CHAPTER 27
Electricity

INTRODUCTION

Electrical power is of great importance in Texas, due to the state's climate and industrial base. Electricity is essential for Texas factories, businesses, homes and most recreational facilities. Even a temporary loss of electricity can cause not only minor and major inconveniences for our citizens, but significant losses to our economy.[1] Texas leads the nation in the generation and consumption of electricity.[2]

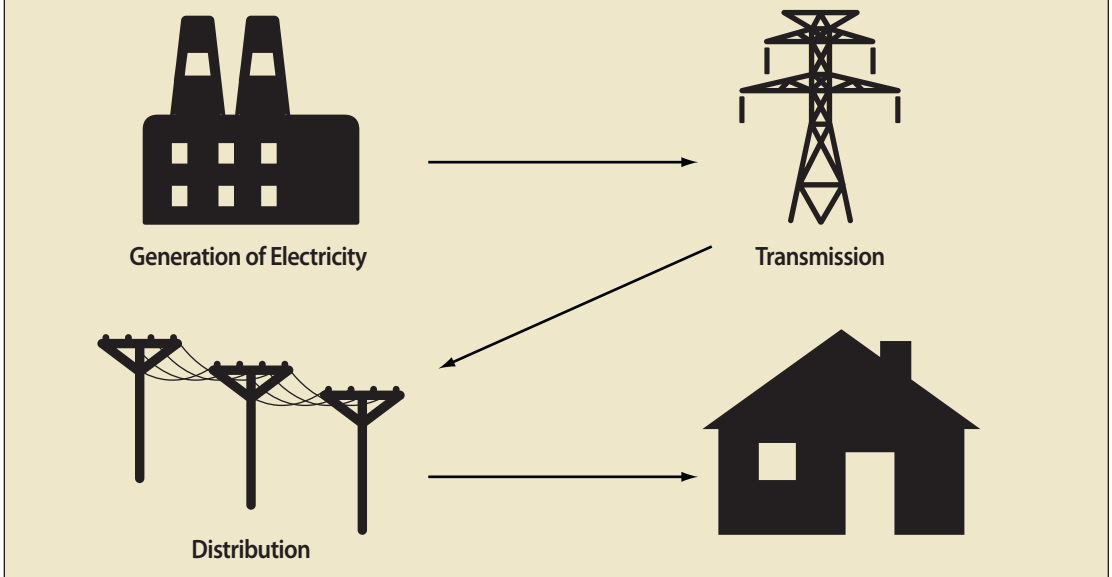
Electricity is a *secondary* energy source, meaning that it comes from the conversion of other sources of energy, such as coal, natural gas, oil, wood and nuclear power. The energy sources used to make electricity can be renewable or non-renewable, but electricity itself is neither. It can be considered a *carrier* of energy rather than an energy source.[3]

Electricity is the flow of energy in the form of electrically charged particles that are repulsed by similarly charged particles and attracted by particles of the opposite charge. All electric power flows through an integrated system of transmission and distribution lines. This system has physical boundaries, making it "the electric grid."

Large-scale electric generators, such as coal plants or large wind farms, are connected to transformers that increase the electricity's voltage, or potential energy, enabling it to be sent via transmission lines over long distances. Transmission lines carry electricity to substations equipped with other transformers that decrease the voltage; from there, the low-voltage electricity is carried on distribution lines to industrial, commercial and residential customers (**Exhibit 27-1**).

EXHIBIT 27-1

How Electricity Flows To Its Users



Source: Energy Information Administration.

The energy sources used to make electricity can be renewable or non-renewable, but electricity itself is neither.

Three electric grids, or interconnections, serve North America, and all cover a portion of Texas. The Western Interconnect includes the El Paso region; the Eastern Interconnect includes the Panhandle, the Beaumont area, and portions of Northeast Texas; and the Electric Reliability Council of Texas (ERCOT) region covers everything else — 75 percent of Texas's land area and 85 percent of the electric load.[4] The Public Utility Commission of Texas (PUC) is responsible for regulating nearly all aspects of the ERCOT market, and certain aspects of the other regions, such as ensuring consumer protection.

The Texas Legislature's restructuring (sometimes called "deregulation") of the retail electricity market, which began in 2002, applies *only* to investor-owned utilities (IOUs) within the ERCOT region. Utilities owned by cities and rural cooperatives may join the deregulated market but are not required to do so, and so long as they have not, they are known as "non-opt-in entities" (NOIEs); at this writing, only one Texas cooperative and no city-owned utilities have opened to competition.

About 60 percent of Texas residents purchase retail electricity in the deregulated market.

In the ERCOT areas that have opened to retail competition, the electric industry has been "unbundled" and structurally separated into three segments: wholesale generation, transmission/distribution and retail. In these areas, suppliers of *wholesale generation* are companies that own power-generating plants and sell electricity to retail electric providers (REPs); the *transmission and distribution* segment comprises companies that own the power lines electricity flows through; and the *retail* segment comprises REPs that sell electricity to end users.

Outside of ERCOT, and in the areas of ERCOT served by NOIEs, one entity may generate, transmit, distribute and sell electricity to all retail customers. These companies are called "vertically integrated" utilities.

In all of Texas, the transmission and distribution of electricity over wires remains regulated. This is because transmission wires and poles are viewed as a natural monopoly, in that it would not be economically efficient for multiple companies to duplicate transmission-line networks.

Wholesale electricity sales (between power generators and REPs) were deregulated within Texas in 1995. The wholesale market within ERCOT is subject to only limited regulation by PUC, while the Federal Energy Regulatory Commission (FERC) oversees wholesale markets in the non-ERCOT portions of Texas. Under a 2005 federal law, FERC also assumed reliability oversight over the entire state.

About 60 percent of Texas residents purchase retail electricity in the deregulated market. The remainder are served by a traditional, regulated market outside of ERCOT, or a NOIE.[5]

Power Generation

Steam turbines, internal combustion engines, gas combustion turbines, water turbines and wind turbines are the most common mechanisms for generating electricity in power plants. Most of the electricity in the U.S., including Texas, is produced by steam turbines. Steam turbines are two machines connected by a shaft, a turbine and a generator set. Electricity is produced by a steam turbine essentially by heating water (with a fuel source such as coal, nuclear fission or natural gas) to create steam. The steam generated is forced against blades mounted on the shaft of the turbine. As the blades rotate, the shaft rotates the coils in the generator to produce an electrical current.

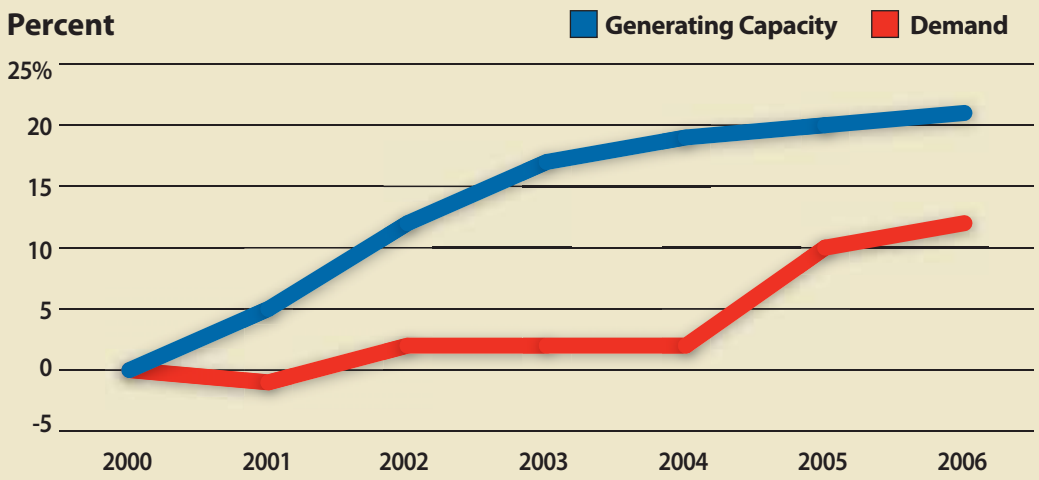
Texas has more than 230 electric providers and over 850 electric generating units and all of them are responsible for ensuring adequate and reliable electricity to consumers in their service areas.[6]

The total U.S. "nameplate" electric generating capacity (that is, the installed generating capacity running at 100 percent) was 1,075,677 megawatts (MW) as of January 1, 2007, about 1.7 percent more than on January 1, 2006.[7] Texas' total nameplate generating capacity was 109,666 MW in 2006.[8]

Most thermal power plants do not meet 100 percent of the nameplate capacity of their generators; instead, their actual output varies depending on planned and unplanned outages, the cost of power production, weather, transmission-grid constraints and system demand. Nationally, the net generation capacity (minus planned and unplanned outages) totaled 986,215 MW in 2006, or 91.7 percent of the total nameplate capacity. The nation's net generation capacity has risen by 78 percent since 1995, while demand has increased 12 percent.[9]

EXHIBIT 27-2

Cumulative Change, U.S. Electricity Generating Capacity and Demand, 2000-2006



Sources: U.S. Energy Information and Texas Comptroller of Public Accounts.

In Texas, 2006 net generation capacity totaled 100,754 megawatts.

Exhibit 27-2 shows the change in net U.S. generation capacity and demand for the last six years.

In Texas, 2006 net generation capacity totaled 100,754 MW, or 91.9 percent of total nameplate capacity. Net generation capacity has risen by 72 percent since 1995.[10]

Exhibit 27-3 shows the change in Texas' net generation capacity and demand for the last six years.

New generating capacity added during 2006 totaled 12,860 MW nationally and 1,667 MW in Texas.[11]

Demand for electricity varies throughout the year, with the greatest demand coming during the summer. During 2006, for example, ERCOT's system demand ranged from a low of 21,309 MW (Nov. 24) to a peak of 62,339 MW (Aug. 17).[12] It is not uncommon in the summer for demand to fluctuate by more than 25,000 MW within a 12-hour period and require the coordinated contributions of more than 400 electric generating units.

Texas has hundreds of electricity generating facilities and a number of entities involved in the retail sale of electricity. **Exhibit 27-4** lists the state's five largest retail sellers of electricity.

Exhibit 27-5 lists Texas' ten largest electricity generating facilities.

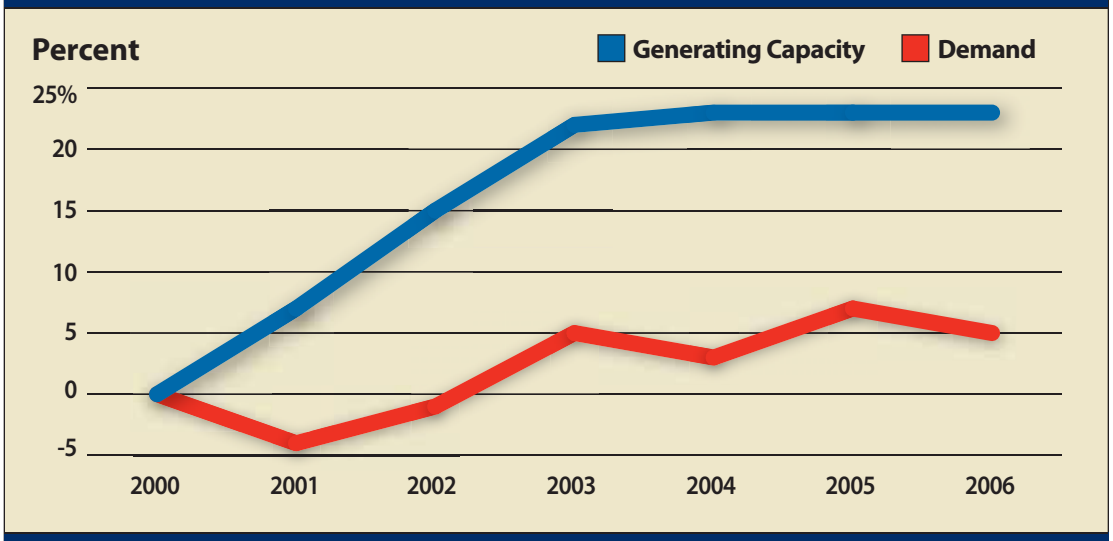
Electricity sold to utilities or REPs is called "wholesale electricity," the sale of which is deregulated in all areas of Texas and for all types of utilities.

Transmission and Distribution

Moving electricity from generators to consumers requires numerous components, including conductors, towers, transformers, relays, breakers and switches, as well as rights of way to the land over which the lines pass.[13] Within ERCOT, transmission and distribution service providers (TDSPs) move electricity along transmission lines to local REPs. They are required to provide nondiscriminatory access to the network of transmission lines collectively known as the "grid."[14]

EXHIBIT 27-3

Cumulative Change, Texas Electricity Generating Capacity and Demand, 2000-2006



Sources: U.S. Energy Information Administration, Electric Reliability Council of Texas and Texas Comptroller of Public Accounts.

The ERCOT grid contains 38,000 miles of transmission lines.

The ERCOT grid contains 38,000 miles of transmission lines. Again, the ERCOT power region covers about 75 percent of Texas' land area and is one of only three grids in the U.S.

The 38,000 miles of lines in ERCOT's region include 8,100 miles of 345-kilovolt (kV) lines, 16,000 miles of 138-kV lines and 11,500 miles of 69 kV lines. Distribution lines that distribute power to homes and businesses are below 69 kV; individual REPs manage these.[15] Data were not available to determine the mileage of transmission and distribution lines outside the ERCOT power region.

The cost of transmission and distribution comes from the capital cost of required equipment and operating and maintenance expenses. PUC reviews proposals for new transmission lines and setting rates for transmission services in all parts of Texas. These are charged to all REPs or utilities that receive power from the generation companies.

Within the ERCOT power region, the "postage stamp" rate is used for transmission costs. The postage stamp rate is a shared expense paid by all REPs, and ultimately the end user, in the ERCOT power region to TDSPs for the cost of transmission services. In 2007, the total cost for transmission approved by PUC was $1.2 billion. The total

EXHIBIT 27-4

Five Largest Texas Retail Sellers of Electricity, 2006

Companies/Entities	Retail Sales
Reliant Energy Retail Services	55,864,759 MWh
TXU Energy Co. LP	51,502,028 MWh
Constellation NewEnergy, Inc.	20,137,227 MWh
City of San Antonio	19,142,270 MWh
Entergy Gulf States, Inc.	15,383,226 MWh

Source: U.S. Energy Information Administration.

EXHIBIT 27-5

Ten Largest Electricity Generating Facilities in Texas, 2006

Plants/Facilities	Generating Capacity	Primary Fuel Source
W.A. Parish	3,681 MWh	Natural Gas
South Texas Nuclear Project	2,560 MWh	Nuclear
Comanche Peak	2,300 MWh	Nuclear
Cedar Bayou	2,258 MWh	Natural Gas
Martin Lake	2,250 MWh	Coal
P.H. Robinson	2,211 MWh	Natural Gas
Sabine	1,890 MWh	Natural Gas
Monticello	1,880 MWh	Coal
Limestone	1,700 MWh	Coal
Fayette Power Project	1,641 MWh	Coal

Source: U.S. Energy Information Administration.

amount paid by each REP is determined by their percent of load (total kWs). For example, if a retail provider accounts for 20 percent of the electricity uploaded onto the ERCOT grid, that provider would be responsible for 20 percent of the approved total cost of transmission services paid to TDSPs. Likewise, if a TDSP is responsible for carrying 15 percent of the ERCOT power region's total load, 15 percent of each REP's transmission service payment would go to that TDSP.

Any new transmission lines built or any increases in line maintenance in the ERCOT power region will result in an increase in the postage stamp rate.

Included in capital costs are the considerable sums to lease or buy easements to the land over which transmission and distribution lines travel. According to ERCOT, installing one mile of 138-kV transmission line costs approximately $1 million; installing one mile of 345-kV transmission lines costs approximately $1.5 million; and installing one mile of 765-kV transmission line costs approximately $2.6 million; land easement acquisition accounts for 5 to 10 percent of that cost in rural areas and 10 to 20 percent of the cost in urban areas.[16] A recent study completed by ERCOT on the potential costs to build transmission lines to West and Northwest Texas to transport electricity generated from wind power estimated that it would cost between $3 and $6 billion depending on the amount and capacity of transmission lines built.[17]

Land easement acquisition for transmission and distribution lines becomes significantly more complicated and costly when eminent domain authority — the ability to take privately owned land through a legal process for the public good — must be asserted to obtain the land.

In a typical eminent domain easement acquisition, the PUC of Texas has already identified the land easements needed for the lines; the TDSP is responsible for acquiring the land easement and offering the landowner an appropriate amount of money for the land easement purchase. More often than not, the amount offered for the easement is based on the fair market value of the taking (land easement) including any damage to the land tract. If the landowner does not want to sell or thinks the offer is too low, the utility company may proceed with an eminent domain process through the county.

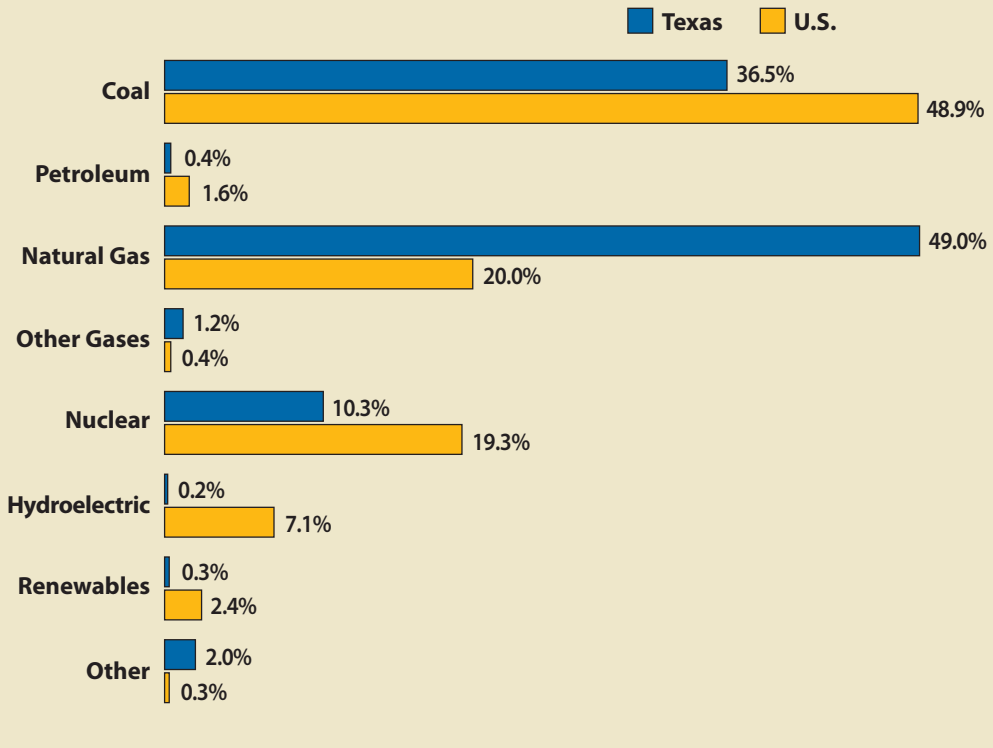
Disputes between landowners and utilities requiring eminent domain proceedings are heard by a condemnation court – a panel of three people appointed by the county judge who are knowledgeable about easement acquisitions and land values in the county. The condemnation court determines the appropriate amount owed to the landowner for the easement. If either party disputes the condemnation

In addition to the generating capacity, Texas has a significant amount of *cogenerated power,* also called combined heat and power (CHP). CHP systems provide both electricity and heat to buildings next to or close to the system. According to the Gulf Coast CHP Application Center, a federal center charged with promoting the development and use of CHP, Texas has 137 cogeneration facilities with an installed capacity of 16.7 gigawatts.[18]

Exhibit 27-6 shows the relative shares of all electricity produced by various fuel sources, including cogeneration, in Texas and the U.S. in 2006.

EXHIBIT 27-6

Percent of Total Electricity Generated by Fuel Source, 2006



Note: Numbers may not total due to rounding.
Source: U.S. Energy Information Administration.

Cogeneration facilities are not new technology; instead, these types of facilities are common in large industrial applications, hospitals, university campuses and district energy systems in urban areas.

court findings, they can appeal the process to the civil court that has jurisdiction over that county.

According to the Lower Colorado River Authority (LCRA), a general wholesaler in Central Texas eminent domain authority is typically used in 6 to 15 percent of land easement acquisitions for transmission lines.[19]

Retail Sales

Electric customers include industrial, commercial, governmental and residential consumers. Typically,

commercial and industrial customers consume significantly more electricity than residential customers. Some industrial plants generate their own electricity to offset the amount of electricity they obtain from the grid. Any additional or excess electricity produced by these plants can be sold back to utilities.

Industrial and commercial customers typically pay a lower price per kilowatt-hour than residential customers, in part because increased usage means increased bargaining power, and in part because residential usage varies according to weather, time of day and other factors, requiring power generators to account and be ready for wide fluctuations in power demand.[20]

Power Control and Reliability

Meeting the ever-changing electric needs of Texas is achieved through a complex, interrelated network of power plants, fuel supplies, and energy delivery systems that collectively is expected to operate continuously, flawlessly, under any weather conditions, and as inexpensively as possible. This formidable challenge is complicated by fluctuations in electric demand by season, day and instant time.

A variety of entities throughout the country control and administer the nation's power grids. In many areas, grids are controlled by independent system operators (ISOs) or regional transmission operators (RTOs); in all, there are ten ISOs and RTOs in the U.S. and Canada.[21]

According to the ISO/RTO Council, ISO/RTOs:

> …schedule the use of transmission lines; manage the interconnection of new generation without any possible conflict of interest; and provide or support market monitoring services to ensure fair and neutral market operations for all participants.[22]

ISOs/RTOs were created to ensure fair access to transmission lines. As a result, creating an ISO or RTO requires utilities to separate their transmission ownership from transmission control. The ISO/RTO then assumes control of the transmission while the utility retains ownership of the lines. In areas without an ISO/RTO, the grid is controlled by vertically integrated utilities that also own the transmission lines.

FERC advocates the use of ISO/RTOs in all areas of the country, although not all utilities have voluntarily acted to form them for their regions. ERCOT acts as an ISO for its region, and is the only ISO not created by FERC, while the Southwest Power Pool (SPP) is the only FERC-chartered RTO that operates in Texas. According to EIA, the benefits of ISO/RTOs include:

- performing and coordinating transmission planning on a region-wide basis to ensure that system reliability is met in an efficient and nondiscriminatory manner.
- operating competitive markets to ensure the reliability of customer service, providing information to market monitors to identify market manipulation, expose anti-competitive behaviors and provide comprehensive market analysis to enhance market design.
- providing more efficient methods for pricing transmission services, resulting in lower transmission costs to customers. This is possible because an ISO/RTO administers a uniform transmission rate for all transmission facilities under its control instead of maintaining multiple utility transmission prices and policies in the region. (See below for an in-depth discussion of transmission pricing.)
- managing and resolving transmission congestion efficiently through market-oriented approaches. This is possible because the ISO has operational oversight of a large regional transmission system. (Transmission congestion also is discussed in depth below.)
- simplifying procedures for transmission customers to obtain transmission services, allowing "one-stop shopping."
- encouraging the entry of competitive generation resources, both through "open access" guarantees and by providing more transparent price signals to encourage needed investment.
- facilitating the growth of renewable resources, again through open-access transmission policies

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and also by creating markets in which renewables can compete.

- laying the groundwork for demand response by providing rapid and accurate grid and market data.[23]

North American Electric Reliability Councils

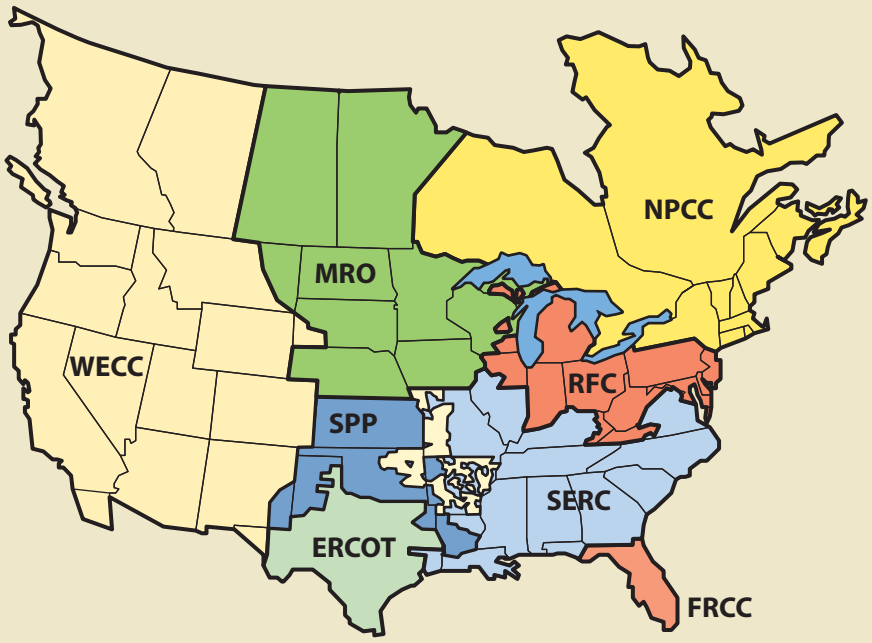
Until recently, eight different reliability councils administered reliability standards in their respective regions. The North American Electric Reliability Corporation (NERC) adopted national standards and supervised these councils to ensure reliable electricity networks.

Most regional reliability councils serve multiple states, and some reach into Canada and Mexico as well (**Exhibit 27-7**). The Western Electric Coordinating Council (WECC) serves the western third of the U.S., Baja California and western Canada. The Midwest Reliability Organization (MRO) serves the upper Midwest and central Canada. The Northeast Power Coordinating Council (NPCC) serves New England and eastern Canada. The Reliability*First* Corporation (RFC) serves the central eastern U.S. from New Jersey to Michigan. The Southwest Power Pool (SPP) serves all of Kansas and portions of Arkansas, Oklahoma, Texas, Louisiana, New Mexico, Missouri and Mississippi. The Southeastern Reliability Council (SERC) serves the southeastern U.S. including Southeast Texas. The Florida Reliability Coordinating Council (FRCC) broke away from SERC in 1996 to serve all of Florida except the western Florida Panhandle. The Florida Public Service Commission regulates electric utilities within FRCC.[24]

Four councils operate in Texas — ERCOT, SERC, SPP and WECC.

Exhibit 27-7

The North American Electric Reliability Corporation Regions



Source: North American Energy Reliability Corporation.

In response to the 2003 Northeast blackout, the Energy Policy Act of 2005 required FERC to designate a privately and independently owned electric reliability organization (ERO) to implement and enforce the complex market, engineering and infrastructure rules needed to keep all grids up and running at all times. It further provided for the creation of "regional entities" to assist the ERO.

NERC was designated as the ERO in 2006, and Regional Entities for the various areas of Texas were designated in 2007. The first federal reliability standards took effect in June 2007 and can carry penalties of up to $1 million per violation. These standards apply throughout Texas, and represent the first significant FERC regulation within the ERCOT market.

North American Electric Grids

As noted above, three interconnected physical grids of transmission lines serve North America — the western grid, the eastern grid and ERCOT (**Exhibit 27-8**).

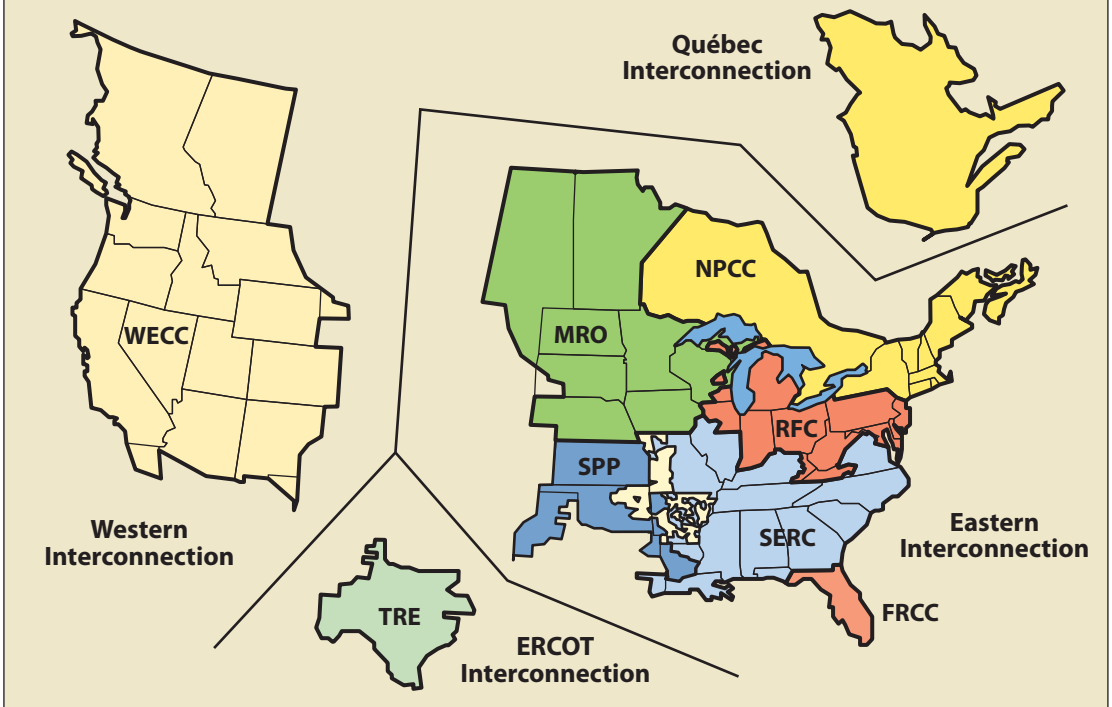
ERCOT

The ERCOT grid is the only entirely intrastate grid, in which ERCOT serves as a reliability council and an ISO, and an independent division of ERCOT is the Regional Entity under the ERO.

Because ERCOT is considered intrastate, its market is subject to regulation by the Texas PUC and not by FERC. All of the other RTOs and regional entities responsible for reliability span multiple states. Under the 2005 legislation, all of the Regional Entities are subject to FERC as their regulating authority, and all of the RTOs other than ERCOT are subject to FERC as their regulating authority for wholesale market issues. State regulatory commissions have jurisdiction over retail issues and certain transmission issues, such as licensing of new facilities.

Exhibit 27-8

U.S. Electric Grids



Source: North American Energy Reliability Corporation.

The ERCOT grid is the only entirely intrastate grid.

Areas of Texas not within the ERCOT region fall into three different multi-state regional entities. WECC includes the El Paso area, while the other regional entities, SPP and the Southeastern Electric Reliability Council (SERC), include the Panhandle, northeast Texas and southeast Texas (**Exhibit 27-9**).

ERCOT's sphere of authority is defined by its electric grid and the customers it serves (**Exhibit 27-10**).

Texas regions outside of ERCOT and SPP have no ISO/RTOs. The vertically integrated utilities that own the power lines there operate the system; end users pay these utilities for power delivered to their homes and businesses.

PUC chose ERCOT to perform ISO services for the ERCOT grid in addition to the reliability council services it was already performing. PUC regulates the system administration fees that ERCOT charges its market participants for these services.

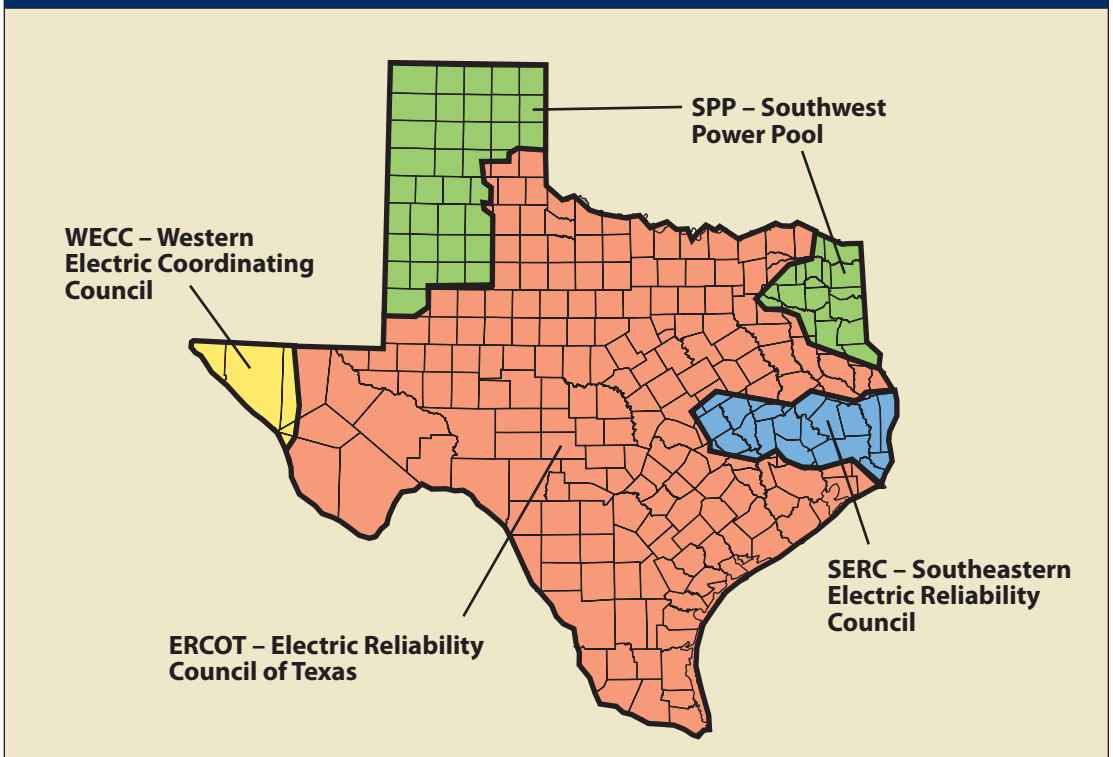
ERCOT's primary mission is to direct and ensure reliable and cost-effective operation of the electric grid and fair and efficient market-driven solutions to customers' electric service needs.[25] With retail deregulation in 1999, the Legislature assigned four key responsibilities to ERCOT:

- ensure open access for all competitors to the transmission and distribution systems;
- ensure reliability of the grid and transmission of power for all;
- convey timely information to consumers to allow them to make informed choices among electricity providers; and

ERCOT's primary mission is to direct and ensure reliable and cost-effective operation of the electric grid and fair and efficient market-driven solutions to customers' electric service needs.

EXHIBIT 27-9

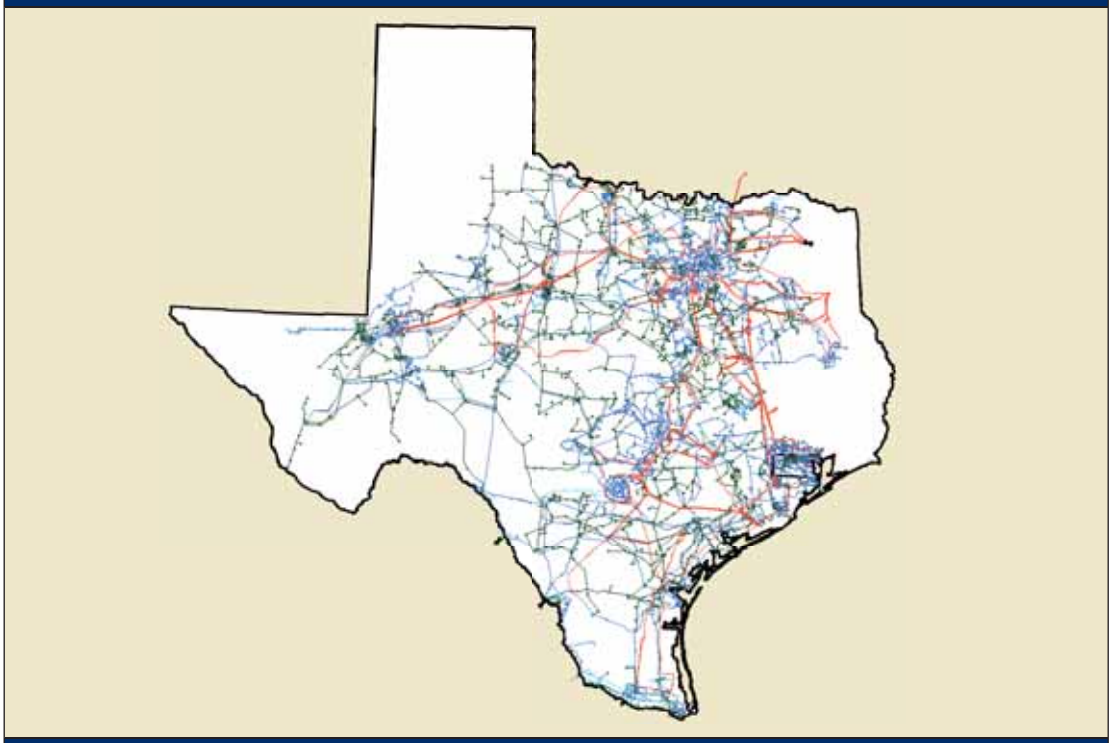
Texas Electric Reliability Council of Texas Boundaries



Source: Electric Reliability Council of Texas.

EXHIBIT 27-10

The ERCOT Electric Transmission Grid



Source: Electric Reliability Council of Texas.

- ensure accurate accounting for electricity production and delivery.[26]

ERCOT's unique status as a state-regulated grid has been protected carefully. One example of the avoidance of federal regulation occurred in fall 2005, after Hurricane Rita struck southeast Texas, knocking out electrical power and infrastructure in the Entergy service area outside of ERCOT. Entergy, the local utility, operates within SERC's electric grid, and Entergy's Louisiana and Texas grid were badly damaged by both Rita and Hurricane Katrina a few weeks earlier. To move electricity to southeast Texas, the state and ERCOT utilities sought and received a waiver from the U.S. Department of Energy to allow ERCOT companies to provide electricity temporarily to some of Entergy's customers without jeopardizing ERCOT's intrastate status.

ERCOT is responsible for:

- managing the flow of electricity in a grid area representing 85 percent of the state's electric load and 75 percent of its land, in both regulated and deregulated markets;
- scheduling power across a grid connecting 38,000 miles of transmission lines and more than 500 generating units, in both regulated and deregulated markets;
- reliably operating the grid to ensure it can accommodate scheduled energy transfers;
- supervising transmission planning to meet existing and future electricity demands;
- administering electricity markets in its area for services needed to ensure reliability;
- maintaining a database to record the relationship between retail electricity providers and their customers; and
- administering the state's Renewable Energy Credit program.

Keeping the overall electric system reliable requires accommodating many kinds of unexpected events, including:

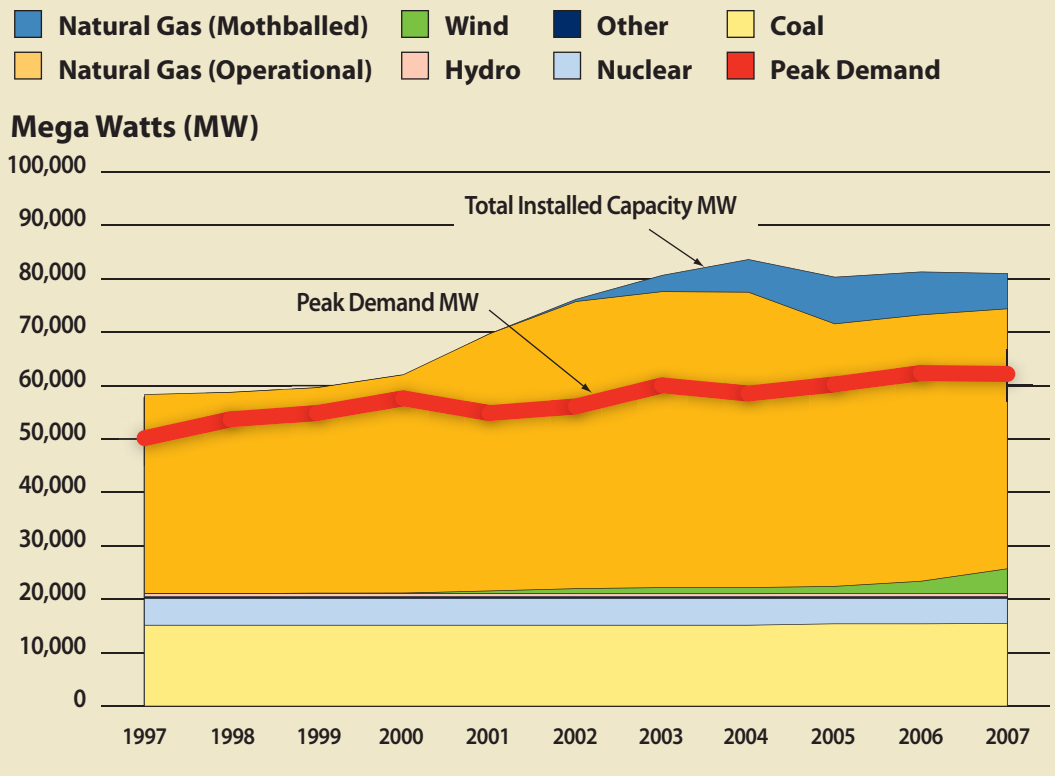
- not enough power plants available;
- not enough fuel available, including problems with fuel delivery systems;
- power line outages or congestion;
- unexpected changes in demand (extreme hot or cold weather); and
- violent conditions such as thunderstorms, tornados, accidents, or attacks.[27]

Meeting these challenges reliably requires a robust array of operating practices and safeguards, including encouraging a surplus level of power plants (reserve margin) to be built for the years ahead (capacity adequacy), arranging for the availability of extra power plants ahead of time that can be deployed within hours or days (replacement reserves or unit commitment), and availability of power plants to start putting power to the grid within seconds during emergencies (responsive reserves). **Exhibit 27-11** shows the fuel mix supplying the state's total installed electric generation capacity, and compares it to peak demand.

ERCOT considers electric capacity to be "adequate" at a 12.5 reserve margin; that is, when forecast installed capacity exceeds the forecast peak

EXHIBIT 27-11

Generation Capacity in the ERCOT Power Grid by Fuel Type, 1997-2007



Source: Electric Reliability Council of Texas.

hourly demand by at least 12.5 percent. In ERCOT's service area, this peak load usually occurs on afternoons in July and August. ERCOT does not expect the reserve margin to drop below 12.5 percent between 2008 and 2011.[28] This guideline is prudent to account for many uncertainties, such as extreme weather conditions that can drive up demand more than anticipated, and the fact that all power plants can break down. Fossil-fueled power plants are typically out for scheduled maintenance about 4 percent of the time and out for unexpected reasons about 6 percent of the time.[29]

Outages and Blackouts

Insufficient capacity can result in problems meeting electricity demands. In April 2006, for example, ERCOT ordered rotating outages across the state due to unseasonably high temperatures and limited available generation capacity. Many generators were offline for seasonal (pre-summer) maintenance, and emergency conditions were triggered by the sudden, unexpected loss of multiple generators. Rotating outages are not "blackouts," they are controlled and managed, and in this case resulted in targeted 10- to 45-minute power outages for some non-critical residential and commercial customers. Within ERCOT, TDSPs controlled the outages, and continued "rolling" the outage to different sets of customers.

Rotating outages such as these help the electrical grid avoid "cascading" blackouts, which are uncontrolled outages that can shut down power across entire regions and take days to correct. Even intentional power outages can disrupt transportation and commercial activities, but cascading outages can be far more troublesome and potentially dangerous. Such an event occurred on August 14, 2003, when the largest blackout in American history affected eight states in the northeastern U.S. and parts of Canada. The blackout affected 50 million people and caused the loss of between $4.5 billion and $12 billion in economic activity.[30]

In all, however, the U.S. electricity grid is extremely reliable, delivering uninterrupted power to customers more than 99 percent of the time each year.[31] Prior to April 2006, the ERCOT grid had not experienced rotating outages since 1989.

But even brief outages and disruptions can cause significant problems for some manufacturers. For example, Samsung, a multi-national technology company with a manufacturing plant in Austin, experienced a 10-minute localized outage in June 2006. This brief outage forced Samsung to shut down for a week to clean, test and recalibrate its equipment before resuming production. Another technology company in Austin, Freescale Semiconductor, Inc., reports that four power outages over four years have cost it between $15 million and $20 million.[32]

Such outages are particularly difficult for high-tech companies such as chip makers, data centers and manufacturers of sensitive equipment and digital components. Evidence shows that businesses will relocate if their power is not reliable. Thirty-four percent of companies responding to a Connecticut Business and Industry Association Survey said they would move their businesses out of state if they experienced ten or more one-hour to one-day unanticipated power losses over a three-month period.[33] As Texas moves toward a more service-oriented, high-tech economy, reliable energy sources will be vital to continued economic development.

Despite its current reliability, experts say that the nation's power system is under increasing pressure, as demand for power outpaces improvements in grid transmission capacity. In the next decade, U.S. demand is projected to increase by 19 percent, while capacity is estimated to increase by just 7 percent.[34] ERCOT demand is projected to increase by 21 percent — very close to the national average — but ERCOT has been far more successful in adding transmission capacity, reporting that it will add $6.1 billion in transmission improvements over the next ten years.[35]

ERCOT considers electric capacity to be "adequate" at a 12.5 reserve margin; that is, when forecast installed capacity exceeds the forecast peak hourly demand by at least 12.5 percent.

Regulation and Oversight

PUC was created by the 1975 Texas Legislature to regulate telecommunication and electric services in Texas. Texas was the last state to create a utility commission. PUC comprises three commissioners appointed by the governor, each serving a six-year term.

In 1995, the Legislature restructured (or "deregulated") the state's wholesale electric market to begin September 1, 1995, and in 1999 deregulated the retail segment in some parts of Texas to begin on January 1, 2002 (see below for a more detailed consideration of deregulation).[36] The term "de-

regulated" as applied to the retail segment of the industry means the Legislature removed monopoly regulations from the investor-owned utility areas within ERCOT to allow new entrants to compete for customers in a free market. Deregulated areas are also called "competitive areas" or areas "open to electric choice" because their electric service is no longer provided by one utility.

Deregulation brought new rules intended to ensure fair competition and protect consumer's rights. As noted above, areas within ERCOT that are served by publicly owned or member owned utilities, such as cooperatives and municipalities, known as NOIEs, were not automatically opened to retail competition, although these utilities may choose to opt into the competitive market. Nueces Electric Cooperative is the only entity to opt in thus far.[37]

Under retail competition, retail electric providers sell electricity to consumers and businesses, and provide customer service functions such as billing, rate plans and choices of renewable or other energy sources. All REPs must be certified to do business by PUC. REPs may compete for customers, both residential and commercial/industrial, by offering lower prices, a variety of service plans, different renewable energy choices or better customer service and can operate in any deregulated area.

Under retail competition, retail electric providers sell electricity to consumers and businesses, and provide customer service functions such as billing, rate plans and choices of renewable or other energy sources.

PUC is responsible for:

- regulation of rates and terms for intrastate transmission service and for distribution service in areas where customer choice has been introduced;
- oversight of the ERCOT market, including market monitoring and the ERCOT administrative system administration fee;
- adopting and enforcing rules relating to retail competition, including customer protection and the state's renewable energy goals;
- retail rate regulation outside of ERCOT;
- licensing of new transmission facilities for investor-owned utilities and cooperatives; and
- licensing of retail electric providers.[38]

Regardless of which REP provides electric service to a customer, PUC continues to enforce consumer protections for residential and small commercial customers and regulates electricity delivery to ensure that the relevant TDSP — the "wires" company — delivers power reliably and without discrimination. (PUC has adopted minimal customer protection rules for industrial and large commercial customers but leaves most of these issues to be resolved by contract between the REP and customer.)

PUC has adopted customer protection rules that affect retail electric providers in several ways. REPs:

- must follow PUC standards to investigate customer complaints;
- may not discriminate;
- may not switch a customer's service without his or her permission. This practice is called "slamming" and it is illegal;
- may not release any customer-specific information to any other company without the customer's permission;
- must provide customers with an Electricity Facts Label (discussed below);
- must provide customers with a terms-of-service agreement;
- must disclose to customers their rights concerning choice of providers and the ability to switch;
- must provide customer information in English and Spanish; and
- must offer customers an average payment plan option to help distribute electricity payments evenly over the year, rather than billing customers for usage by month.[39]

Industry Structure

The electric industry's structure varies depending on the ownership of the entity providing the electric service (NOIE or competitive) and the geographic location of the customer (inside or outside ERCOT).

In most traditionally-regulated retail areas of Texas (outside of ERCOT), vertically integrated utility companies control the complete process of providing electricity, including electric generation, transmission, distribution and retail customer sales. (It should be noted that some NOIEs may not participate in all three areas.)

In deregulated retail areas, these functions have been separated into distinct units so that multiple power companies can sell power to any retail provider, and so that multiple retail electric providers, in turn, can sell electricity to consumers within the same geographic location.

Again, the transmission and distribution function remains regulated throughout the state.

Texas has four basic types of utilities: investor-owned utilities (IOUs), publicly owned municipal utilities (MOUs), cooperatives and river authorities.[40]

Investor-Owned Utilities

IOUs are private, shareholder-owned companies ranging in size from small local operations to large multi-state holding companies. An IOU in a regulated area can offer all electricity functions from generation to retail sales, but in deregulated areas IOUs have been required to separate their generation functions from their transmission functions and their retail sales.

Within the deregulated ERCOT power region, the state can license more than one entity to sell retail electrical services within a particular area. These entities are free to set their own rates and compete with one another for customers.[41] IOUs outside the ERCOT power region continue to be regulated by PUC, meaning that the agency typically has granted only one IOU a license to provide electrical services within an area and sets the rates that can be charged to customers. There are a few areas, however, where service territories overlap, and an IOU and cooperative or an IOU and MOU may both have the right to provide electric service.

Municipally Owned Utilities

MOUs are publicly owned, nonprofit utilities that generate or purchase power and control its distribution to area residents. Municipal utilities began in the 1800s as a way to bring power to cities that lacked investor-owned utilities. Municipal governments either set their electric rates or approve the rates set by their utilities.

Texas has 73 municipal utilities serving more than 3 million Texans, or roughly 15 percent of the state's retail electric customers.[42]

Electric Cooperatives

Electric cooperatives are private, nonprofit utilities owned and controlled by the members they serve. Cooperatives pay no federal taxes, but do pay state property taxes.

Cooperatives began in the 1930s, to bring power to rural communities where investor-owned utilities could not operate profitably. Public municipal utilities, moreover, could not afford to build electric facilities in rural areas. Federal legislation created the Rural Electrification Administration, which allowed people in sparsely populated areas to join together to borrow money at low-interest rates and build facilities to bring electricity to their homes and farms.

Texas has 74 cooperatives, mostly but not entirely serving areas that are still rural. Texas' co-ops own more than 286,000 miles of lines serving nearly 3 million Texans in 232 of the state's 254 counties.[43]

River Authorities

Between 1929 and 1949, Texas formed four river authorities to manage water resources and produce electricity. These are the Lower Colorado, Brazos, Sabine and Guadalupe-Blanco river authorities, all of which still operate today.

The Legislature created all four authorities as conservation and reclamation districts. However, in addition to their conservation and reclamation responsibilities each authority produces electricity. They are considered public entities, although they are not state agencies. Each operates as an independent nonprofit organization, without any taxing authority. Utility revenues and fees generated from supplying energy, water and community services cover their operating expenses. A governor-appointed board of directors manages each organization.[44]

The LCRA, created in 1934, with more than 3,600 megawatts of installed electrical capacity, is by far the largest of these authorities. LCRA does

Texas has four basic types of utilities: investor-owned utilities, publicly owned municipal utilities, cooperatives and river authorities.

not sell electricity directly to any retail customers but instead sells wholesale electricity to more than 40 retail utilities, including MOUs and electric cooperatives that serve more than 1 million people in 53 counties. In addition, LCRA operates more than 3,300 miles of transmission lines statewide.[45]

The remaining river authorities, (Brazos, Sabine and Guadalupe-Blanco), are primarily conservation and reclamation entities. Each of these authorities has some electrical power generation capabilities but none has more than 100 megawatts of installed capacity.[46]

Exhibit 27-12 details the number of customers served by each different utility type. The term "customer" represents one electric meter; for example, one residential customer represents one house or apartment.

Electricity Rates

Utility companies typically offer different electric service rates for each customer class: residential, commercial and industrial. In regulated retail areas, PUC sets rates for IOUs in each class based on their costs, allowing them to earn an approved rate of return on their investments. In deregulated retail areas, each REP sets its rates based on what the market will pay.

Texas' retail deregulation began on January 1, 2002, based on legislation passed in 1999.[47]

Texas' MOUs and cooperatives set their own rates, which typically include payments to the municipality in lieu of taxes and a margin to cover unanticipated costs and support new investments.[48] These rates are not regulated by PUC, but the agency has appellate jurisdiction over rate disputes involving municipal utilities.

Deregulation

Following the breakup of AT&T in the early 1980s, and the subsequent growth of new telephone vendors and providers, Congress provided for limited competition in the power generation industry with the Energy Policy Act of 1992, which allows complaints to be filed with the FERC to obtain transmission service. In 1996 FERC adopted a broad requirement that the utilities it regulates provide open transmission access that would permit other utilities and independent generators to sell electricity to any wholesale buyer. FERC adopted a code of conduct that provided a separation of the transmission personnel from the wholesale sales personnel of an integrated utility.

Deregulation in Texas required formerly vertically integrated investor-owned utilities to divide into independent business units to generate power, transmit it or sell it to retail customers.

Texas' retail deregulation of electricity in 1999 was intended to lower prices and increase choice for consumers while providing an attractive business climate for new, privately held providers of generation or retail services.[49]

Supporters pointed out that the old regulatory model created incentives for regulated IOUs to

Deregulation in Texas required formerly vertically integrated investor-owned utilities to divide into independent business units to generate power, transmit it or sell it to retail customers.

Exhibit 27-12

Utilities' Share of Texas Residential, Commercial and Industrial Customers, by Type (both Inside and Outside of ERCOT), March 2007

Utility Ownership	Residential Customers	Percent of Residential Customers	Commercial Customers	Percent of Commercial Customers	Industrial Customers	Percent of Industrial Customers
Cooperatives	1,336,188	16%	211,056	14%	21,040	18%
Municipals	1,312,740	15	185,175	12	1,783	1
IOUs (Deregulated)	4,927,987	58	940,050	63	85,450	72
IOUs (Regulated)	916,394	11	165,108	11	10,872	9
Total	8,493,309		1,501,389		119,145	

Source: Public Utility Commission of Texas.

increase their capital investments, since they were allowed a percentage rate of return on the capital investments. While the rate of return percentage would remain the same, a utility could earn more profit if its capital investments were higher.

Competition tends to encourage markets to lower their costs, and therefore prices, to attract customers. Changing from a regulator's estimate of a utility's average cost pricing (under regulation) to market-driven marginal cost pricing is expected to result in lower prices, assuming other factors remain constant.

Supporters believed that competition is always a better way to set rates than government regulation. With this in mind, all customers — from small residential consumers to large industrial plants — would benefit financially from utilities competing in an open market.

Critics believed deregulation would not bring lower rates to consumers and ultimately could jeopardize the reliability of electrical supplies. They pointed to rocky deregulation experiences in other states as a warning against moving too quickly. Critics believed electric costs were declining already in a regulated market, and that deregulation would only boost profits for utilities without lowering costs for consumers.

Texas' transition from a regulated to partially deregulated industry in Texas has been a complex and lengthy process. Before 2002, PUC regulated the retail rates for all investor-owned electric utilities in the state.

IOUs were allowed to operate within a particular territory, and generally owned their own generation, transmission and distribution facilities. The IOU was obligated to serve every customer within its territory that requested service. Customers had one energy company, one bill and a "bundled" rate; that is, each bill listed rates for the electricity that were based on the operations and maintenance costs plus a regulated rate of return on the utility's capital investment for all of the functions of producing, delivering, and selling electricity to customers.

The 1995 Texas Legislature began deregulating electricity, beginning with the statewide wholesale market. Senate Bill 373 of that year had two main requirements: utilities were required to provide stand-alone, wholesale transmission service on a non-discriminatory basis, and independent generating companies (referred to as exempt wholesale generators) were explicitly permitted to compete in the wholesale market. In 1996, PUC adopted open access transmission rules to implement S.B. 373 and directed that an independent system operator be established. ERCOT became the state's ISO.[50]

Retail competition — called "Texas Choice" — began in January 2002. The 1999 Legislature deregulated retail electricity with S.B. 7, but only in areas served by IOUs. This law also permitted PUC to delay competition in areas where PUC concluded that fair competition could not be ordered. Competition was delayed in the non-ERCOT areas pursuant to this provision and other sections of the Public Utility Regulatory Act. MOUs and cooperatives within ERCOT were not required to deregulate but can opt to do so.

S.B. 7 required IOUs to separate their business activities (where retail competition was initiated) into three separate companies: a wholesale power generation company, a transmission and distribution company and a retail electric provider. This separation could take place either through the sale of assets to another party or by the creation of separate companies.[51] In addition, while the utilities were required to create separate companies to perform these functions, they could maintain common ownership through a holding company structure. These separated companies could not discriminate in favor of, or collude with, one another or make claims of superior reliability.[52]

Once the separation was complete, the newly created REP in each area was then distinguished as the incumbent or "affiliated" REP, and as the former monopoly provider it was subject to specific limitations on its behavior in the nascent market. ("Affiliated" is a reference to that REP's prior status as part of the former monopoly utility.) Affiliated REPs (AREPs) could enter one another's territories, and new-entrant companies could create new competitive REPs (CREPs) to compete with the incumbent REPs.

The most important limitation on the incumbent AREPs was PUC regulation of the incumbent AREP's price for residential and small com-

Texas' transition from a regulated to partially deregulated industry in Texas has been a complex and lengthy process.

mercial customers; this became the price new competitors had to beat to lure consumers away from their existing electric provider. This price was known as the "price to beat." For large commercial customers and industrial customers, there was no PUC-regulated rate, and prices were established by competitive forces beginning in January 2002.

For three years, AREPs were not allowed to alter their "price to beat," except to request adjustments due to increases in natural gas prices, unless or until a minimum of 40 percent of their customers within each of the two customer classes (small commercial and residential) had left for new competitors. As of September 2004, more than 18 percent of residential customers and more than 25 percent of non-residential customers switched.[53]

On January 1, 2005, AREPs were allowed to lower their prices without any approval from PUC. They could not, however, *increase* their price without PUC approval, and price increases due to natural gas prices could be requested only twice per year. After January 2005, some AREPs began offering new plans with lower rates. Customers then could choose a lower-rate plan and stay with their same REP.

Finally, the "price to beat" was eliminated entirely on January 1, 2007, allowing the AREPs to set whatever price they choose. At this point, the retail electric market was considered fully competitive in the applicable areas. By this time the switch rate had grown to 36 percent for residential, and more than 38 percent for commercial and 72 percent for industrial.[54]

The Competitive Market

As of May 31, 2007, 5.4 million Texas customers lived in areas open to electric competition.

Of those 5.4 million customers, 2.5 million or 39 percent had chosen to switch their electric service from the AREP to a new CREP as of May 2007 (**Exhibit 27-13**).[55] However, the 61 percent who were served by the former AREP would include many customers who had switched to a competitive product offered by that CREP, and also customers that had switched but had been "won back" by the AREP. About 84 percent of the customers with a CREP, or 2.1 million Texans, were residential customers.[56]

In September 2006, 34 percent of the customers who switched to a CREP purchased 56 percent of the electricity sold to all customers in those areas.[57] This indicates that larger customers are more likely to switch REPs than smaller customers. This hardly seems surprising, as larger customers have a greater financial incentive to find lower electricity rates. This observation is reinforced by the fact that residential customers represented 83 percent of the total number of customers in 2006 who switched services, but used just 20 percent of the electricity sold to switched customers.[58]

Each of the five retail service territories in ERCOT open to competition has REPs with varying numbers of electric service products available to residential customers.[59] Each REP may offer multiple products or service packages within any region, allowing customers to choose among different types of energy sources or pricing options. Consumers interested in promoting "green" renewable energy

Exhibit 27-13

REP Switching in the ERCOT Power Region, June 2007

	Customers in Competitive Areas	Percent	Customers Who Switched	Percent	Percent Who Switched
Residential	5,393,286	84.7%	2,103,828	84.0%	39.0%
Commercial	965,512	15.2%	398,826	15.9%	41.3%
Industrial	3,560	0.1%	2,537	0.1%	71.3%
Total	6,362,358	100.0%	2,505,191	100.0%	39.4%

Source: The Electric Reliability Council of Texas.

production, for instance, can choose an electric service package that uses renewable energy.

PUC and FERC continue to regulate IOUs in areas of Texas outside of ERCOT's power region. (More information on the Texas electricity market can be found in **Appendix 1.**)

Educated Consumer Choice

One of the biggest challenges for consumers in the new competitive market is how to choose the best or lowest-price REP for their needs. Surveys since 2002 have revealed that consumer knowledge of electricity pricing and costs is growing, but it will take time for all consumers to be ready to make informed choices.[60]

To aid consumers, PUC requires REPs to produce an Energy Facts Label, designed to standardize electricity information so that consumers in deregulated areas can compare competing REP prices. The label resembles the nutrition labels found on many food products, and provides information on electricity prices, contract terms, sources of generation and emissions levels (**Exhibit 27-14**).

Has Deregulation Succeeded?

Texas' wholesale deregulation is widely viewed as successful, but the results of Texas' retail deregulation legislation are disputed. Supporters say deregulation has achieved what the legislation intended and that prices are comparable to where they were when deregulation began in January 2002, despite a 105 percent increase in the price of natural gas as of September 2007.[61] Critics say deregulation has raised prices for consumers and increased the profits of investor-owned competitive market participants.

Much of this difference in viewpoints, however, comes from differing understandings of what deregulation was intended to accomplish. According

EXHIBIT 27-14

Electricity Facts Label

Electricity Facts
[Name of REP], [Name of Product] [Service area *(if applicable)*]
[Date]

Electricity price

Average monthly use:	500kWh	1,000kWh	1,500kWh
Average price per kilowatt-hour:	**(¢)**	**(¢)**	**(¢)**

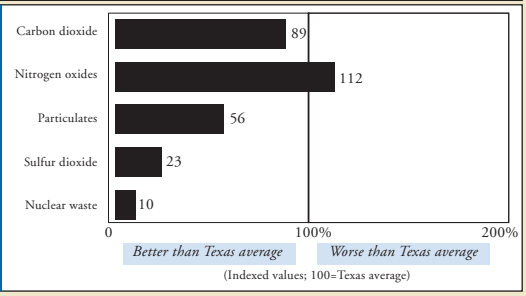
Contract

Minimum term: (months) Penalty for early cancellation: ($)
See Terms of Service statement for a full listing of fees, deposit policy, and other terms.

Sources of power generation

	This Product	*Texas average*
Coal and lignite	___%	___%
Natural gas	___%	___%
Nuclear	___%	___%
Renewable energy	___%	___%
Other	___%	___%
Total	**100%**	**100%**

Emissions and waste per kWh generated



Source: Public Utility Commission of Texas.

to the federal Electric Energy Market Competition Task Force:

> …prices are expected to guide consumption and investment decisions, leading to more economically efficient investments and lower prices than under traditional cost of service monopoly regulation.[62]

In its review of deregulated states, this task force concluded that it is difficult to draw conclusions about the effect of retail competition on prices, mostly because of the structure of the price caps in the newly deregulated market. It further stated: "there is no reason to believe, however, that retail competition in this market will not function as competition does in any market, by reducing quality-adjusted prices."[63]

Retail electric providers' rates in deregulated areas of Texas may be particularly sensitive to changes in natural gas prices.

Supporters of Texas deregulation say it provides more choices for customers and better service, and that rates ultimately will be fairest when set by the market rather than a regulator. They say the increase in rates since deregulation was caused not by the new competitive market, but rather by market forces such as the spiraling cost of natural gas, and events such as hurricanes Katrina and Rita, which would have forced rates up even under regulation. In fact, supporters believe consumer electric rates would have risen even more than they have since 2002 if the market had remained regulated.[64]

Critics say deregulation has severed all ties between price and cost, allowing the private sector to raise prices for consumers and profits for the deregulated, investor-owned power generation companies and REPs. Critics compare rates in deregulated areas to rates under regulated, municipally owned utilities and co-ops; on average they state, MOUs, co-ops, and IOUs within Texas still subject to rate regulation charge lower rates than deregulated IOUs.[65] **Exhibit 27-15** identifies residential rates in select areas of the state.

Natural gas prices have increased drastically worldwide since the start of deregulation in 2002, a major cause of electric price increases for those IOUs with predominately natural gas fuel mixes. Texas, which generates about half its electricity from natural gas, has seen electricity rates rise as gas prices have increased.[66]

REP rates in deregulated areas of Texas may be particularly sensitive to changes in natural gas prices, since a majority of Texas electricity is generated by natural gas. These providers must purchase electricity on the wholesale market and then sell it to commercial or residential customers. Prices on the wholesale market, therefore, tend to fluctuate along with natural gas prices.

MOUs and regulated vertically integrated utilities that can retain ownership of power plants base prices on their average costs, including capital investment, return, operations and maintenance expenses, and fuel costs. Deregulated REPs are more likely to charge their customers rates tied to the marginal cost of wholesale electricity prices, which in turn are correlated with natural gas prices. Marginal costs will exhibit greater variability than average costs and thus, some argue, rates in the deregulated areas of Texas have been higher in recent years largely because of increasing natural gas prices.[67]

Supporters of deregulation also argue that MOUs and co-ops have a higher percentage of coal generation, which is significantly cheaper than the predominantly natural gas fuel mix for IOUs. Critics point out that regulated MOUs and co-ops also avoid the costs of federal taxes and profits, thus allowing them to offer lower rates to consumers.[68]

PUC measures the success of the deregulated market by the number of REPs available in the market; the number of customers who choose to switch from an AREP to a CREP; and the number of customer complaints it receives. The good news, PUC says, is that there is an abundance of new REPs and service plans, some with prices below the formerly regulated rate.[69] Nearly 50 percent of all residential customers, however, have not selected a cheaper plan either with their affiliate REP or a new, competitive REP, even though they are available.

The Outlook for Electricity

The Texas state demographer projects that the state's population will rise to more than 33 million in 2025, and more than 36 million in 2030.[70] This growing population will create a rising demand for electricity in all sectors. Federal and state poli-

EXHIBIT 27-15

Residential Rate Comparisons in Texas, December 2007

City	Retail Electric Provider	Average Cost Per Kilowatt Hour (kWh)	Reliability Council	Deregulated
Amarillo	Xcel	$0.083 kWh	Southwest Power Pool (SPP)	No
Austin	Austin Energy (City of Austin)	$0.084 kWh	Electric Reliability Council of Texas (ERCOT)	No
Beaumont	Entergy Gulf States	$0.113 kWh	Southeastern Electric Reliability Council (SERC)	No
Brownsville	Brownsville Public Utility Board	$0.100 kWh	ERCOT	No
Dallas*	TXU Energy	$0.139 kWh	ERCOT	Yes
El Paso	El Paso Electric	$0.113 kWh	Western Electric Coordinating Council (WECC)	No
Houston*	Reliant Energy	$0.141 kWh	ERCOT	Yes
Laredo*	AEP Texas Central	$0.156 kWh	ERCOT	Yes
Lubbock	Lubbock Power and Light	$0.083 kWh	SPP	No
Odessa*	TXU Energy	$0.139 kWh	ERCOT	Yes
San Antonio	City Power Service (City of San Antonio)	$0.067 kWh	ERCOT	No

*The average kWh charge listed for these cities is based on the rates charged by the largest electric provider in the area for a 12 month electric rate program.
Source: Public Utility Commission of Texas.

cies and market forces will determine how this demand will be met.

Texas has access to energy resources sufficient to meet its projected electricity demands through 2030 and beyond. Generating capacity is likely to be a bigger concern for Texas in the future.

Projected Demand

By 2030, the federal Energy Information Administration (EIA) projects that U.S. commercial demand for electricity will rise by 63 percent, residential demand will rise by 39 percent, while the industrial sector will rise by 17 percent. The increase in demand will be due not only to population growth, but also to increased disposable income, which spurs increased purchases of products and homes with additional floor space needing electricity.[71]

Historically speaking, energy demand and consumption are correlated to three factors: the state's economy and demography, which affect mid- and long-term variations in energy demand, and the weather, which affects short-term variations.[72]

ERCOT expects energy demand in its power region to increase by 39.4 percent from 2007 through 2025, from about 313 million megawatt-hours (MWh) to more than 436 million MWh, while peak demand is expected to increase at about the same rate, rising by 40.9 percent, to 89,883 MW in 2025 (**Exhibit 27-16**).[73]

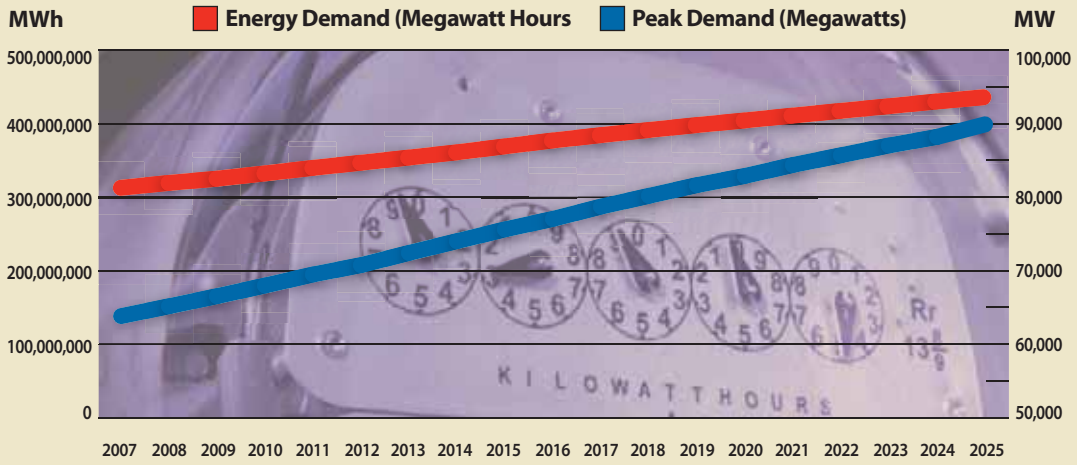
The average hourly load in the ERCOT power region increased by 22.5 percent from 1997 to 2006. The average hourly load is expected to rise by 22.9 percent over the next 9 years (**Exhibit 27-17**).[74]

ERCOT has set a target reserve margin of 12.5 percent for electricity generation capacity within its boundaries. The reserve margin is the amount by which capacity exceeds projected peak hourly load, which typically occurs on afternoons in July and August in the ERCOT region.[75] ERCOT projects that, given expected population and economic growth, the reserve margin will drop below the 12.5 percent target as early as 2008, though reserve margins will exceed 12.5 percent by 2009 if planned generation facilities come online.[76]

ERCOT expects energy demand in its power region to increase by 39.4 percent from 2007 through 2025.

EXHIBIT 27-16

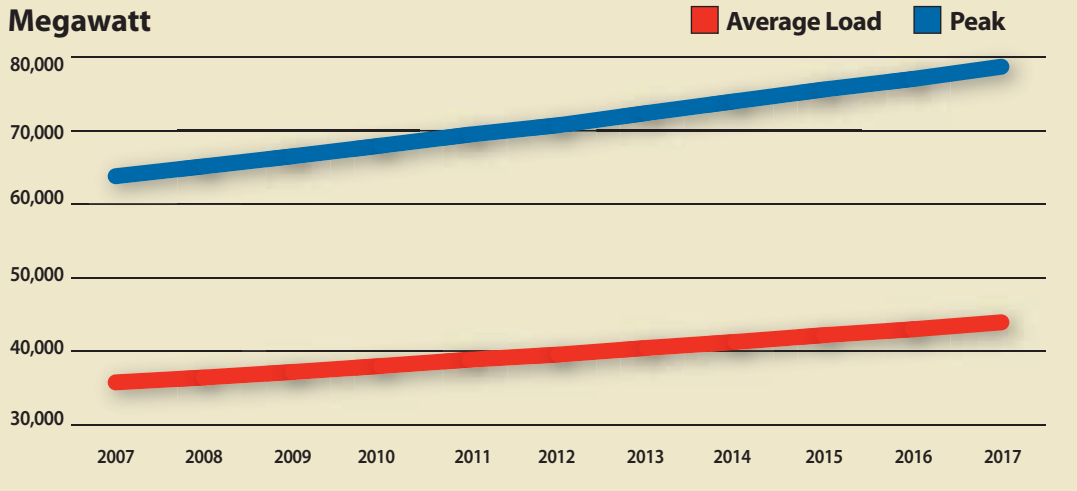
Annual Energy and Peak Demand Forecast 2007-2025, ERCOT Power Region



Source: Electric Reliability Council of Texas.

EXHIBIT 27-17

MWh Peak Demand and Average Hourly Load Forecast in ERCOT Power Region, 2007-2017



Source: Electric Reliability Council of Texas.

Meeting the growing demand for electricity in Texas will require new generation and transmission capacity. ERCOT projects $3.1 billion in spending on transmission lines from 2007 through 2011 and that another $3 billion will need to be invested from 2011 through 2016 in order to ensure adequate transmission capacity.[77] Substantial investments in new generating capacity also will be needed. In the longer term, increased energy efficiency and demand response may also act to limit consumption.

Meeting Projected Needs

According to EIA, coal-fired plants will continue to provide the nation's largest share of electricity for the foreseeable future, producing 57 percent of the nation's electricity by 2030, followed by natural gas (16 percent) and nuclear power (15 percent).[78]

The projected fuel mix for Texas is different, however, due to our greater use of natural gas and the difficulty in building new Texas coal plants due to environmental issues. In Texas in 2006, 49 percent of generation came from natural gas, compared with 37 percent for coal.[79]

Federal and state policy, along with technological breakthroughs, could lead to substantial deviations from these projections. Policies to limit carbon emissions currently being considered by Congress, for example, could erode coal's price advantages. If carbon emissions are taxed or capped in some manner, the price of using coal to generate electricity with current technology is sure to increase. Unless currently experimental technology to capture carbon emissions is proven to be effective and affordable, any restrictions on carbon emissions will force Texas and the U.S. to turn to new sources of energy to meet future electricity demands.

Texas has a competitive wholesale market structure and new power plant decisions are left up to private investors (or public power entities such as Austin Energy and San Antonio's City Public Services, or CPS). Under this system, all risks related to new power plants — construction cost overruns, fuel costs and compliance with future environmental regulations — are borne by the investors. **Exhibit 27-18** indicates the types of power plants that are being evaluated by developers within ERCOT.

The electric industry is in the midst of a significant period of change and the predominant type of power plants being evaluated have changed rapidly. A significant portion of the possible power plants (**Exhibit 27-19**) will not be completed for a wide variety of reasons. Any power project that does ultimately move to completion requires a signed interconnection agreement. During 2007, there were 19 interconnection agreements signed of which 17 were for wind power projects, representing 78.6 percent of the new MW capacity that have committed to connect to the ERCOT system.[80]

Since the collective output of numerous wind power plants is variable, large amounts of wind power create challenges in planning for capacity adequacy. During summer afternoons coincident with peak loads, ERCOT data suggests the output of Texas wind power plants typically *average* about 23 percent of their nameplate rating except along the South Texas coast, where sea breeze driven winds result in an average of about 50 percent.[81] There are instances, however, when wind generation can drop dramatically, well below the average nameplate rating. In February 2008, ERCOT had to shutoff power to some industrial users to prevent rolling blackouts partially due to a sudden drop in wind. To ensure reliability of the system, it is appropriate to view a new, variable output resource like wind power conservatively until such time as it is better understood how it will integrate within the system.

Meeting our growing demand for electricity will require large capital investments in generation and transmission capacity. Another factor that is expected to make future generating plants

Meeting the growing demand for electricity in Texas will require new generation and transmission capacity.

EXHIBIT 27-18

Generation Interconnection Requests by Fuel Type through 2007, MW

Fuel	Public	Not Public	Total
Coal	4,841	2,708	7,549
Natural Gas	3,708	26,367	30,075
Nuclear	5,986	6,400	12,386
Other	0	425	425
Wind	9,631	31,486	41,117
Total	24,166	67,386	91,552

Source: Electric Reliability Council of Texas.

EXHIBIT 27-19

Generation Interconnection Request Activity in 2007

Screening Studies Requested

Fuel	Number of Plants	MW
Coal	6	2,008
Natural Gas	40	23,613
Nuclear	2	6,400
Other	0	0
Wind	79	29,478
Total	127	61,499

Interconnection Studies Requested

Fuel	Number of Plants	MW
Coal	4	383
Natural Gas	17	5,292
Nuclear	3	9,100
Other	1	45
Wind	45	13,076
Total	70	27,896

Interconnection Agreements Signed

Fuel	Number of Plants	MW
Coal	1	581
Natural Gas	1	255
Nuclear	0	0
Other	0	0
Wind	17	3,064
Total	19	3,900

Source: The Electric Reliability Council of Texas.

significantly more expensive than existing plants is accelerating global demand for basic materials such as steel and copper and skilled personnel to build and operate power plants. These factors could coincide with new policies that increase the cost of burning fossil fuels. A restricted fuel supply resulting from resource depletion or new regulatory restrictions, combined with increased demand for electricity, will translate into higher electricity costs, unless new technologies reduce the cost or expand the supply of other sources of energy, or lead to efficiency gains that reduce energy demand. Higher electricity prices are also likely to affect demand for electricity as homeowners and businesses turn to more energy-efficient homes and commercial buildings and more efficient appliances.

The continuing growth of the Texas economy depends on the ability for residents and businesses to access affordable and reliable electricity. Texas must find ways to expand generating capacity, continue the trend toward improved efficiency and diversify our energy portfolio to meet the state's growing electricity demand.

ENDNOTES

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