated above, load serving entities in ERCOT have a strong preference for long-term supply contracts. A consequence of this bias, which serves to perpetuate it, is how transmission service is paid for in ERCOT. Each year, load serving entities are required to specify the generation resources they have under long-term contract to meet expected demand. The annual fixed costs of the ERCOT utilities transmission systems are allocated to load serving entities based on peak demand (70%) and on the absolute megawatt-miles of transmission paths expected to be used (30%). This is called “planned transmission service.” Transmission service for short-term energy transactions is free, except for a small administrative fee. This is called “unplanned transmission service.”

There are nine types of unplanned energy transactions of different degrees of firmness. The pattern of short-term trading indicates that load serving entities use unplanned energy transactions to supplement their planned resources. Less than 4 percent of these trades are non-firm. The most established energy type, “ERCOT B”, is firm. The price of ERCOT B energy is used for ERCOT's market price index. Two other types of firm have been growing in popularity:

- “ERCOT D” is less firm than “B” and can be interrupted if a pre-specified unit goes down.
- “ERCOT G” is less firm than “B” and can be interrupted and redirected to a designated load entity to avoid taking emergency assistance.

ERCOT B, D, and G account for about 95 percent of all unplanned energy transactions. This means that when load serving entities enter the short-term market they primarily are backing up their long-term supplies, not trying to lower short-term costs.

Despite the fact that the PUCT has stated its concern that the thinness of the short-term market may weaken competition, this market is unlikely to grow significantly in the next few years. The construction of new plants by non-utility generators should make more capacity available to the short-term market, but the recent tight supply situation in ERCOT has led some utilities to contract for firm delivery from non-utility generators. This takes capacity out of the short-term market, which means that economy energy trading is almost non-existent in ERCOT. What little financially firm trade there was dropped significantly between the second quarter of 1999 and 2000.⁷

⁷Update on Activities in the ERCOT Wholesale Electricity Market, April-June 2000, Project 19616, Public Utility Commission of Texas, September 22, 2000, p. 7.

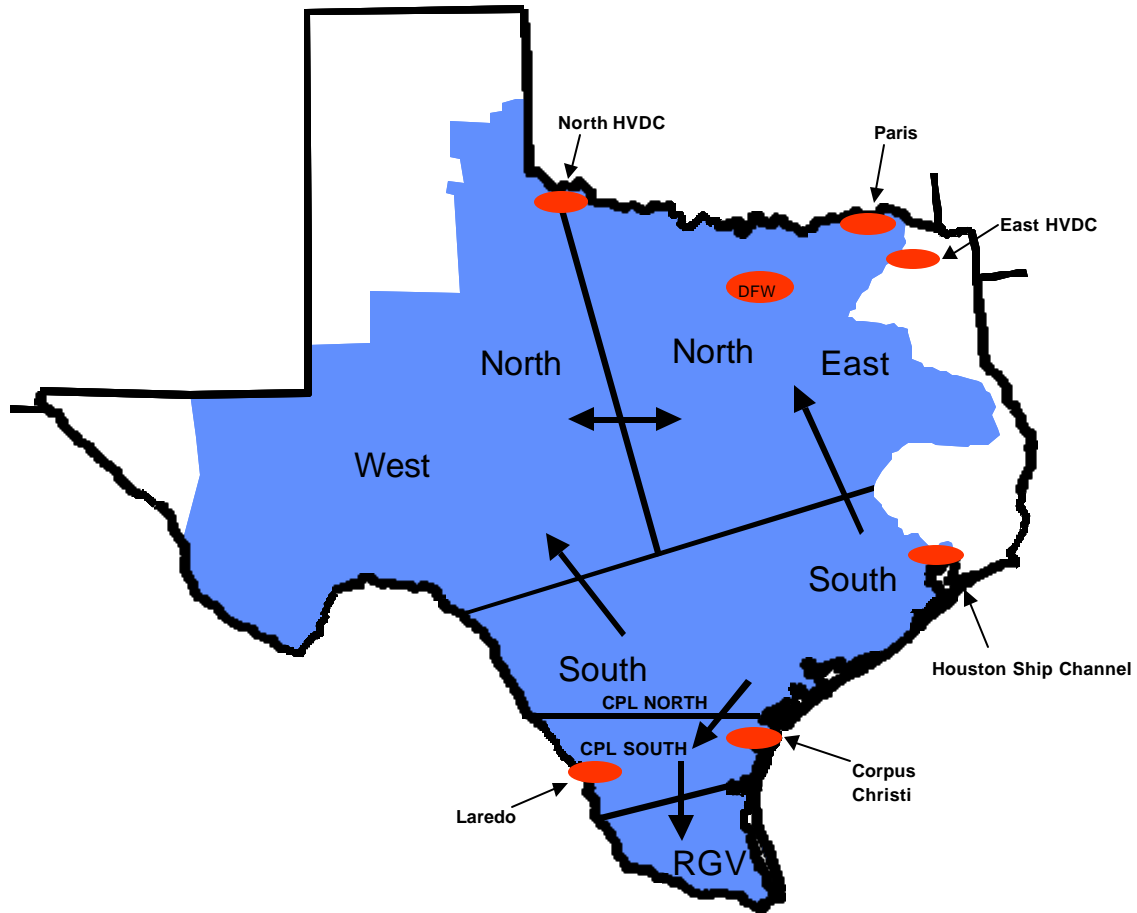
There are no price caps in ERCOT. Price caps have not been needed because the consequences of price spikes are so limited. This occurred because the spikes are not very high or sustained and the volume of trades at these prices are very small. Thus, price spikes in ERCOT's short-term market have served as a signal to build generation and transmission capacity without raising retail prices or harming utilities financially.

2. Transmission Constraints in ERCOT

The ERCOT transmission system contains a number of bottlenecks that limit ability to move power around within ERCOT. This restricts the ability of marketers and operators to move power from one portion of the system to another, constrain efforts to maintain reliability and limits efficient trading in the market.

Figure 4-3 shows the key points at which these constraints exist between south and north Texas, to and from western Texas, into the Rio Grande valley (RGV), on the DC tie between ERCOT and the Southwest Power Pool in northeast Texas and between the north and south parts of AEP's Central Power and Light operating company area. These constraints define distinct markets within Texas and are reflected in the Texas restructuring statute requirement that limits utilities to owning less than 20 percent of the generation within any one of 15 "power regions" in Texas.

Figure 4-3. Major Transmission Constraints in ERCOT



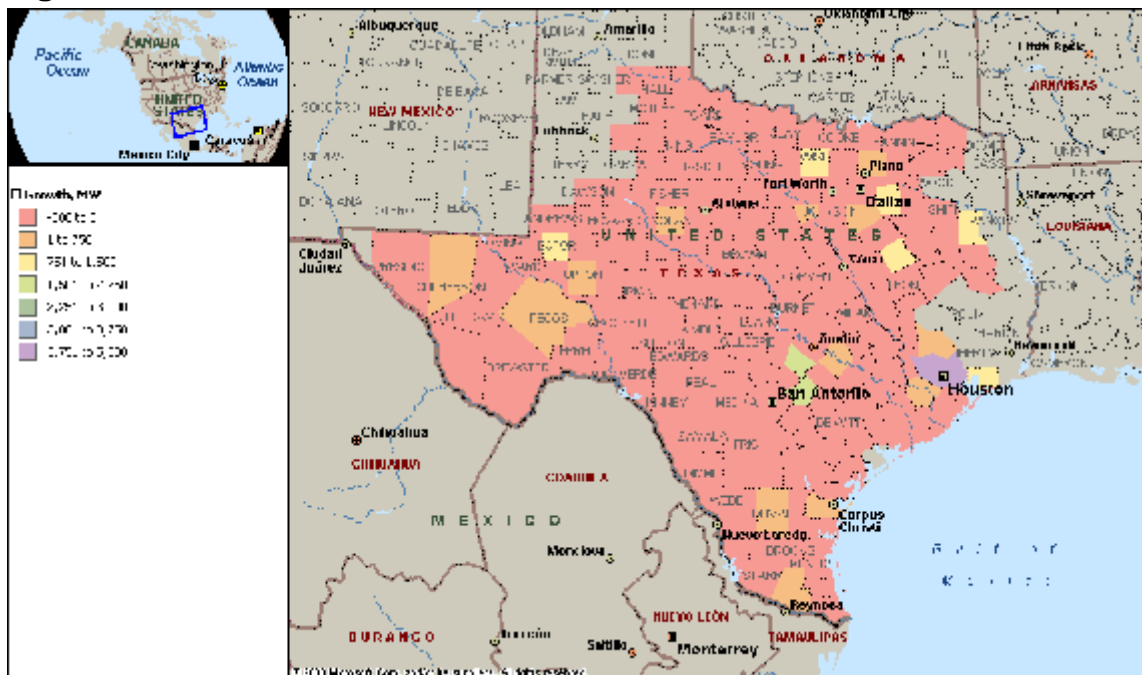
Source: Report on Existing and Potential Electric System Constraints and Needs Within ERCOT, ERCOT, October 1, 2000.

The current major ERCOT transmission constraints, as reflected in the arrows in Figure 4.3, are:

- South Texas “TO” North Texas - Thermal Limit ~2,000 MW total transfer
- West Texas
 - ~700 MW “TO” total transfer limit - Thermal Limit
 - ~900 MW “FROM” total transfer limit - Stability Limit
- Rio Grande Valley “TO”
 - ~905 MW total transfer limit - Voltage Stability Limit
- Northeast Texas - East DC Tie Area - Stability Limit
- North to South Central Power & Light - Thermal Limit

These transmission limitations also appear to have influenced the siting of new generating plants within the state. Because constraints make it difficult to transmit power across the state, much of the new capacity is being constructed near growing load centers. Figure 4-4 shows that between 3,751 and 5,000 MW of new generating capacity is under construction near Houston, which is expected to become a net exporter of power. From 1,501 to 2,250 MW of capacity is under construction between Austin and San Antonio. While little capacity is being built in Dallas and Fort Worth due to environmental limits, significant new capacity is under construction in five counties adjacent to Dallas-Fort Worth.

Figure 4-4: Location of New Generation in ERCOT



Source: Report on Existing and Potential Electric System Constraints and Needs Within ERCOT, ERCOT, October 1, 2000.

ERCOT has an aggressive transmission construction program to overcome the constraints within its service territory. Nine construction projects are now under way or under review, eight of which will be completed by December 2002, and an additional one which is under possible acceleration to be completed in the same year. Three projects that were originally to be completed by summer 2003 have been accelerated to December 2002, and three are to be completed not later than June 2001. Six of the projects are considered critical to relieving current congestion and possible reliability problems. The schedules reflect the liberal attitude toward transmission construction that the PUCT has adopted in Texas to meet the needs of the ERCOT bulk power system.

C. Performance in 1999

PUCT reports disclose that in 1998, the Public Utility Commission of Texas became concerned that generation reserves might fall below 15 percent (ERCOT's planned reserve margin). The PUCT identified utilities with potential capacity deficits below a 15-percent reserve margin and actively encouraged utilities to ensure adequate reserves. In summer 1999, there was barely enough supply to meet rising demand. One indication of short supply was how often utilities called on their interruptible customers to reduce demand. It got so bad that Texas Utilities' interruptible customers started complaining about frequent interruptions and how the program was run.⁸

Since 1999, a number of generation projects have been completed or announced that should gradually ameliorate the situation. Before the summer of 2000 (June 1), about 2,600 MW of new generating capacity was completed. Currently under construction in ERCOT is about 8,500 MW of capacity expected to be available before June of 2001, and another 4,600 MW before June of 2002. 20,000 MW has been announced that may be completed in the 3 to 4 years.⁹

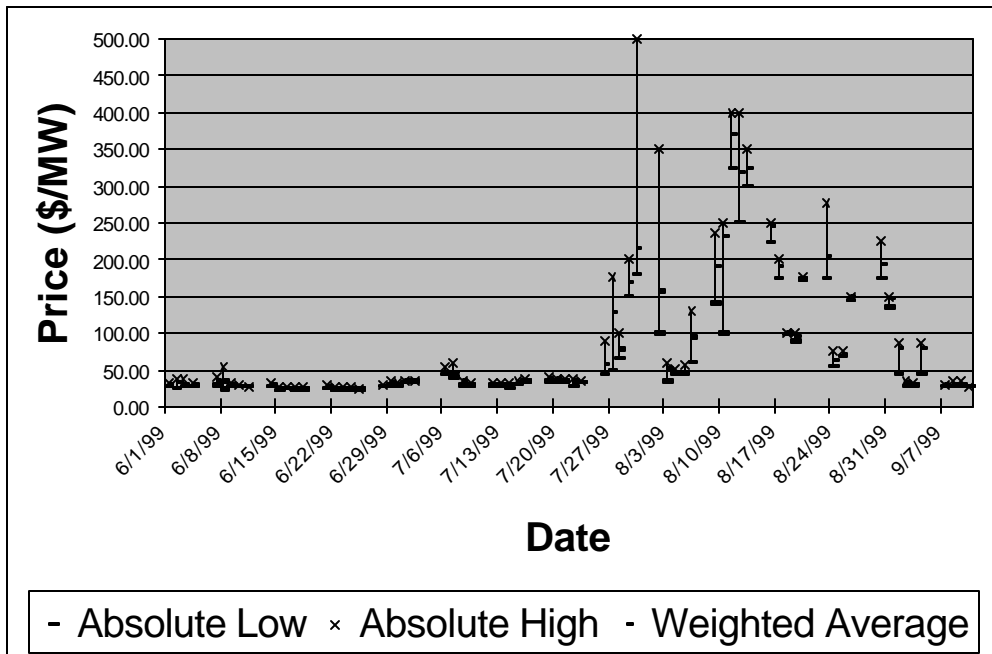
D. Key Events in Summer 2000 in ERCOT

In addition to the expected supply shortfall in 1999, price spikes helped spur construction of new generating capacity. For much of the year, the price for ERCOT B traded between \$20 and \$30 per MW. However, the ERCOT market has seen some price volatility in the summer months. In late July and throughout August 1999, ERCOT's short-term market experienced price spikes as high as \$500 per MWh (see Figure 4-5). All transactions in ERCOT are bilateral and most load is supplied under long-term contracts. Unlike in California this summer, these high prices affected only a small

⁸Public Utility Commission of Texas on the Scope of Competition in Electric, Public Utility Commission of Texas, August 2, 2000, p. 42.

⁹The latter is subject to the caveat that announced capacity that is not now under construction will not be available for at least 2 years and could be canceled or deferred relatively easily before its announced completion date.

Figure 4-5. ERCOT B Daily Energy Prices for Summer 1999



Source: ERCOT Unplanned Transaction Data.

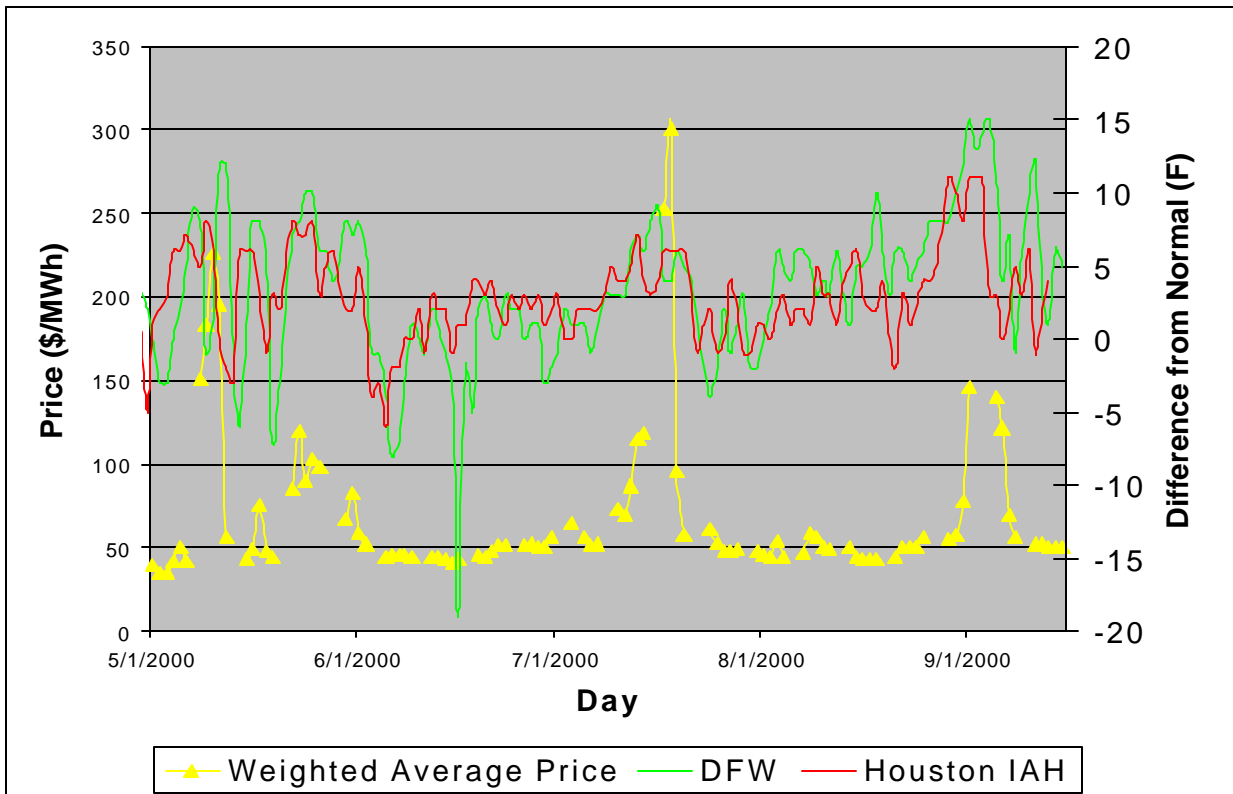
number of transactions.

Even with the addition of significant new generating capacity for the summer of 2000, it was an unusually hot summer and peak demand and short-term prices rose sharply. Figure 4-6 plots short-term energy prices and temperature differences from normal at the Dallas-Fort Worth and Houston's Bush International airports. It shows a fairly close relationship between unusually high temperatures and spikes in short-term energy prices.

ERCOT set all time peaks three times this summer. Demand reached 55,796 MW on July 19, 55,994 MW on August 30, and 57,731 on August 31. The previous peak high was 54,849 in August 1999. August 31, 2000 saw 109 degree temperatures in College Station, 108 degrees in Dallas and 107 degrees in Austin. These temperatures were 10 to 15 degrees above normal.

Although demand did not reach an all time high peak, the week of May 7, 2000, was probably the most difficult for operators in the ERCOT region. Just as in the Northeastern United States, a heat wave hit before all plants were back in service from the spring plant maintenance season. (ERCOT asks plant operators not to schedule maintenance outages after mid-May.) Temperatures were around 10 degrees above normal for four days in Dallas-Fort Worth and 6-8 degrees above normal in Houston. Operators had to call on some interruptible customers to shut down to keep the lights on.

Figure 4-6. Weighted Average ERCOT B Daily Energy Prices (to 7/1/2000) & Daily Spot Prices (after 7/1/2000)

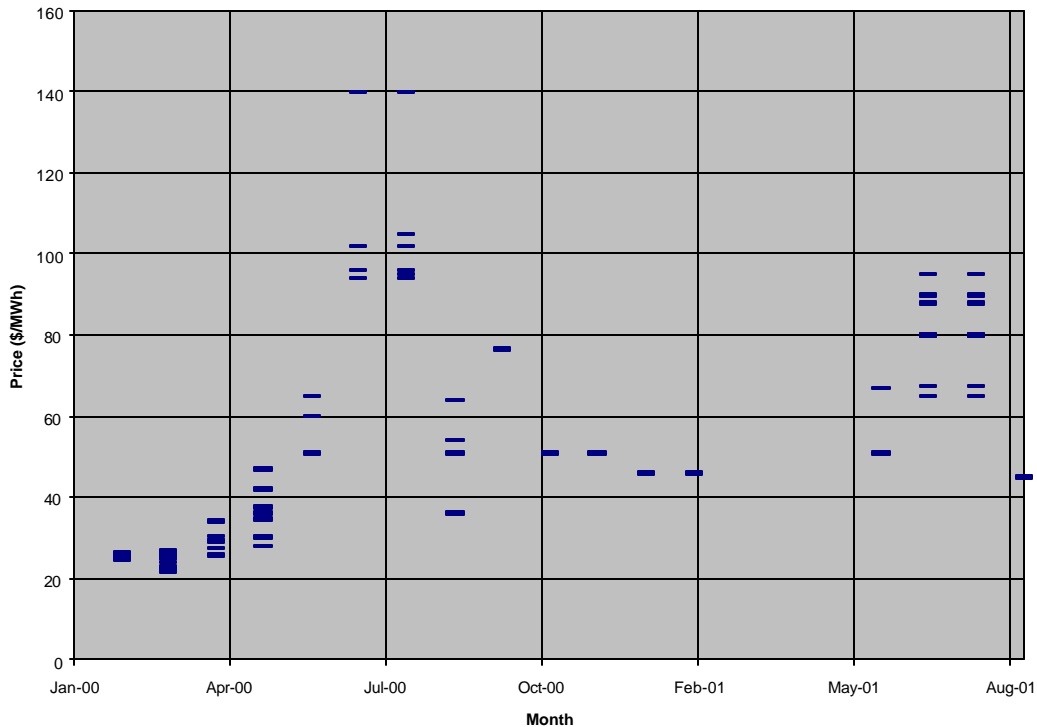


Source: ERCOT Unplanned Transaction Data and *Power Markets Week's Daily Peak Spot Price Index*, Unedited Local Climatological Data, NOAA, National Climatic Data Center, 2000.

(Interruptible customers were not called on during the other summer 2000 heat waves.) Short-term energy responded to the supply shortage by rising to around \$200 per MW for several days in the middle of the week of May 7.

The expected increase in capacity of 8500 MW by June 1, 2001 represents about a 13-percent increase in the 62,000 MW of capacity that was available in the summer of 2000. Since the ERCOT was generally able to cope with a 5-percent increase in demand in the year 2000 over the prior year 1999, there should be adequate capacity to meet next summer's demand even if temperatures continue to be unusually hot and demand increases by the same amount.

Figure 4-7. Contract Transactions for Monthly Firm Energy in 2000-2001



Source: *Power Markets Week* monthly forward market data.

The expected increase in capacity and the fact that the overall market is relatively stable has not deterred the ERCOT utilities from hedging against price next year. Figure 4-7 show transactions for June and July 2001. Recognizing that the number of transactions is limited, the peak months reflect contract prices that are about three times the price level of the rest of the year. However, the maximum prices are lower than those of the prior year and reflect the additional capacity that is coming on line. In 1999, a year of normal weather, but one where supply was short, the range was \$61-87. In the year 2000, with high temperatures and constrained demand, the range was \$63 to 140. For the July-August 2001, the current range is \$67 to \$95. Thus, while the prices may vary depending on the market involved, a combination of increased capacity and an bilateral hedging system appears to be resulting in lower overall prices.

5. Conclusions

This report has surveyed the ERCOT region and reaches four basic conclusions:

1. While the ERCOT system suffers from transmission constraints, these are being addressed in an orderly and aggressive fashion and do not appear to present serious reliability issues. Rather, the principal impact of such constraints is on the ability to deliver power between ERCOT subregions, which reduces competitive alternatives. As the transmission system improves, broader sources of supply should become available throughout the ERCOT system.
2. Generation is being added at a sufficient rate that the ERCOT area is much less likely to encounter the sharp price spikes that have been experienced in previous years. Mandatory level payment plans, providers of last resort, price to beat, and the liberal use of forward contracting should further mitigate any rate shocks. Price spikes are already relatively transitory, and the requirement that the concentration of generation ownership be reduced is a further safeguard.
3. The additional generation and transmission capacity that has come on line, is under construction, or projected has been encouraged by three significant factors: economic growth, the prospect of serving a deregulated or lightly regulated market (wholesale prices are exempt and retail will be substantially so in 2002), and a stable and well defined, if progressive, regulatory environment. Due to the growth and stable regulatory climate, business risk is relatively low for the first wave of new entrants. This permits potential entrants to more accurately judge the market value of the capacity that they propose to construct.
4. Control of electric deregulation in Texas is vested in one regulatory body with a clearly defined mission, explicit instructions on the pace of deregulation, and with responsibility of assuring the generation supply is adequate to meet projected increases in demand and that plans are developed that will achieve that goal. The legislature has limited its role to creating two detailed organic statutes, and thereafter to receiving quarterly and bi-annual reports on the structure of the market. This fixes regulatory responsibility, and is reflected in the orderly and well phased, approach pursued by the PUCT, and in the professionalism exhibited by its rulemakings, data, and reports.

Appendix Major Restructuring Rules

| Major Restructuring Rules Adopted By PUCT | Date Adopted |
|---|---------------------|
| ERCOT Independent Organization Funding | 9/9/1999 |
| Electric Service for Public Retail Customers | 9/23/1999 |
| Code of Conduct for Electric Utilities and Affiliates | 11/11/1999 |
| Rules for Interconnecting Distributed Generation | 11/18/1999 |
| Electric Reliability Standards | 12/1/1999 |
| Goals for Natural Gas Generating Capacity | 12/1/1999 |
| Terms and Conditions for Transmission Service, including Tariffs and Modifications to Existing Transmission Rules | 12/1/1999 |
| Cost Unbundling and Separation of Business Activities | 12/16/1999 |
| Renewable Energy Mandate | 12/16/1999 |
| Energy Efficiency Programs | 2/24/2000 |
| Registration of Power Generation Companies and Aggregators | 5/31/2000 |
| Certification of Retail Electric Providers | 7/12/2000 |
| Market Power Mitigation Plans and Generation Capacity Reports | 8/10/2000 |
| Retail Competition Pilot Project | 8/10/2000 |
| Standards for Recognition of Cost of Environmental Cleanup or Plant Retirement | 8/24/2000 |

| Proposed Major Restructuring Rules | Target Date |
|---|--------------------|
| Customer Protection Rules | November 2000 |
| Capacity Auction | November 2000 |
| Terms and Conditions for Transmission and Distribution Utilities' Retail Distribution Service | December 2000 |
| System Benefit Fund Administration, Low-Income Customers | December 2000 |
| Provider of Last Resort | December 2000 |
| Price to Beat | February 2001 |
| Code of Conduct for Municipal Utilities and Electric Cooperatives | February 2001 |

