

Third Edition

Guide to Electric Power in Texas



January 2003

Houston Advanced Research Center
and

Institute for Energy, Law & Enterprise
University of Houston Law Center

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Preface

This Third Edition of *Guide to Electric Power* in Texas comes at a time of great change and uncertainty in the electric power industry in Texas and the United States. Nationwide, the outstanding questions deal with how best to build workably competitive markets for bulk, wholesale transactions of power and the financial settlements that accompany these sales. Should we adopt a national market design that will establish and enforce common standards for how these transactions take place? Will such an approach ensure adequate and efficient investments in transmission capacity? How can we best provide open, transparent flows of information so that trading, marketing and risk management for both power and a critical generation fuel, natural gas, can proceed with confidence and integrity? What are the roles of national and state regulators and policy makers? And will our market design encourage continued experimentation with renewable energy sources like wind and solar, where those make sense, and help to foster and improve environmental quality across the system? These and other issues are being debated at a time when our energy policy decisions as a nation are being monitored by other countries as never before, a consequence of the sharp conflicts surrounding California's electric power restructuring program and the corporate governance and ethics issues emanating from the energy trading sector.

Among state-based programs, our Texas Electric Choice initiative remains the one most watched. As a consequence, customer education and participation, as well as customer feedback both to electric power providers and

our Public Utility Commission and Legislature, are important benchmarks.

This edition of the *Guide*, like previous versions, was prepared to provide a comprehensive and balanced educational resource for a wide range of retail customer groups, from interested residential consumers to large commercial and industrial organizations. The *Guide* was first published in 1997, after the Texas Legislature created our own wholesale market and when thinking began to coalesce with regard to participation in the marketplace by retail customers. Our goal was then, and remains, to provide both background on our state's electric power industry and history and the points of debate on how best to provide free choices and a different set of options so that the benefits of competition can be introduced and flourish. Texas remains unique among the states in how our electric power system is organized. Most electric power customers reside within the Electric Reliability Council of Texas or ERCOT, an island within the interconnected national grids. Our state competes for jobs and industries with other states, and so how our grid and other parts of the electric power system work are important for comparative advantage. As the electric power industry evolves nationwide we may become increasingly integrated, and so how our rules and framework "fit" with other state and regional approaches is of great interest to customers and the electric power industry. Finally, this book serves as a resource in Mexico, where there is ongoing discussion about how best to restructure that electric power system and where closer ties to Texas are a strategic objective on both sides of the border.

The *Guide* was conceived of and prepared at the Houston Advanced Research Center (HARC) and the Institute for Energy, Law & Enterprise (IELE) at the University of Houston's Law Center.

The Houston Advanced Research Center is a private, non-profit research organization located in The Woodlands, Texas seeking to improve ecosystem and human health through research and service. HARC's activities are

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focused on three primary areas – Energy, Environment and Life Sciences. HARC relies on the expertise and knowledge of its research partners, such as the University of Houston, for projects and publications like the *Guide*.

The University of Houston's IELE is a university-wide research, education, and outreach center on energy and related environmental issues. Formerly the Energy Institute located in the C.T. Bauer College of Business, our main focus is on economic, legal, regulatory, and financial frameworks to support sustainable, commercially successful energy development worldwide. Our work at the IELE extends across the energy value chains, from oil and gas exploration and production, to transportation and distribution, and to conversion and delivery for end use as petroleum products (gasoline, jet fuel and so on), electric power, or natural gas. The IELE specializes in the particular problems and issues surrounding the natural gas-to-electric power value chain, including liquefied natural gas (LNG). The transmission and local distribution "grid businesses" have historically been operated as public utilities because of their strong network economies of scale and potential to exert market power. For the past 25 years, the natural gas and electric power industries have experienced substantial restructuring in the U.S. and other countries as ways are sought to introduce competition, spur innovation and entrepreneurship, and instill market pricing and market-driven behavior. These policy actions have been taken mindful of the public interests involved. This bigger picture underlies the purpose and intent of our *Guide*.

In addition to the *Guide*, the IELE maintains ongoing research on issues in electric power restructuring and our natural gas supply and delivery system in the U.S., and on comparative approaches to gas and power restructuring both within the U.S. and across a number of countries. Our briefing paper on the Texas Electric Choice program can be found at www.powertochoose.org. We place particular emphasis on Mexico and the emerging North American continental marketplace, South America, West Europe and Turkey, and

East Asia. The IELE helps to expand energy content in UH courses and degree programs and hosts an international education program, *New Era in Oil, Gas and Power Value Creation* each May. The IELE is supported by the following financial partners. The University of Houston is a member of the HARC higher education consortium.

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Facts on Texas Electric Power

Electricity: We Make and Use a Lot

By far, Texans use more electricity than any other state and many countries. In 2000, we bought almost 10 percent of all electricity sold in the U.S., exceeding customers in California, the next largest state, by 44 percent. We used over 60 percent more electricity than Florida, the third largest consuming state or almost twice as much as Ohio, the fourth largest consuming state, and more electricity than the 20 lowest consuming states combined. Texas uses a lot of electricity!

Texas utilities sold 318 billion kilowatt hours (kWh) of electricity in 2000 - 97 billion more than California and almost 122 billion more than Florida. And this doesn't include electricity generated by industry for its own use. Texans use this much electricity because of the concentration and type of businesses and the climate.

Who Uses Electricity in Texas?

There are more than 9 million customers that buy electricity from Texas utilities and about 86 percent of these are residential. There are nearly 1.1 million commercial customers and more than 61,000 industrial customers. Utilities receive much of their revenue from residential customers who spent about \$9.3 billion on electricity in 2000. In this same year, industry spent \$4.5 billion and commercial users about \$5.8 billion.

The average Texas industrial customer consumes as much electricity as 114 homes. The average residence consumes more than 14,500 kilowatt-hours (kWh) per year while the average industrial customer uses about 1.66 million kWh per year. Average commercial customers use more than 5 residences - approximately 77,600 kWh.

Large volume electricity customers, such as industries and large commercial operations pay lower rates than low volume users, such

Electricity - it's always there except for an occasional storm, and we expect it to be there wherever we go. It works so well most of the time that we're surprised when it's in the news. In Texas today, electricity is big news, big business and important to all of us.

Texas electricity is different. We make more, use more, and have our own niche in the U.S. system. Texas produces and uses more electricity than any other state in the U.S., considerably more than California which has about 13 million more people. Why? And what does that mean for the future?

Texas also stands alone in the way it is connected to the electric power grid - there's the eastern part of the system, the western part, and

Overview

the ERCOT part. How did this happen and why?

Texas relies heavily on coal for electric power generation, although we have more than three times the amount in natural gas generation capacity. Fuel competition is driving change in the industry. Why?

Texas electricity on average is cheaper, but we spend more and costs vary widely across the state and from consumer to consumer. Why is it cheaper (when it is) and why do prices vary?

Finally, how will these characteristics change in today's industry now that full competition was started on January 1, 2002?

as residences. This lower cost for large customers is attributed to lower delivery costs and more stable demand. In 2000, average rates for different types of customers in Texas were 7.96¢ per kWh for residential customers; 6.88¢ for commercial customers; and 4.42¢ for industrial customers. These are average rates that vary from area to area in the state. Also, an industrial or commercial customer using small amounts of electricity would pay higher rates.

Making & Moving Electricity

Texas electricity used to be made and moved primarily by electric utilities. However, electric power is not simple and utilities are not the only organizations involved, especially now that we are implementing Texas Electric Choice - what this third edition of Guide to Electric Power in Texas is really all about. There are several types of utilities; many investor-owned utilities

Facts on Texas Electricity - 2000

No. of Generating Stations (2001)	531
Total No. of Electric Utilities	182
No. of Investor Owned Utilities	10
No. of Municipal Utilities	79
No. of Cooperatives	87
No. of River Authorities	4
Total Annual Consumption	318 GWh
Total Generating Capacity (2001)	79.5 GW
No. of Residential Customers	8 million
No. of Commercial Customers	1.1 million
No. of Industrial Consumers	61,280
Avg. Residential Consumption	14,570 kWh
Avg. Commercial Consumption	77,600 kWh
Avg. Industrial Consumption	1.66 mil. kWh
Avg. Residential Rate	7.96¢/kWh
Avg. Commercial Rate	6.88¢/kWh
Avg. Industrial Rate	4.42¢/kWh
U.S. Avg. Residential Rate	8.24¢/kWh
U.S. Avg. Commercial Rate	7.43¢/kWh
U.S. Avg. Industrial Rate	4.64¢/kWh

Source: U.S. Energy Information Administration (EIA) and the Public Utility Commission of Texas.

Facts on Texas Electric Power

What's a Kilowatt-hour?

Part of our bill for electricity is based on how many kilowatt-hours (kWh) we use. The "W" is capitalized because it is named after James Watt who devised this measure in 1892.

A kilowatt equals 1,000 watts of power so a 1,000 watt light bulb (very bright) burning one hour would use one kWh.

Watts are simply a measure of the rate at which work is done by electricity with a kilowatt equaling about 1.34 horsepower.

have created separate subsidiaries to make and sell electricity, and these must function apart from the parent company; some industries cogenerate electricity moved on the power grid; power marketers now buy and sell electricity; an Independent System Operator (ISO) has been created in Texas; and there is government involvement in all of this.

With the passage of Senate Bill 7 (SB 7) in May 1999, the Texas legislature restructured the state's electricity industry. Through the Texas Electric Choice program, the goals laid out in SB 7 are being implemented. The idea is to allow customers to benefit from competition to make and sell electricity, and to create a marketplace that is more efficient while at the same time protecting customer rights and providing education and assistance to customers that need it. Importantly, while the marketplace is changing, the fundamentals of electricity remain the same. The electric power system consists of complex equipment - the power plants that generate electricity, the transmission system, local distribution and the control systems associated with each of these.

What are Electric Utilities?

Private utilities are a unique U.S. invention. Historically they have been highly regulated monopoly industries that provide water, telephone service, natural gas, and electricity in this country. While still closely regulated, natural gas, telephone, and electricity regulation has changed over time toward less regulation and increased competition. In most other countries, these services are provided by government owned and operated monopolies. This is changing as these countries seek more efficient ways of providing these services through private investment and competitive markets.

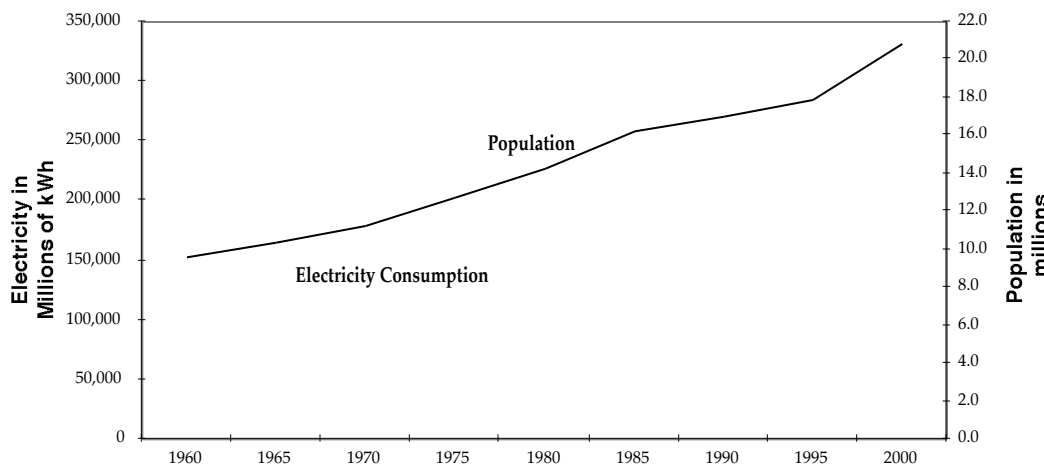
Texas actually has four types of electric utilities: investor-owned (IOUs), municipal utilities (munis), electric cooperatives (co-ops), and river authorities. In 2000, Texas had 10 IOUs which provided roughly 84 percent of the state's electricity. TXU Electric and Reliant Energy HL&P were the largest. According to SB 7, only the transmission and distribution (T&D) activities can now be seen as utilities while the generation and retail sales are now competitive businesses. However, in parts of Texas where retail competition was delayed, utilities remain integrated (see Part IV for details).

There are 87 electric cooperatives, four river authorities and 79 munis that are partially regulated by the Public Utilities Commission of Texas (PUCT). Of the munis, 19 actually generate electricity with the remainder buying and distributing electricity to their customers.

Cogenerators, Qualifying Facilities and Independent Power Producers

The U.S. Public Utility Regulatory Policy Act of 1978 (PURPA) created a category of non-utility power producers called qualifying facilities (QFs). This category includes cogeneration plants, facilities

**Texas Electricity and Population Growth
1960 to 2000**



Use of electricity in Texas has grown much faster than the population. By 2000, consumption per capita was over 4 times what it was in 1960. This increase has occurred across the board, with residential consumers outpacing industrial customers.

Source: U.S. EIA.

Facts on Texas Electric Power

using waste products as fuel (such as petroleum coke or manure), and renewable resources like wind and solar. Cogeneration (cogen) provides process energy (usually steam) as a by-product of power generation. PURPA required the host utilities of QFs to purchase energy from the QFs at avoided costs. In Texas, QF cogeneration plants may sell power to the steam host and excess energy to the host utility or another electric utility.

In 2000, about 15 percent of the total power generation capacity in Texas was associated with non-utility generators (NUGs). With the addition of about another 8,000 MW of mostly merchant plants, the share of NUGs reached about 20 percent by the end of 2001. Until recently, Texas accounted for more than 20 percent of total U.S. non-utility power generation. Restructuring of the industry required the generation arm of utilities to be separated from the transmission and distribution operations. Today, even the generation companies affiliated with the old utilities have to compete to sell the power they generate. As such, almost all generation in Texas is now non-utility.

Regulators

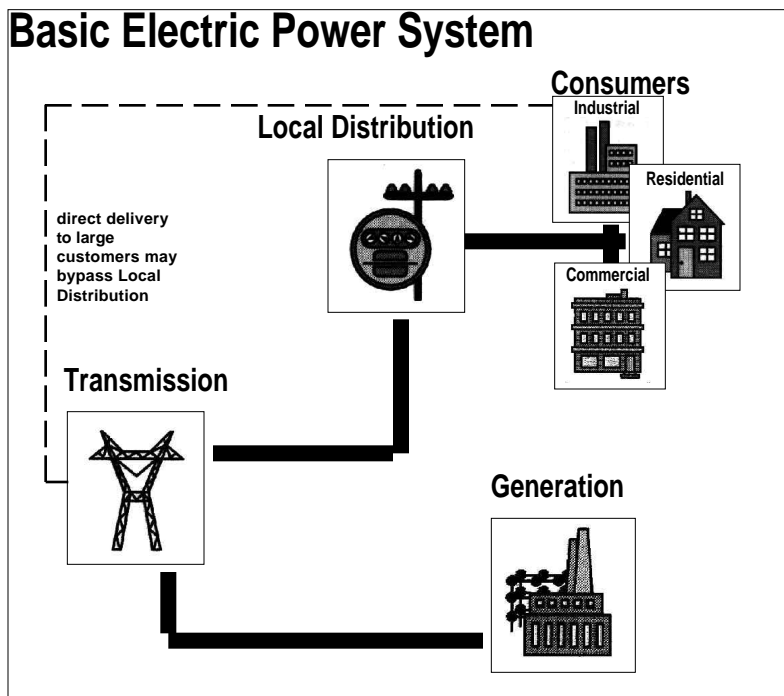
Texas utilities and electric power are regulated primarily by the Public Utility Commission of Texas (PUCT). Created by the state legislature in 1975, Texas was the last state to authorize a PUC.

The primary Federal regulator is the Federal Energy Regulatory Commission (FERC). The FERC regulates the transmission and sale of wholesale power in interstate commerce and thus has regulatory authority over most of the utilities in the U.S. Texas utilities are subject to FERC jurisdiction only for the sale of electric power in the wholesale or "bulk" market in the U.S. (FERC has no jurisdiction in the Texas wholesale market) or the transmission of power for interstate sales. The PUCT has requirements comparable to FERC's for utilities operating in Texas.

Electric Utilities Generating Capacity in Texas By Primary Energy Source — Year End 2001

Primary Energy Source	Generating Capacity (MW)	Percentage of Total Capacity
Coal Fired	16,185	20.4 %
Gas-fired	56,364	70.9 %
Nuclear	5,139	6.5 %
Renewable	1,061	1.3 %
Petroleum	220	0.3 %
Hydroelectric	471	0.6 %
Total	79,479	100 %

Source: ERCOT EIA-411 filing (4/1/02).



Recent Actions

FERC Orders 888 and 889 issued April 30, 1996 were major federal actions affecting electric utilities. Order 888 required FERC-regulated utilities to file tariffs (what they would charge) for wholesale transmission services. Order 889 required FERC-regulated utilities to create an information system for access by others (by August 1996).

These two orders did not require separation or unbundling of all utility services, but did require the functional separation of transmission from power marketing. The FERC has left it up to the states to decide whether and how utilities should be reor-

2000 Electricity Retail Sales

	Millions of kWh
Texas	318,263
California	244,057
Florida	195,843
Ohio	165,195
New York	142,027
Illinois	134,697
Pennsylvania	133,845
North Carolina	119,855
Georgia	119,185
Michigan	104,772
Indiana	97,775
Virginia	96,715
Washington	96,511
Tennessee	95,728
Alabama	83,524
Top 15 States	2,147,992
Total U.S.	3,421,414

Source: U.S. EIA.

Facts on Texas Electric Power

Some of the Utilities in Texas That Provide Electricity Services

Investor Owned Utilities

American Electric Power (AEP) Company
 El Paso Electric Company
 Entergy/Gulf States Utilities Company
 Houston Lighting & Power Company
 Sharyland Utilities
 Southwestern Electric Power Company
 Southwestern Public Service Company
 Texas-New Mexico Power Company
 Texas Utilities Electric Company
 West Texas Utilities

Cooperatives

Brazos Electric Power Cooperative
 Northeast Texas Electric Cooperative, Inc.
 Sam Rayburn G&T, Inc.
 San Miguel Electric Cooperative, Inc.
 STC/MEC Power Pool

Municipal Utilities

City of Brady
 Brownfield Municipal Power and Light
 City of Austin Electric Utility
 City Public Service-San Antonio
 City of Coleman
 City of Electra
 City of Floydada
 City of Hearne
 Lubbock Power and Light
 Public Utilities Board-Brownsville
 City of Robstown
 Sam Rayburn Municipal Power Agency
 Texas Municipal Power Agency
 Bryan, Denton, Garland, Greenville
 Tulia Power and Light
 Weatherford Municipal Utility System
 City of Whitesboro

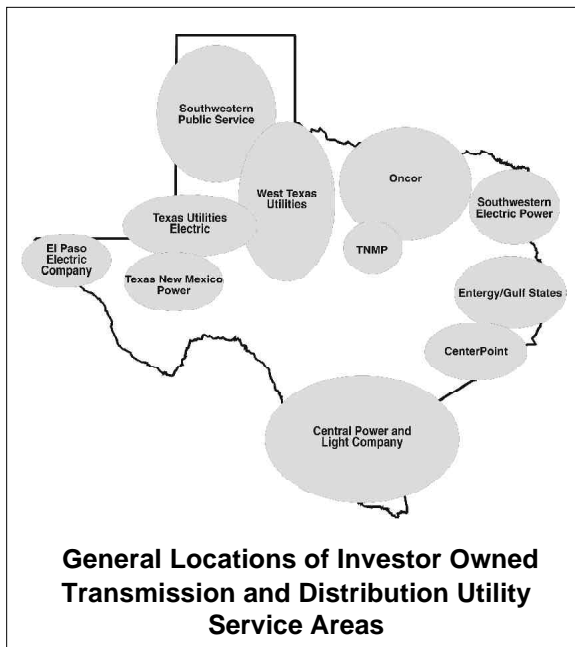
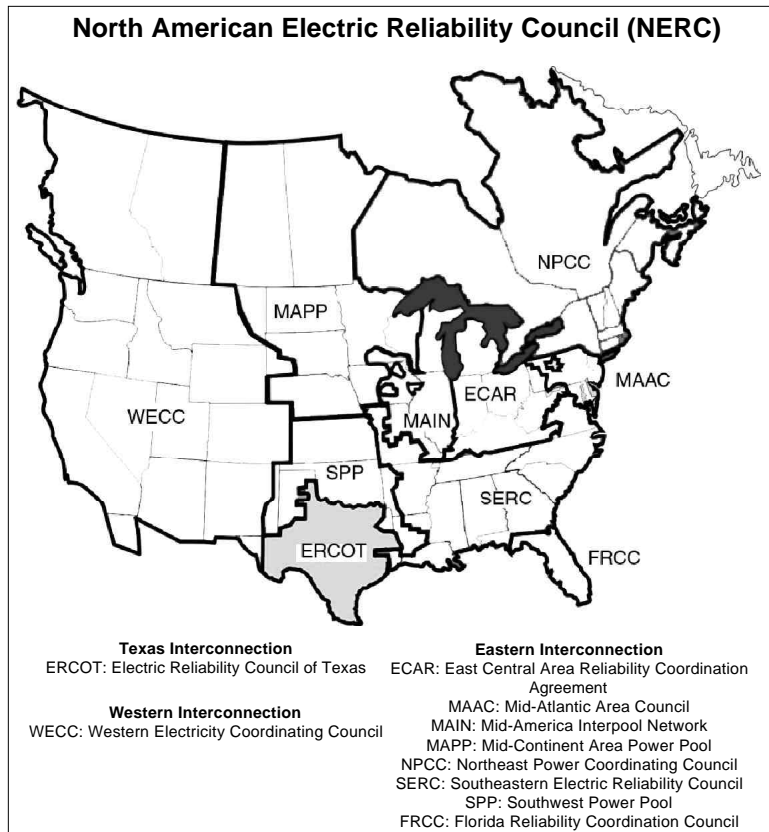
River Authorities

Guadalupe-Blanco River Authority
 Lower Colorado River Authority
 Sabine River Authority
 Brazos River Authority

ganized.

In December 1999, the FERC issued Order 2000. In that policy, the FERC requires all owners of transmission assets to organize these facilities into Regional Transmission Organizations (RTOs). The intention is to create larger markets for the transmission of electricity, facilitating competition and competitive pricing. Under Order 2000, it is expected that the portions of Texas that are included in the Electric Reliability Council of Texas (ERCOT) would function as a separate RTO. The FERC is holding hearings and encouraging meetings among all stakeholders (utilities, generators, marketers, customers and so on) to determine how best to implement Order 2000.

When the Texas legislature passed SB 7 in May 1999, utilities were required to unbundle



their services into generation, transmission and distribution (T&D) and retail. Today, generation and sales (both wholesale and retail) of electricity are competitive businesses while the T&D companies remain regulated utilities.

The Equipment of an Electric Power System

The physical equipment of an electric power system includes generation which makes electricity, a transmission system that moves electricity from the power plant closer to the consumer and local distribution systems which move electric power from the transmission system to most consumers.

Generation

Power plants use coal, lignite, natural gas, fuel oil, and uranium to make electricity. In addition, renewable fuels include moving water, solar, wind, geothermal sources and biomass.

The type of fuel, its cost, and generating plant efficiency can determine the way a generator is used. For example, a natural gas generator with steam turbines has a high marginal cost but can be brought on line quickly. Coal, lignite, and nuclear units have lower marginal costs but cannot be brought on line quickly. They are used primarily to provide the base load of electricity.

Costs for fuel, construction and operations and maintenance vary greatly among types of power plant. For example, renewable generation plants, such as solar or wind, have virtually no fuel costs but are expensive to manufacture and install. Nuclear- and coal-fueled plants have low fuel costs but can be more expensive to build and maintain. Coal units also incur additional costs for meeting air quality standards. Natural gas plants have higher fuel costs than coal or nuclear, but have lower initial construction costs.

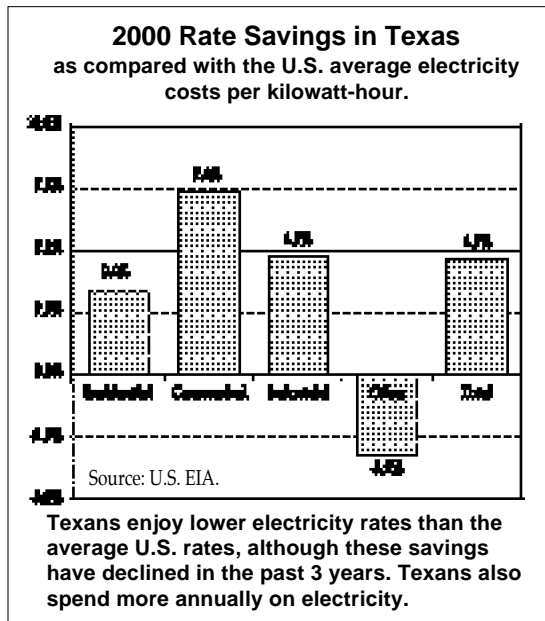
Companies affiliated with utilities have the capacity to generate almost 65 gigawatts of power (65 million kilowatts). This capacity has not changed much since the opening of the wholesale market to competition. This is because, unlike other states, SB 7 did not require utilities to fully divest themselves of all of their

electric power generation assets. As older units are retired, this capacity will decline. On the other hand, "merchant," or non-utility, generation capacity added almost 15 gigawatts between 1999 and 2002, bringing total generation capacity of the state to more than 80 gigawatts. By comparison, that is twice as much as the entire country of Mexico. Merchant generators are companies that seek to invest in new electric power generation capacity based on their assessment of supply and demand conditions in the marketplace. Thus, these companies only enter the market if economic conditions warrant.

Capacity vs. Actual Generation – As of early 2002, almost 70 percent of Texas generating capacity is natural gas. In contrast, gas-fired generation accounted for only about 50 percent between 1999 and 2001. The rest of our electricity is mostly generated from coal, lignite or nuclear power plants. This is because of fuel costs. Although coal and nuclear power plants are more expensive to build than natural gas plants, fuel costs for coal and nuclear are considerably less. Thus, electricity is usually dispatched first from nuclear plants, then coal, and last from natural gas. Nuclear and coal generators provide most of the base load of electricity day-in and day-out, while natural gas generators provide the peak loads which occur during certain periods of the day such as when air conditioning is in high demand.

Storing Electricity – Unlike water and natural gas, electricity cannot be easily stored. This presents a fundamental challenge to the electric power system. There is no container or large "battery" that can store electricity for indefinite periods (see following). Energy is stored in the fuel itself before it is converted to electricity. Once converted, it has to go out on the power lines.

Electricity Storage Technologies - Compressed air, pumped hydroelectric, advanced batteries and superconducting magnetic energy storage are the four main technologies being studied for possible electricity storage. Compressed air and pumped hydro are already being used in some locations in the U.S.



Facts on Texas Electric Power

Cost Per Kilowatt-Hour and Average Annual Cost Per Customer Texas and the U.S. - 2000

	Cost per kWh		Avg. Cost Per Customer	
	Texas	U.S.	Texas	U.S.
Residential	7.96¢	8.24¢	\$1,160	\$879
Commercial	6.88¢	7.43¢	\$5,337	\$5,464
Industrial	4.42¢	4.64¢	\$73,287	\$93,760
Other	6.77¢	6.56¢	\$8,295	\$7,369
All	6.49¢	6.81¢	\$2,220	\$1,828

Source: U.S. EIA

Texans pay 5% less per kWh than the U.S., but because we use 28% more electricity on average, our electric bills are 21% higher.

Transmission System

Power plants are located at points, which allow access to the fuel source, generally away from population centers, and electricity must be moved from that point to the consumer. The transmission system accomplishes much of this task with an interconnected system of lines, distribution centers, and control systems.

There are about 50,000 miles of transmission lines in Texas. 37,000 miles of lines are located within the ERCOT system (see NERC map on page 4). These consist of roughly 8,000 miles of 345 kilovolt (KV) lines; 17,000 miles of 138 KV lines; and 12,000 miles of 69 KV lines. About 13,000 miles of lines are located in non-ERCOT areas of Texas, especially within the Southwest Power Pool territory (the Panhandle and east Texas).

Electricity is transported at high voltages (69 KV or greater) over a multi-path powerline network that provides alternative ways for electricity to flow. The large three-conductor lines and substations are familiar to most Texans, but the control systems that keep the system functioning are less visible.

The control systems

move power between T&D utilities by adjusting generator output in the T&D utility areas involved, not by switches. Movement among several utilities means complex adjustments in which rules of operation are followed carefully.

The transmission system has been built over several decades and early developers could not have envisioned the movement of electricity being considered under many of today's competitive scenarios. As such, the transmission system is a critical link in the move to change the electric power system.

Local Distribution Systems

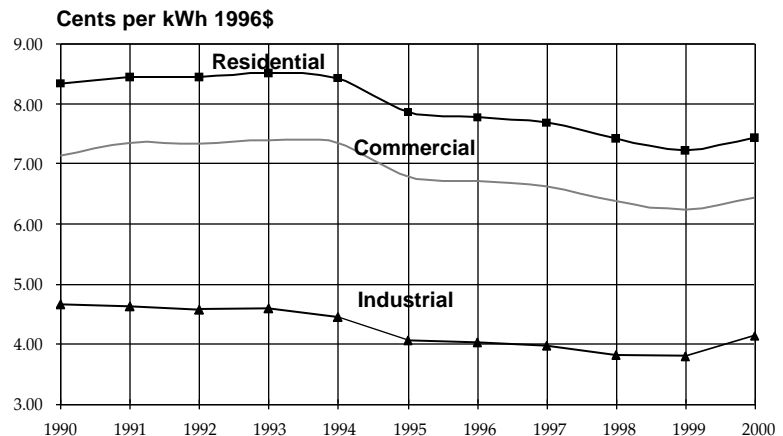
Most homes and businesses use 120- and 240-volt electric power while industries often use higher voltages. Large commercial and industrial customers may bypass the local distribution system, receiving electricity at high voltage directly from the transmission system.

Substations on the transmission system receive power at higher voltages and lower them to 24,900 volts or less to feed the distribution systems. The distribution system is the poles and wires commonly seen in neighborhoods. At key locations, voltage is again lowered by transformers to meet customer needs.

Customers on the distribution system are categorized as industrial, commercial and residential. Industrial use is fairly constant, both

Real Change in Cost of Electricity in Texas

Adjusted to 1996 Dollars (1996 GDP Deflator)
1990 to 2000



Source: U.S. EIA.

over the day and over seasons. Commercial use is less constant and varies over seasons. Residential and commercial use is more variable, sometimes changing rapidly over the day in response to occupant need, appliance use and weather events.

Many Texas municipal utilities and co-ops provide only distribution services, purchasing power from the IOUs, other cooperatives or river authorities.

Texas and the U.S.

The electrical systems in the U.S. and much of Canada are divided into three major regions - the Eastern Interconnection, the Western Interconnection and the Texas Interconnection, which includes most of the state. These are groups of utilities which connect to each other to form the three power grids.

The utilities operate in such a way that electricity can move reliably between utilities within the Interconnections. Few direct connections exist between the Interconnections. ERCOT has two high voltage DC (direct current) connections, both to the Eastern Interconnection. The northern tie has a capacity of 200 megawatts and the eastern tie, a 600 megawatt capacity. These DC ties accept AC (alternating current) in and provide AC out, but they are not necessarily synchronous (see page 12 on system stability).

In response to a major blackout in 1965 in the Northeast, the North American Electric Reliability Council (NERC) was created. Most electric power systems in the U.S. and Canada are members of one of NERC's 10 Regional Reliability Councils (see Part 2 for details).

ERCOT serves approximately 85 percent of the state's electric load and oversees the operation of approximately 70 gigawatts of generation and over 37,000 miles of transmission lines. Most of the Texas Panhandle and part of East Texas are in the Southwest Power Pool (SPP). The El Paso region is in the Western Electricity Coordinating Council (WECC). A small part of Southeast Texas (Beaumont area) is in the Southeastern Electric Reliability Council (SERC).

In 1995, Texas created an Independent Sys-

tem Operator (ISO) as proposed by ERCOT. An ISO is an independent, unbiased third-party entity that oversees the activities related to the reliable and safe transmission of electricity within a specified geographic area. After SB 7, ERCOT also provides the platform for an open, competitive marketplace for the majority of Texas customers. ERCOT is required to (1) ensure non-discriminatory access to the T&D systems for all electricity buyers and sellers, (2) ensure the reliability and adequacy of the regional electric network, (3) ensure that information related to customer retail choice is provided in a timely manner, and (4) ensure that electricity production and delivery are accurately accounted for among all regional generators and wholesale buyers and sellers. As the ISO, ERCOT operates an information network for all market participants' use as a primary means of facilitating efficient and equitable use of the transmission system.

How Much Does It Cost and What Do We Spend?

Texas electricity is cheaper than the U.S. average but because we consume more, monthly bills are higher. Electricity rates and costs for Texas residential, commercial and industrial customers are compared with the U.S. in the table on the previous page.

The electricity rate averaged for all customer classes in 2000 was 6.49¢ per kilowatt hour (kWh), 4.7 percent lower than the U.S. average. The average residential electricity rate in Texas was 3.4 percent lower than the U.S. average. However, higher use in Texas resulted in residential bills that were higher by \$281 - about 32 percent higher.

In 2000, commercial customers in Texas paid 6 percent more per kWh than the overall Texas average and about 14 percent less than residential customers.

At 4.42¢ per kWh, industrial customers paid slightly more than half the rate of residential customers. Texas industrial rates were 4.7 percent lower than the U.S. industrial average. With interruptible service, large electricity users may have lower rates. Such rates also reflect lower fuel costs in Texas, the economies

Facts on Texas Electric Power

Cost Variation Among Utilities (¢ per kWh, 2000)

	<u>Residential</u>	<u>Commercial</u>	<u>Industrial</u>
Texas Average	7.96	6.88	4.42
Texas Lowest	1.51	5.18	2.71
Texas Highest	17.66	27.66	12.37
IOU Average	7.97	6.94	4.76
IOU Lowest	5.86	5.18	2.71
IOU Highest	10.60	9.83	9.26
Co-op Average	8.42	7.71	5.56
Co-op Lowest	5.35	5.26	3.31
Co-op Highest	17.66	10.9	8.18
Muni Average	7.84	8.20	6.48
Muni Lowest	1.51	5.47	3.51
Muni Highest	11.63	27.66	12.37

Source: U.S. EIA.

Rates for all customer groups vary widely across Texas. In particular, co-op and muni rates demonstrate large variability due to generation type, the extent of the T&D system and the size and mix of customer types. On average, however, IOU rates are lower than those of co-ops and munis.

of serving large users, and lower variability.

In the U.S. from 1991 to 2000, average electricity rates (adjusted to constant 1996 dollars) decreased by 17.1 percent. Industrial customers have seen their rates decrease by 22.7 percent. Rates for commercial customers decreased by 19.7 percent while those for residential customers decreased by 14.4 percent.

In Texas, rates also declined over the same period but not as much. Average electricity rates (in 1996 dollars) decreased by 10.7 percent. Residential rates decreased by 12.6 percent and commercial rates by 13 percent while industrial rates declined by 10 percent (see chart on page 6).

Cost Variation Among Utilities

As reported in the table above, electricity rates have varied widely within the state during 2000. Each utility had its own rates and cost basis, and each was treated separately in rate making by the PUCT. The process of establishing rates and cost basis will continue for T&D utilities under SB 7.

Residential rates varied from as little as 1.51¢ per kWh (City of San Augustine, a muni) to as much as 17.66¢ (Harmon Electric Association

Inc., a co-op); the next lowest rate was 5.35¢ (Southwest Arkansas ECC, a co-op) and the next highest rate was 13.04¢ (Rio Grande Electric Coop Inc., a co-op). The rates varied from 122 percent higher than the state average of 7.96¢ to 81 percent lower. IOUs averaged 7.97¢ while co-ops averaged 8.42¢ and munis averaged 7.84¢.

Electricity rates for commercial customers in Texas varied from as low as 5.18¢ (Southwestern Electric Power Co., an IOU) to 27.66¢ per kWh (City of Flatonia, a muni); the next highest rate was only 17.01¢ (City of San Augustine, a muni). The rates ranged from 24 percent below to 302 percent above the average commercial rate of 6.88¢. IOUs averaged 6.94¢ while co-ops averaged 7.71¢ and munis averaged 8.20¢.

Rates for industrial users varied from as low as 2.71¢ (Southwestern Public Service Co., an IOU) to 12.37¢ per kWh (City of Hearne, a muni) with a variation from 38 percent lower to 180 percent higher than the state average of 4.42¢. IOUs averaged 4.76¢ while co-ops averaged 5.56¢ and munis averaged 6.48¢.

The Electric Power Industry in Texas

Historically, total expenditures for all energy have accounted for about seven percent of the Gross Domestic Product (GDP) in the U.S. Purchase of natural gas and electricity services have amounted to more than three percent of GDP. Investment in natural gas and electricity services has been about five percent of total, fixed, nonresidential investment. Energy is big business in the U.S. and electricity is a vital input to our national economy.

Texas accounts for almost 10 percent of net electricity generation in the U.S., a result mainly of our large petroleum refining and petrochemical industries. We provide about nine percent of the \$226 billion electricity final sales revenue in the U.S., more than any state except California, which provides 10 percent.

Clearly, electricity is important to Texas. It is relatively cheap, and so has been beneficial to business and residential growth. The size of the Texas electric power industry means that policies and business trends that impact electric power in the U.S. will have a big effect here.

The Basics of Electric Power

Electricity travels fast, cannot be stored easily or cheaply, and cannot be switched from one route to another. These three principles are basic to the operation of an electric power system.

Electricity is almost instantaneous. When a light is turned on, electricity must be readily available. Since it is not stored anywhere on the power grid, electricity must somehow be dispatched immediately. A generator is not simply started up to provide this power. Electric power must be managed so that electricity is always available for all of the lights, appliances and other uses that are required at any particular moment.

Electricity traveling from one point to another follows the path of least resistance rather than the shortest distance. With thousands of miles of interconnected wires throughout the U.S., electricity may travel miles out of any

The main function of an electrical power system is to transmit all electricity demanded reliably, and in the exact amount, where it is needed. In addition, it should provide for unforeseen contingencies arising from larger than expected demand or system outages. The industry structure has three main segments - generation, transmission, and distribution.

Generation - The process of producing electric energy by transforming other forms of energy such as coal, natural gas or solar power.

Transmission - The movement or transfer of electric energy over an interconnected group of high voltage lines between points of supply and points at which it is transformed for delivery to consumers or other electric systems. Transmission ends when the energy is transformed for input into the distribution system.

Distribution - The portion of the electrical system which operates at low voltages and delivers electricity to an end-user such as a home, business or industrial plant.

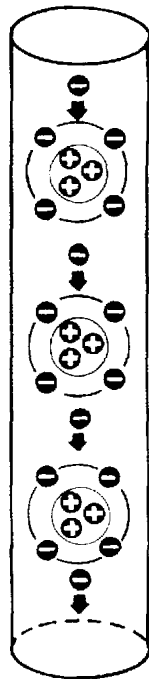
Most electrical services used to be provided by large, vertically integrated companies that owned the gen-

Overview

eration, transmission and distribution (T&D) facilities within a specified service area. Today, the generation and sale of electric power in ERCOT can be provided by unregulated (but certified) companies in competitive markets. T&D operations are still provided by regulated utilities, who must unbundle their systems so that generation, sales and related services are separate and so that "open access" can be provided in a fair, nondiscriminatory way to all competitors. Competitors include competing generators, marketers, aggregators (who combine customers into larger groups), retail electric providers or REPs (who handle customer accounts and sales) and qualified scheduling entities or QSEs (who handle the scheduling of electricity supplies from generators and demand from aggregators, marketers and REPs).

Diagram 1
Electric Current

When a metal wire, such as copper, is passed through a magnetic field, electrons are exchanged from atom to atom. This forms a moving stream or *current* of electricity.



direct path to get where it is needed.

As a result of these three principles, designing and operating an electrical system is complex and requires constant management.

Defining and Measuring Electricity

Electricity is simply the flow or exchange of electrons between atoms. The atoms of some metals, such as copper and aluminum, have electrons that move easily. That makes these metals good electrical conductors.

Electricity is created when a coil of metal wire is turned near a magnet (Diagram 1). Thus, an electric generator is simply a coil of wire spinning around a magnet. This phenomenon enables us to build generators that produce electricity in power plants.

The push, or pressure, forcing electricity from a generator is expressed as volts. The flow of electricity is called current. Current is measured in amperes (amps).

Watts are a measure of the amount of work done by electricity. Watts are calculated by

Basic Measures of Electricity

Volts

The push or pressure forcing electricity in a circuit.

Amperage

Unit of measurement (amps) of electrical current or flow

Watts, Kilowatts and Megawatts

A measure of electricity's ability to do work.
Equals volts times amps
Kilowatt=1,000 watts
Megawatt = 1,000,000 watts

Resistance

The measure in ohms of how much force it takes to move electric current through a conductor. Resistance in conductors causes power to be consumed as electricity flows through.

The Basics of Electric Power

multiplying amps times volts. Electrical appliances, light bulbs and motors have certain wattage requirements that depend on the tasks they are expected to perform. One kilowatt (1,000 watts) equals 1.34 horsepower.

Kilowatts are used in measuring electrical use. Electricity is sold in units of kilowatt-hours (kWh). A 100-watt light bulb left on for ten hours uses one kilowatt-hour of electricity (100 watts \times 10 hours=1,000 watt hours=1 kWh). The average residential customer in Texas uses more than 14,500 kWh annually. In 2000, Texans used more than 318 billion kWh.

Electricity in the U.S. is generated and usually transmitted as alternating current (AC). The direction of current flow is reversed 60 times per second, called 60 hertz (Hz). Because of the interconnection within the power grids, the frequency is the same throughout the grid. Operators strive to maintain this frequency at 60 Hz.

Higher voltages in many instances can be transmitted more easily by direct current (DC). High voltage direct current (HVDC) lines are used to move electricity long distances.

Types of Generators

Steam Turbine

Uses either fossil fuel or nuclear fuel to generate heat to produce steam that passes through a turbine to drive the generator; primarily for base load but some gas-fired plants are also used for peak loads; range in size from 1 to 1,250 megawatts.

Combustion Turbine

Hot gases are produced by combustion of natural gas or fuel oil in a high pressure combustion chamber; gases pass directly through a turbine which spins the generator; used primarily for peak loads but combined cycle plants are used for base load; generator is generally less than 100 megawatts; quick startup suitable for peaking, emergency, and reserve power.

Hydroelectric Generating Units

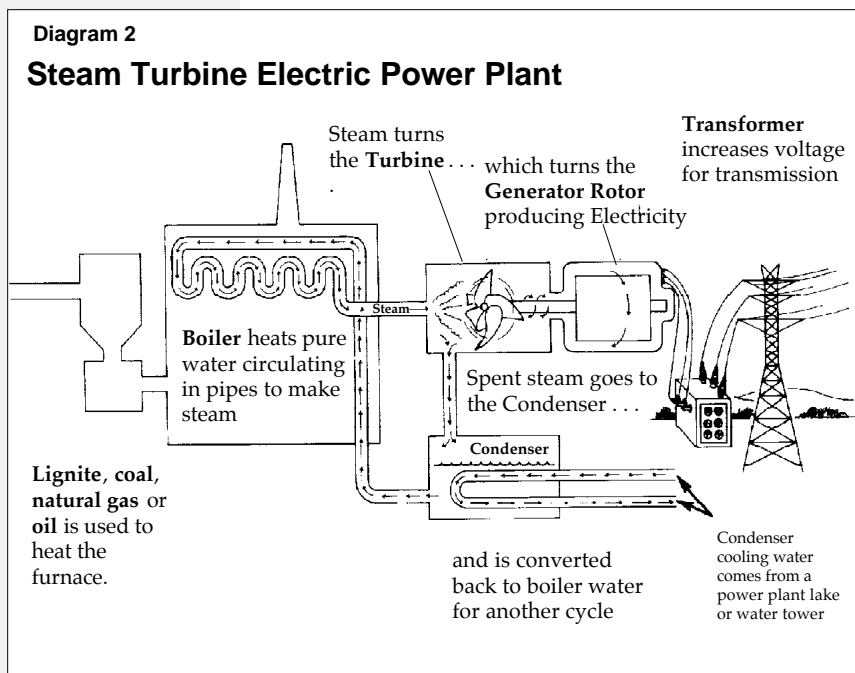
Flowing water used to spin a turbine connected to a generator; range in size from 1 to 700 megawatts; can start quickly and respond to rapid changes in power output; used for peak loads and spinning reserve, as well as baseload.

Internal Combustion Engines

Usually diesel engines connected to the shaft of a generator; usually 5 megawatts or less; no startup time; operated for periods of high demand.

Others

Geothermal, solar, wind, and biomass; many different technologies; range widely in size and capabilities.



Generating Electricity

There are many fuels and technologies that can generate electricity. Usually a fuel like coal, natural gas, or fuel oil is ignited in the furnace section of a boiler. Water piped through the boiler in large tubes is superheated to produce heat and steam. The steam turns turbine blades which are connected by a shaft to a generator. Nuclear power plants use nuclear reactions to produce heat while wind turbines use the wind to turn the generator.

A generator is a huge electromagnet surrounded by coils of wire which produces electricity when the shaft is rotated (Diagram 2). Electricity generation ranges from 13,000 to 24,000 volts. Transformers increase

Uses of Generating Units

Base Load Unit

Generates the minimum or baseload requirement of the power system; operates at a constant rate and runs continuously.

Peak Load Unit

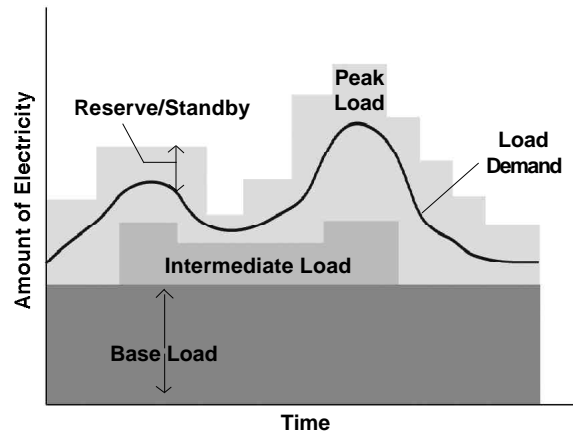
Used to meet requirements during the periods of greatest demand.

Intermediate Load Unit

Used during the transition between base load and peak load requirements.

Reserve or Standby Units

Available to the system in the event of an unexpected increase in load or outage.



the voltage to hundreds of thousands of volts for transmission. High voltages provide an economical way of moving large amounts of electricity over the transmission system.

Transmission & Distribution

Once electricity is given enough push (voltage) to travel long distances, it can be moved onto the wires or cables of the transmission system. The transmission system moves large quantities of electricity from the power plant through an interconnected network of transmission lines to many distribution centers called substations. These substations are generally located long distances from the power plant. Electricity is stepped up from lower voltages to higher voltages for transmission.

High voltage transmission lines are interconnected to form an extensive and multi-path network. Redundant means that electricity can travel over various different lines to get where it needs to go. If one line fails, another will take over the load. Most transmission systems use overhead lines that carry alternating current (AC). There are also overhead direct current (DC) lines, underground lines, and even under-water lines.

All AC transmission lines carry three-phase current -- three separate streams of electricity traveling along three separate conductors. Lines are designated by the voltage that they

can carry. Power lines operated at 60 kilovolt (kV) or above are considered as transmission lines. There are about 50,000 miles of transmission lines in Texas.

Even though higher voltages help push along the current, electricity dissipates in the form of heat to the atmosphere along transmission and distribution lines. This loss of electricity is called line loss. About 7 percent of all electricity generated in Texas is lost during transmission and distribution.

Switching stations and substations are used to (1) change the voltage, (2) transfer from one line to another, and (3) redirect power when a fault occurs on a transmission line or other equipment. Circuit breakers are used to disconnect power to prevent damage from overloads.

Control centers coordinate the operation of all power system components. One or more utilities can make up a control area. To do its job, the control center receives continuous information on power plant output, transmission lines, ties with other systems, and system conditions.

Transmission Constraints

There are some important constraints that affect the transmission system. These include thermal limits, voltage limits, and system operation factors.

The Basics of Electric Power

Power System Limits

Thermal Limits

The maximum amount of electrical current that a transmission line or electrical facility can conduct over a specified time period before it sustains permanent damage by overheating or violating public safety requirements.

Voltage Limits

The maximum voltage that can be handled without causing damage to the electric system or customer facilities. System voltages and voltage changes must be maintained within the range of acceptable minimum and maximum limits. A widespread collapse of system voltage can result in a blackout of portions or all of the interconnected network

Stability Limits

An interconnected system must be capable of surviving disturbances through time periods varying from milliseconds to several minutes. With an electrical disturbance, generators can begin to spin at slightly differing speeds causing differences in frequency, line loads (current) and system voltages. These oscillations must diminish as the electric system attains a new stable operating point. If a new point is not quickly established, generators can lose synchronism and all or a portion of the interconnected system may become unstable, causing damage to equipment and, left unchecked, widespread service interruption.

Thermal/Current Limits

Electrical lines resist the flow of electricity and this produces heat. If the current flow is too high for too long, the line can heat up and lose strength. Over time it can expand and sag between supporting towers. This can lead to power disruptions. Transmission lines are rated according to thermal limits as are transformers and other equipment.

Voltage Limits

Voltage tends to drop from the sending to the receiving end of a transmission line. Equipment (capacitors and inductive reactors) is installed to help control voltage drop. If voltage is too low, customer equipment and motors can be damaged.

System Operation Constraints

Power systems must be secure and reliable. Operating constraints are needed to assure that this is achieved.

Power Flows: Electricity flows over the path of least resistance. Consequently, power flows into other systems' networks when transmission systems are interconnected. This creates what are known as loop flows. Power also flows over parallel lines rather than the lines directly connecting two points - called parallel flows. Both of these flows can limit the ability to make other transmissions or cause too much electricity to flow along transmission lines thus affecting reliability.

Preventive Operations: The primary way of preventing service failures from affecting other areas is through preventive operations. Standards and procedures from the NERC are followed. Operating requirements include (1) having a sufficient amount of generating capacity available to provide reserves for unanticipated demand and (2) limiting the power transfers on the transmission system. The guidelines recommend that operations be able to handle any single contingency and to provide for multiple contingencies when practical. Contingencies are identified in the design and analysis of the power system.

System Stability: The two types of stability problems are maintaining synchronization of

the generators and preventing voltage collapse. Generators operate in unison at a constant frequency of 60 Hz. When this is disturbed by a fault in the transmission system, a generator may accelerate or slow down. Unless returned to normal conditions, the system can become unstable and fail.

Voltage instability occurs when the transmission system is not adequate to handle reactive power flows. "Reactive power" is needed to sustain the electric and magnetic fields in equipment such as motors and transformers, and for voltage control on the transmission network.

Distribution

The distribution system is made up of poles and wire seen in neighborhoods and underground circuits. Distribution substations monitor and adjust circuits within the system. The distribution substations lower the transmission line voltages to 34,500 volts or less.

Substations are fenced yards with switches, transformers and other electrical equipment. Once the voltage has been lowered at the substation, the electricity flows to homes and businesses through the distribution system.

Conductors called feeders reach out from the substation to carry electricity to customers. At key locations along the distribution system, voltage is lowered by distribution transformers to the voltage needed by customers or end-users.

Customers at the End of the Line

The ultimate customers who consume electricity are generally divided into three categories: industrial, commercial, and residential. The cost to serve customers depends upon a number of factors including the type of service (for example, if service is taken at high or low voltage) and the customer's location with respect to generating and delivery facilities.

Industrial

Industrial customers generally use electricity in amounts that are relatively constant throughout the day. They often consume many times more electricity than residential consum-

ers. Most industrial demand is considered to be base load. As such it is the least expensive load to serve. Many industrial loads are expected to remain within certain levels over time with relatively little variation. Major industrial customers may receive electricity directly from the transmission system (rather than from a local distribution system).

Some industrial plants have their own generators. If they are qualifying facilities (QFs) or exempt wholesale generators (EWGs), their excess electricity can be sold to utilities on the grid.

Commercial

Commercial loads are similar to industrial in that they remain within certain levels over intermediate periods of time. Examples of commercial customers are office buildings, warehouses, and shopping centers.

Residential

Residential electrical use is the most difficult to provide because households use much of their electricity in the morning and evening and less at other times of the day. This is less efficient to provide and therefore a more expensive use of the utility's generators. Over time, as homeowners buy new appliances and change life-styles, the expected loads also change. Examples of residential loads are individual residences.

Putting the Parts Together

The physical parts of the electric power system are generation, transmission and distribution. Numerous power plants, thousands of miles of transmission lines, and thousands of substations and other infrastructure are part of this physi-

cal inventory.

In addition, hundreds of organizations and corporations make up the electric power system. These include investor-owned utilities, municipal and cooperative utilities, river authorities, power producers, holding companies, retail electric providers and others.

Activities are regulated by state and federal agencies under the direction of state and federal legislation. Regional coordination is accomplished through reliability councils.

Organizations

Private Utilities: The IOUs are granted a license by the state to provide electrical services to a particular area. Many areas compete under multi-certifications which allow more than

Energy Sources for Generating Electricity

FOSSIL FUELS

Fossil fuels are derived from decaying vegetation over many thousands or millions of years. Coal, lignite, oil (petroleum) and natural gas are all fossil fuels. Fossil fuels are non-renewable, meaning that we extract and use them faster than they can be replaced. Fossil fuels are combusted in boilers, and combustion turbines and engines in order to convert water to steam that is used to power the turbines in an electric generator. A concern is that fossil fuels, when combusted, may emit gases into the atmosphere that contribute to climate change. Considerable effort is underway to devise clean technologies that will allow fossil fuel use with few or no emissions.

Coal

A black or brownish black solid combustible fossil fuel typically obtained from surface or underground mines. Coal is shipped by rail to power plants and may be imported from other countries. In Texas, as in other coal producing states, electric generating stations are often "mine-mouth," meaning that they are built at the mine and extracted coal is taken directly to the generator.

Coal is classified according to carbon content, volatile matter and heating value. Lignite coal generally contains 9 to 17 million Btus (British thermal units, a measure of heat content) per ton. Texas lignite has somewhat lower heat content. Sub-bituminous coals range from 16 to 24 million Btu per ton; bituminous coals from 19 to 30 million Btu/ton; and anthracite, the hardest type of coal, from 22 to 28 million Btu per ton.

Texas has about 10 billion tons of recoverable

lignite reserves and, in 2001, ranked first in the U.S. in consumption, fifth in production and seventh in recoverable reserves.

Natural Gas

Natural gas is a mixture of hydrocarbons (principally methane, a molecule of one carbon and four hydrogen atoms) and small quantities of various non-hydrocarbons in a gaseous phase or in solution with crude oil in underground reservoirs. Texas has approximately 42 trillion cubic feet (tcf) of proven natural gas reserves, 24 percent of proven U.S. domestic reserves.

Fuel Oil

Fuel oils are the heavier oils in a barrel of crude oil, comprised of complex hydrocarbon molecules that remain after the lighter oils have been distilled off during the refining process. Fuel oils are classed according to specific gravity and the amount of sulfur and other substances that might occur. Virtually all petroleum used in steam electric plants is heavy oil. Currently, a negligible amount of Texas electricity is generated using fuel oil.

RENEWABLES

Renewable fuels are those that are not depleted as they are consumed. The wind, sun, moving waters (hydroelectric), water heated in the earth (geothermal) and vegetable matter (biomass) are typical renewable energy sources for electricity.

(cont'd next page)

The Basics of Electric Power

Energy Sources for Generating Electricity (cont'd)

Hydroelectricity

Electricity can be created as turbine generators are driven by moving water. Texas has one quadrillion Btus (quad Btu) per year of potential hydroelectric resources. (For comparison, the U.S. consumes about 99 quad Btu of energy per year.) Texas has about 472 megawatts of installed capacity. While hydroelectricity is considered a renewable fuel, management of flowing rivers and cycles of rain and drought can impact hydroelectric capacity greatly as well as contribute to other environmental effects.

Wind Electricity

Electricity can be created when the kinetic energy of wind is converted into mechanical energy by wind turbines (blades rotating from a hub), that drive generators. It has been estimated that Texas has four quad Btus per year of potential wind electricity. 37 percent of the Texas Panhandle could produce 205 gigawatt hours of electricity per year (about 64 percent of Texas consumption), if transmission can be built economically to move this electricity to population centers. It has been estimated that three states - Texas, North and South Dakota - could provide, in principle, all of the electricity needed in the U.S. Again, this depends on the economics of transmission. Wind energy is intermittent and in Texas, and many other states, is located away from major demand areas. SB 7 calls for 2,000 megawatts of new renewable energy to be part of the total electric power generation mix by 2009. Today, there is more than 1,000 megawatts of wind capacity. More than 900 megawatts of this capacity were built in 2001.

Solar Electricity

Radiant energy from the sun can be converted to electricity by using thermal collecting equipment to concentrate heat, which is then used to convert water to steam to drive an electric generator. Solar electricity is about a decade behind wind electricity in development for commercial applications. Texas has 250 quad Btu per year of potential solar-powered electricity, or about 90 gigawatts. Solar electricity represents an important future energy source for Texas, especially for niche markets like off-grid power. Solar energy depends on available sunlight and is reliant on storage or supplementary power sources.

Biomass and Geothermal

Electricity can be created when various materials (like wood products and agricultural waste, or even crops grown for use in electricity production) are combusted. Heat from combustion is used to convert water to steam for power generation. Texas has an accessible biomass resource base of three quad Btu per year, although this would require a substantial amount of acreage and soil resources and large amounts of water to produce sufficient biomass feedstock. Electricity can also be created when steam produced deep in the earth is used to run turbines in a generator. Texas has an accessible geothermal resource base of one quad Btu per year. Currently, a negligible amount of Texas electricity is generated using biomass.

one service provider. In exchange for the obligation to serve all customers, utilities are allowed the opportunity to earn a reasonable return on those investments which are deemed by the state to have been constructed in the interest of serving customers in their service area. This relationship between private industry and governments at the local or state level is the historical arrangement for providing electricity service. In 2000, there were 12 investor-owned utilities in Texas. After SB 7, only the T&D services remain as regulated services provided by the utilities. The operational rights of these systems were transferred to the ERCOT ISO (see below for more on the ERCOT ISO) while the utilities will continue to provide the expansion and maintenance, includ-

ing emergency service, of the wires in their service territories.

Municipal Utilities: These utilities provide all of the same functions as the private utilities but are managed by a municipality. Municipal utilities, like their private counterparts, charge a rate of service sufficient to recoup their investment and ensure for continued reliable services within a service area.

Cooperatives: Historically, cooperatives developed in response to the need to serve rural areas. Public utilities could not recover the costs of building electrical facilities to remote areas and, therefore, did not want to serve those areas. Federal legislation in the 1930's allowed for the creation of Rural Electric Cooperatives by providing low interest loans guaranteed by the government. Local cooperatives coordinate closely with utilities in adjoining areas to ensure reliability to their service areas and to avoid duplication of facilities.

Municipal Governments: In Texas, municipal governments are generally responsible for ap-

proving rates which utilities will charge for their services. It is their responsibility to review the prudence of investments made by utilities to determine if costs will be allowed to be recovered. Municipal governments that do not want to perform this review process can turn over this responsibility to the PUCT.

Public Utility Commission of Texas (PUCT): Established by the Texas legislature in 1975, this statewide regulatory body was created to oversee the operations of private and municipal utilities. Originally this included electricity, telephones, water and sewage. Today it includes primarily certain electric utilities and telecommunications companies. The PUCT has jurisdiction over electric and phone in unincorporated areas of Texas. Municipal

governments can vote to turn over this responsibility to the PUCT.

Non-Utility generators (NUG's): Electricity customers have always had the option of providing their own electrical supply. In Texas, refineries, chemical and other large industrial plants generate large portions of their own electricity needs. A non-utility generator is a corporation, which is not affiliated with a public or municipal utility or a cooperative, that generates electricity. Federal legislation (PURPA) provides the option for some NUG's to sell excess electricity to utilities (see Part 4 - Regulations and Policies for details). Utilities are required to buy this excess electricity at the cost they would incur to generate an equivalent amount of electricity themselves.

With the restructuring of the industry, much of the generation in Texas has become non-utility generation. Utilities have created new, affiliated generation companies that are functionally separated from their T&D businesses. As SB 7 preserves existing contracts, utilities assigned the PURPA contracts they hold with NUG's either to the affiliated power generation company (PGC) or the affiliated retail electricity provider (REP).

Federal Energy Regulatory Commission (FERC): The FERC is successor to the Federal Power Commission (FPC) which was charged with regulating the natural gas and electricity industries in 1938. The FPC was abolished in 1977 and in its place the Department of Energy and the FERC were established. The FERC has jurisdiction over interstate electricity transactions as well as wholesale (sales for resale) electricity transactions. Its original authority over natural gas remains in place, among other functions.

Regional Reliability Councils: As a result of the complexity of the electricity industry, regions have been established throughout the United States to ensure reliable operation of the electrical system. These regional reliability councils are nonprofit organizations funded by utility and non-utility entities. The councils in Texas are the Southwest Power Pool (SPP), the Western Electricity Coordinating Council (WECC), Southeastern Electric Reli-

ability Council (SERC) and the ERCOT. ERCOT is by far the largest of the four with a service area that serves about 85 percent of the electrical load in Texas (The implementation of SB 7 has been delayed in SPP, WECC and SERC territories within Texas).

Reliability Councils

The need to coordinate electrical systems in North America arose after a series of major blackouts in the Northeast in 1965. The North American Electric Reliability Council (NERC) was formed for "coordinating, promoting and communicating about reliability." Most electric power systems in the U.S., Canada and some in Mexico are members of one of 10 Regional Reliability Councils (the state of Florida recently became a separate member of NERC). Each region adheres to operating rules for one of the three major power grids in the U.S - the Eastern Interconnection, the Western Interconnection and the Texas Interconnection. The Texas Interconnection is the ERCOT region.

Utilities in each of these interconnections are continuously synchronized so that their systems operate at the same frequency. In addition, utilities communicate with each other about system maintenance and operation to ensure that sufficient electricity will be available when it is required.

Since its formation in 1970, ERCOT has operated as one of 10 regional reliability councils within the NERC umbrella organization. In 1996, it became the ERCOT ISO (Independent System Operator), keeping its security respon-

Energy Sources for Generating Electricity (cont'd)

NUCLEAR

Nuclear energy is a non-renewable, non-fossil fuel form of energy derived from atomic fission.

Nuclear Electricity

The heat from splitting atoms in fissionable material, such as uranium or plutonium, is used to generate steam to drive turbines connected to an electric generator. Uranium is a heavy, naturally radioactive metallic element which has two principle isotopes, uranium-235 or uranium-238. Uranium-235 is the only isotope existing in nature in appreciable quantities and is thus indispensable to the nuclear industry (which includes applications other than electric power for civilian use). Uranium-238 absorbs neutrons to produce a radioactive isotope that decays to plutonium-239, which is also fissionable. About 10 percent of electricity produced by Texas utilities is nuclear. Nuclear plants have been by far the most expensive to construct, although uranium is the least expensive fuel to use (apart from questions about disposal costs). No nuclear plant has been ordered in the U.S. since 1978. The costs and potential hazards associated with decommissioning nuclear facilities are likely to be substantial and the disposal of radioactive wastes from these facilities remains an unresolved issue in the U.S. However, in recent years nuclear facilities have proved to be reliable generators and the proportion of nuclear power consumed in all of the U.S. has grown. Nuclear generation produces no greenhouse gas emissions. New, small scale nuclear generation technologies such as pebble-bed modular reactor are under development.

The Basics of Electric Power

sibilities while adding facilitation of the wholesale transmission market to its responsibilities. This includes administration of the ERCOT OASIS (an on-line information system for energy transaction scheduling and energy accounting) and coordination of transmission

What is ERCOT ISO?

The ERCOT ISO is the nonprofit corporation that administers the power grid.

The ERCOT ISO serves 85 percent of the state's electric load and oversees the operation of over 70,000 megawatts of generation and over 37,000 miles of transmission lines. Texas restructured its electricity industry, bringing "customer choice" as of January 1, 2002. Under the new legislation, ERCOT has the responsibility to develop market structure, infrastructure, and business processes to facilitate retail competition.

The ERCOT ISO is one of 10 electric reliability regions in North America operating under the reliability and safety standards set by the NERC. As a NERC member, ERCOT's primary responsibility is to facilitate reliable power grid operations in the ERCOT ISO region by working with the area's industry organizations.

The PUCT has primary jurisdictional authority over ERCOT to ensure the adequacy and reliability of electricity across the state's power grid. A Board of Directors comprised of market participants governs the ERCOT ISO. Its members include retail consumers, investor and municipally owned electric utilities, rural electric coops, river authorities, independent generators, power marketers, and retail electric providers.

planning with ERCOT. Today its role is expanded in response to the SB 7. Under the new legislation, and with the "customer choice" mandate that came into effect in January 2002, ERCOT has been given the responsibility to develop market structure, infrastructure, and business processes to facilitate retail competition.

The ERCOT ISO's members include participants from Cooperatives and River Authorities, Municipals, Investor-Owned Utilities, Independent Power Marketers, Independent Retail Electric Providers, Independent Generators, and Consumers. As of October 7, 2002, ERCOT's Membership included 147 voting and non-voting Members. The Member groups are comprised of 44 Cooperatives and River Authorities, 23 Municipals, 13 Investor Owned Utilities, 21 Independent Power Marketers, 15 Independent Generators, 14 Independent Retail Electric Providers, and 15 Consumers, as well as two Adjunct Members.

Transmission systems of the members cover 200,000 square miles. ERCOT members serve over 12 million customers, with annual

electricity sales of 270 gigawatt hours, representing 85 percent of the total load in Texas.

ERCOT transmission lines extend as far north as Wheeler in the Texas Panhandle to 650 miles south to Brownsville in the southernmost tip of Texas. The lines run from the junction of I-10 and I-20 in West Texas to the Sabine River bordering Louisiana, also approximately 650 miles.

In addition to the 37,000 miles of transmis-

sion lines in ERCOT, there are an additional 13,000 miles of transmission lines operated in non-ERCOT areas of Texas, especially within the SPP.

ERCOT member facilities form a single interconnection, located entirely within the state. The other areas are served by El Paso Electric (far west Texas), Southwestern Public Service (Texas Panhandle), South Western Electric Power and Entergy/Gulf States Utilities (East Texas). Two DC ties provide 800 megawatts of transfer capability between this intrastate interconnection and the Eastern Interconnection.

The ERCOT operating protocols incorporate the reliable operation and planning of the interconnected system. The basic element within a Regional Reliability Council is known as a control area. Control areas are responsible for matching electricity supply and demand on an instantaneous basis. One or more utilities can operate within a control area but only one is assigned the responsibility of being the Control Area Operator.

Control areas are electrical systems, bound by interconnect metering and telemetry which continuously regulate through automatic generation control. Control areas generate and interchange schedules (purchases and sales) to match loads, and contribute to the frequency regulation of the interconnection.

Vertically integrated utilities typically operate their own control areas. In some areas of the country, utilities have joined together to create "tight power pools" which act as control areas for multiple utilities and centrally dispatch all of the generating facilities in the pool based on economic criteria without regard to ownership. There are over 140 separate control areas in the U.S.

There used to be nine control areas in ERCOT, operated by TXU Electric, Houston Lighting & Power, Central and Southwest Services, Texas Municipal Power Pool (a combination of Brazos Electric Coop and Texas Municipal Power Agency), Lower Colorado River Authority, City of Austin, South Texas/Medina Coop Power Pool, the Public Utilities Board of Brownsville, and Texas New Mexico Power Company. In order to manage its tasks under

the restructured industry, the ERCOT region has become a single control area and the ERCOT ISO has become its operator.

ERCOT is responsible for coordinating the actions of market participants and also ensuring that the transmission system is not overloaded. Parallel flows and reactive power are monitored to help accomplish this. The ISO is also responsible for coordinating exchanges of electricity between neighboring control areas, although this is very limited in the case of ERCOT as there are only two interconnects with neighboring regions. Finally, the ISO ensures that adequate reserve electricity capacity is available to meet any operational or emergency situations.

A balanced Board of Directors, made up of members from each of ERCOT's electricity market groups, governs the ERCOT ISO. A Technical Advisory Committee (TAC) consisting of members from each market group makes policy recommendations to the Board of Directors. Four committees assist TAC: Protocol Revisions, Reliability and Operations, Retail Market, and Wholesale Market. The committees are assisted by numerous workgroups and task forces. The Board of Directors hires the CEO and also appoints the ERCOT ISO's officers. These executives direct and manage the ERCOT ISO's day-to-day operations. The ERCOT ISO is organized to provide a voice for the various groups that are ERCOT market participants so that decisions on system security and market facilitation can be made in a democratic and open atmosphere.

Beginning with the phased-in competitive retail market Pilot Program on June 1, 2001, ERCOT's duties are categorized into four primary operations: Production Operations, Market Operations, Financial Operations, and Registration.

Production Operations

This task involves system security, planning, and market support. These technical responsibilities include supporting resource and obligation scheduling, real time operations, operations analysis, system planning, analysis and data collection. The ERCOT ISO monitors

and analyzes all of the electricity transmission components every two to four seconds for status, load, and output to maintain the reliable transmission of electricity at every moment. The ISO has a sophisticated new technological infrastructure, called the Energy Management System, and an expanding engineering staff that monitors the balance between power generation and power demand. The ERCOT ISO also keeps one eye on Texas's future transmission requirements.

Market Operations

This includes monitoring the balance between forecasted electricity power generation schedules and actual electricity demand among all competing market participants. The ERCOT ISO estimates electricity generation and demand requirements for every 15-minute interval of every day. Plus, it assesses the ancillary services required to maintain reliable electricity production for the actual demand at any moment and procures additional ancillary services which are held on standby to ensure reliability when there are gaps between forecasted and actual electricity usage.

Financial Operations

This duty includes client relations, meter acquisition and data aggregation, settlements, billing, business rules, registration, load profiling, and the renewable energy credit program management.

Registration

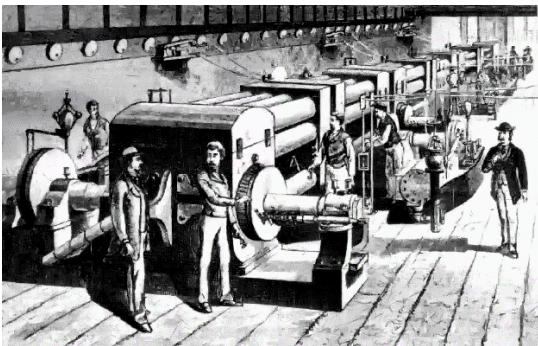
The ERCOT ISO is the centralized registration agent for both retail electric providers and market participants for the entire state of Texas.

Clearly, the ERCOT ISO is one of the most crucial and central entities in today's restructured electricity industry in Texas.

History

The electrical system we have today did not come into being overnight. It has been built piece by piece over the last 120 years. This history (as well as the history of other utilities and industries) provides a useful framework for thinking about the future.

The first commercial electric power installation in the U.S. was constructed in the latter part of the 19th century. The Rochester, N.Y., Electric Light Co. was established in 1880 and Thomas A. Edison's Pearl Street steam-electric station began operation in New York City two years later. Within a year, it had 500 customers for its lighting services. A short time later a station powered by a small waterwheel began operation in Appleton, Wisconsin.



Edison's Pearl Street Steam Electric Station—1882

The electric power industry in the U.S. grew from its small beginnings in less than 100 years to become the most heavily capitalized industry in the country. It comprises about 3,100 different corporate entities, including systems of private investors, federal and other government bodies, and cooperative-user groups. Less than one-third of cooperative groups have their own generating facilities, most being involved only in transmission and distribution.

Early Texas History

Electricity first came to Texas in 1878 with electric arc lights that had gained attention at the Paris Exposition. Electric lights were installed in Galveston and Dallas only a few

Electric power systems in the U.S. and Texas were established first in urbanized areas where enough customers existed to support development. Electrification was extended to rural areas through special state and federal programs that subsidized infrastructure development.

The early electric power industry was quite competitive, with companies competing to build systems and add customers. Regulated, private monopoly franchises evolved as a way of ordering industry development.

Regulation began at the state level through public utility commissions, the first of which was formed in Massachusetts in 1885 to regulate natural gas. Emergence of large holding companies that controlled many local utilities led to the federal Public Utility Holding

Overview

Company Act (PUHCA) in 1935 which restricted the size and scope of these businesses.

Electricity arrived in Texas in 1878 and by World War II nearly all of the state was electrified. Our Public Utility Commission was not established until 1975, a time of upheaval in the industry as world oil prices soared and the long-time trend of declining electricity costs reversed.

The electric power industry in Texas and the U.S. today faces a new challenge as competition increases and customers seek out new options and choices.

months after Edison's first electric system began operation in New York City. By 1890, electricity was available in several Texas cities. Hundreds of small electric companies were created and generators were built especially to power ice plants, trolley systems, and cotton gins. These specialized power generators were often extended to surrounding homes and businesses to be used only at night. For example, power lines from trolleys were simply connected to homes from lines running along the street.

Early electricity use was largely confined to Texas cities where factories and other large electric users were located. The cost of serving rural areas was prohibitive due to the miles of lines that would be needed. While many cities had two or more companies competing for customers, rural areas went unserved. In 1935, the Rural Electrification Act was passed by the U.S. Congress which provided low interest, long-term financing that would bring electricity to farmers and farming communities in Texas and other states.

In 1934, the Lower Colorado River Authority was chartered to develop flood control, hydroelectric and related services. Other federally financed hydroelectric plants followed on the Colorado, Brazos and Red Rivers. These plants sold power to rural cooperatives to pro-



Thomas Alva Edison

History

vide electricity to rural areas. In 1937, the Texas Legislature passed legislation to match the U.S. REA for the formation of rural electric cooperatives.

By the end of World War II, almost all of Texas was electrified. Electricity use grew rapidly after the War with prices dropping from as high as 15¢ to only 4¢ per kilowatt hour. In 1942, the Texas Interconnected System (TIS) was informally organized among utilities to help meet heavy wartime demand for electricity. Even though not as simple to operate as separate island systems, the interconnections in the early TIS were single lines making interchange of electricity relatively easy to handle, predict and understand.

Public Utilities: A U.S. Private/Public Model

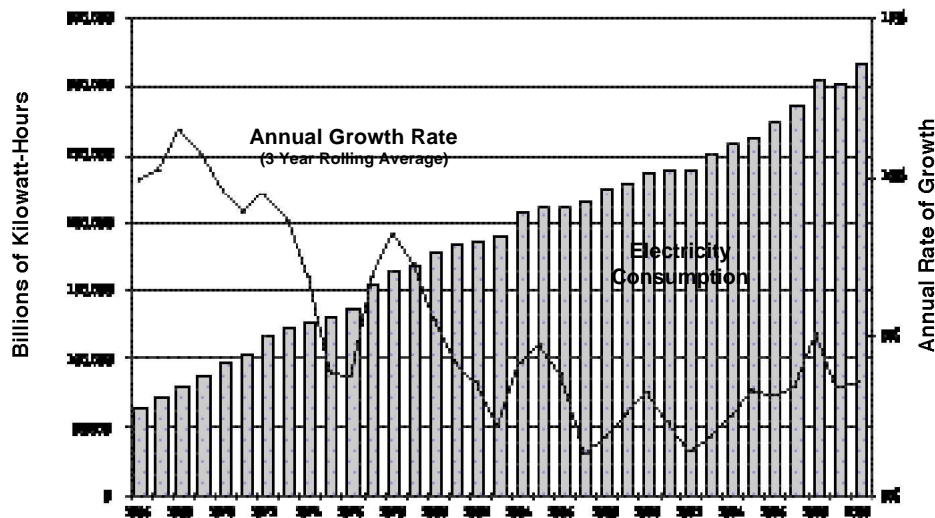
The Public Utilities Holding Company Act (PUHCA) of 1935 provided the basic structure of the current U.S. electrical industry. The Act limited the size of electric holding companies that owned utilities and required that these utilities serve integrated, contiguous territories. In addition, technological constraints limited the distance that electricity could be trans-

mitted. These two factors – PUHCA requirements plus technological limitations - yielded a utility model in which electric power was owned widely by many companies and was operated under close government regulation. (The reader can refer to Part 4 on Regulation and Policies for details on U.S. federal approaches and issues.)

The idea of private ownership with public oversight had emerged in the early part of the century for many services in the U.S. including the telephone, transportation and energy. For electricity, as with these other industries, the general philosophy was that only one electric service provider was needed for an area or there would be duplication of generating facilities and power lines, resulting in waste and inefficiency. Private companies were granted exclusive franchises to serve designated geographic areas. This monopoly privilege bore an obligation to serve all customers within a service area. In return, companies had the opportunity to earn a reasonable rate of return (profit) as determined by the PUCs. This private/public model is unique to the U.S. (although Canada had a similar model in some locations) and was introduced at a time when

**Texas Growth in Consumption of Electricity
1965 to 2000**

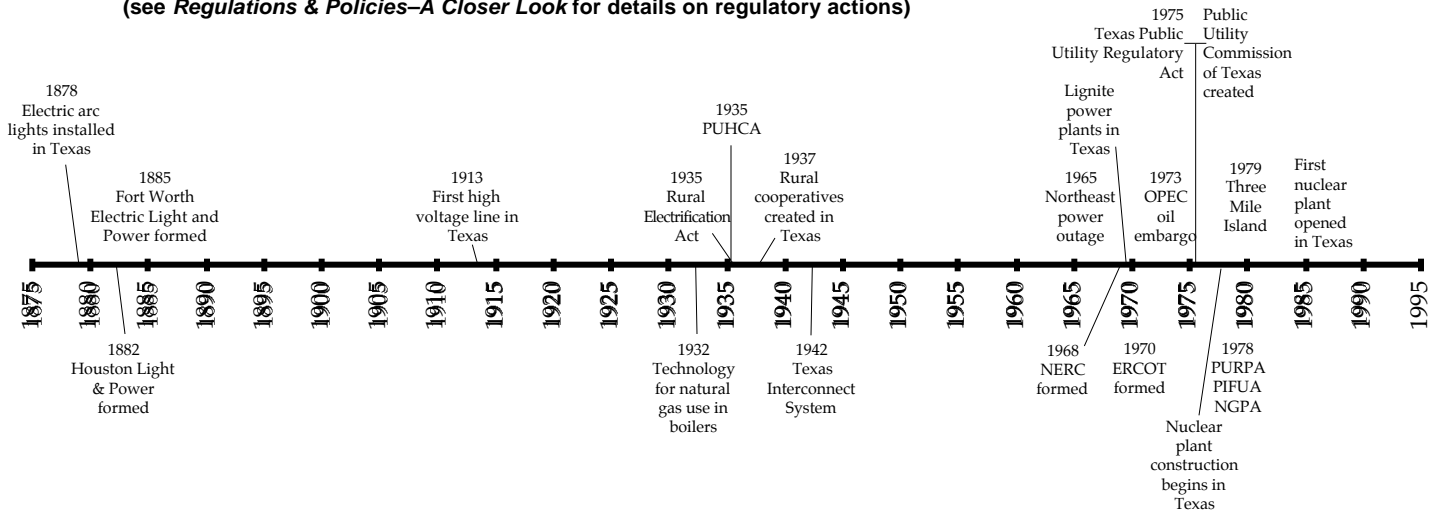
The amount of electricity consumed in Texas has increased by more than five times in the past 30 years. However, the *rate* of growth has dropped substantially, a pattern similar to the rest of the United States. Growth rates have declined from above 12 percent in the 1960s to levels of 2 to 3 percent in the last 10 years.



Source: U.S. EIA.

Timeline of Electricity Events in Texas and the U.S.

(see *Regulations & Policies—A Closer Look* for details on regulatory actions)



widespread communication, transportation and energy services were seen as critical for economic growth and to bind the nation. Other countries also recognized the importance of these services, but instituted governmentally owned and operated programs.

Forces for Change in the U.S.

Until the 1960s, the electric utility structure provided services at a relatively low cost. Utility owners and investors were generally satisfied with the rate of return on new plants as well as the ability to pass on most costs of operations and maintenance (O&M) for old plants. They could also increase profits on existing facilities through technological innovations and efficiencies. Consumers were generally satisfied since they were guaranteed service and the technological improvements kept the cost of service low or declining as demand grew for electricity.

Earlier in 1935, the Federal Power Commission (FPC) had asserted its jurisdiction over the wellhead price of natural gas sold in interstate commerce. Through various pricing methods, the FPC set prices so low that new production would not meet demand. This caused curtailments and high prices in the U.S. interstate markets.

In the late 1960s and early 1970s, various economic and technological factors affected

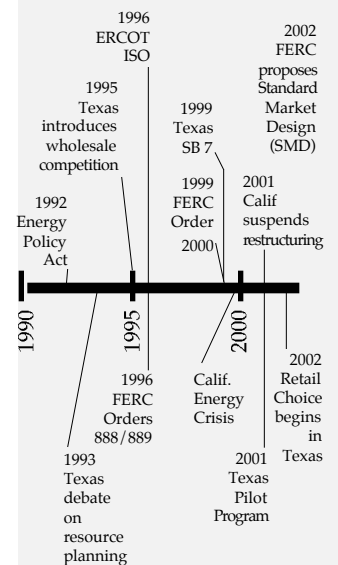
utilities. America's growing dependence on imported oil combined with production quotas instituted by a cartel, the Organization of Petroleum Exporting Countries (OPEC), led to rapid energy price increases. Inflation and higher interest rates followed. Larger power plants were being built that could produce electricity at much lower O&M costs but also at much higher construction costs. The construction of larger plants, high interest rates and inflation led to increases in consumer rates. For the first time, consumers on a large scale were faced with increasing service costs for electricity while companies were being squeezed by rising costs and interest rates.

In 1965, a massive power outage in the northeastern U.S. plunged 33 million people into darkness. For the first time since electricity began its rapid growth in the U.S., the attention of most Americans was focused on electricity. A continuous, reliable source of electricity had become vital to the nation's economy and security.

In 1967, the FPC determined that the electric industry must take steps to increase reliability and reduce the potential for such blackouts. In 1968, the North American Electric Reliability Council (NERC) was formed as the electric industry's voluntary response to the need for increased reliability. Almost every electric utility now belongs to NERC.

Recent Timeline

1990 to 2002



History

During the 1970s, large industrial and commercial customers were the first segments of the economy to look for alternatives to utility-provided electricity. They sought legislation which would allow them to obtain electricity from other sources. Residential customers and consumer groups complained to elected officials who began to review utility rates more

Parallels for Electric Power in Texas

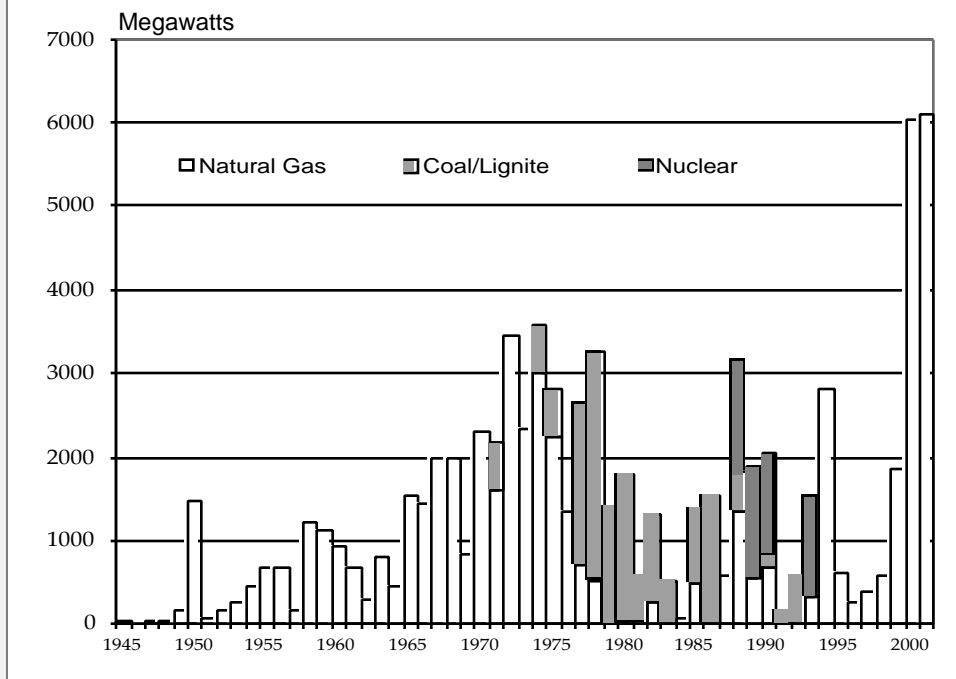
Texas was affected by many of the same forces as the utility industry in the rest of the country. During the 1950s and 1960s more electrical appliances entered the consumer market and the economy was strong. In Texas, new homes were being built with air conditioning and units were added to existing homes. Annual growth in demand averaged 10 percent during this time. The advent of large, more efficient power plants reduced prices further to 2¢ per kilowatt hour for residential customers. The rapid growth of electricity use was fairly constant until the early 1970s, when high fuel prices from the crisis in world oil markets, environmental concerns and a slowing U.S. economy resulted in reduced growth.

While many other utilities in the U.S. struggled with rising fuels costs, Texas was blessed with an abundance of natural resources - oil, gas and lignite - and natural gas became the fuel of choice for electricity up through the 1960s. In the 1970s, in the heavily regulated U.S. natural gas market, the perception grew that there was a shortage of natural gas, a perception made worse by widespread curtailments during the winter of 1976. In actual fact, regulatory distortions had created a situation in which inadequate supplies of natural gas were being developed. Because natural gas prices were

controlled in the interstate markets by the FPC, but largely unregulated in the intrastate markets in locations like Texas, more gas was being sold in the intrastate markets leading to shortages elsewhere (even though prices did not reflect this situation). Erroneously, state and federal laws were passed which prohibited the construction of new gas-fired base load power plants. Utilities in Texas and elsewhere moved to diversify their fuels to include coal, lignite, and nuclear power.

Texas also followed the drive in the U.S. to increase reliability after the 1965 blackout. In

**Power Plants Opened in Texas
by Size of Plant, Year Opened and Fuel**



carefully. Cost increases were more frequently disallowed when officials believed that utilities were not incurring costs in a prudent manner.

Legislators were also pressured by utilities who believed that they had a contract which allowed them to recover costs they incurred in providing services to the community. Utilities argued that if they were not allowed to recover costs, this jeopardized their financial standing, could force bankruptcy and thereby endanger the provision of this basic commodity.

1967, the Texas Interconnected System (TIS) developed more formal agreements to handle administrative as well as planning and operational activities. In 1970, the ERCOT was formed out of the TIS. And in 1975, the Public Utility Commission of Texas (PUCT) was established to oversee statewide issues that were not addressed by regulation at the local level. Texas was the last state to establish such a commission. The main issues for the PUCT were fuel diversification and increased rates for electricity.

Regulators and utilities felt they had a solution which would address these issues simultaneously. The solution was the construction of large lignite and nuclear power plants, which would take advantage of expected lower generation costs (through economies of scale) for larger facilities. Between 1971 and 1988, almost 15,000 megawatts of lignite and bituminous coal plants were built. In the late 1980s, two nuclear facilities were built: South Texas Nuclear Project (HL&P) and the Comanche Peak nuclear facility (TXU Electric).

In 1979, the Three Mile Island nuclear plant in Pennsylvania suffered a serious accident which caused public outcry for more stringent regulation of nuclear power. Construction costs began to increase along with increased O&M costs for all nuclear facilities. As construction costs increased, utilities asked for and received rate increases to recover these costs as well as inflation-driven increases for operating and maintenance. Consumer complaints led to even greater scrutiny of rate increases.

When nuclear plant construction was completed, some utilities proposed rate increases exceeding 50 percent. The PUCs examined each request on a case-by-case basis, disallowing some and approving others. Utility credit ratings in some cases were downgraded and some came close to or declared bankruptcy, as in the case of El Paso Electric Company. By the early 1990s most of the ratemaking issues associated with nuclear power were resolved. However, also by the 1990s, growth in electricity consumption in Texas had declined sharply, ranging from one to three percent per year in contrast to the more than 10 percent per year

in the 1960s.

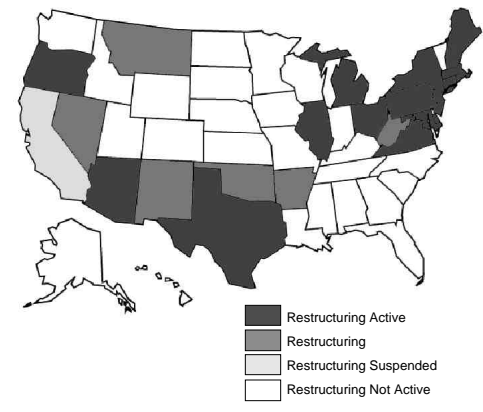
Restructuring and Re-regulation in the U.S.

Since the 1960s, much has been learned about public utility industries in the U.S. Many assumptions that were made when the current utility industry structure evolved in the 1930s - not just for electricity but also natural gas, telephones and other public utility services - are being challenged by changes in technologies and resulting changes in industry structure. In a nutshell, markets moved ahead of public policy and we are in the process of adjusting public policy to fit new realities.

The most influential change has been the growing role for competition in the delivery of services. This has been a general trend in the U.S. since airline and banking deregulation were proposed in 1975 and for the electric power industry it has been marked by three characteristics. One is the impact of technology change. Improved designs for gas-fired turbines and computer information technologies that allow real-time management of systems and market transactions have had a tremendous impact on the electric power industry. The second characteristic is the introduction of entrepreneurial busi-

Status of State Electric Industry Restructuring Activity (EIA, July 2002)

Twenty-four states and the District of Columbia (D.C.) have either enacted enabling legislation or issued a regulatory order to implement retail access. Dark gray colored states are active in the restructuring process, and these states have either enacted enabling legislation or issued a regulatory order to implement retail access. Retail access is either currently available to all or some customers or will soon be available. Those states are Arizona, Connecticut, Delaware, District of Columbia, Illinois, Maine, Maryland, Massachusetts, Michigan, New Hampshire, New Jersey, New York, Ohio, Oregon, Pennsylvania, Rhode Island, Texas, and Virginia. Clear colored states are not actively pursuing restructuring. Those states are Alabama, Alaska, Colorado, Florida, Georgia, Hawaii, Idaho, Indiana, Iowa, Kansas, Kentucky, Louisiana, Minnesota, Mississippi, Missouri, Nebraska, North Carolina, North Dakota, South Carolina, South Dakota, Tennessee, Utah, Vermont, Washington, Wisconsin, and Wyoming. A medium gray colored state signifies a delay in the restructuring process or the implementation of retail access. Those states are Arkansas, Montana, Nevada, New Mexico, Oklahoma, and West Virginia. California is the only light gray shaded state because direct retail access has been suspended.



History

State Initiatives on Electricity Restructuring

Arizona

Phase in customer choice between 1/99 and 1/01. Recent decision to reconsider retail competition.

California

On 3/31/98 began offering retail choice to all customers of the three largest utilities. Stranded cost recovery and related pricing issues forced some competitors to exit the market. Price spikes of Summer 2000 led to the suspension of restructuring.

Connecticut

Access to competitive suppliers for 35 percent of consumers by 1/00 (with a ten percent rate reduction) and for all consumers by 7/00. Utilities to sell non-nuclear generation assets by 1/00 and interests in nuclear generation by 1/04 - first State to require divestiture of nuclear assets. 5.5 percent renewable portfolio standard.

Delaware

A phase-in of retail competition for large customers in Connecticut's service territory beginning on 10/1/99 and ending on 4/1/01; a residential rate cut of 7.5 percent for Connecticut customers and a rate freeze for co-op customers.

cont'd on page 25

nesses, often a consequence of technology change, seeking to enter existing industries protected by regulation. These include nonutility generators of electricity and power marketers, and they are equivalent in effect to start-up airlines, the array of electronic banking services, long-distance and wireless service providers and independent marketers of natural gas. The third characteristic is the value-seeking behavior of customers, in particular those who purchase services in large enough quantities to exert influence - large industrial and commercial enterprises. These characteristics - technology change, new entrants and consumer value - have been at work in every industry affected by restructuring and re-regulation in the U.S.

Analogies for restructuring the electric power industry in the U.S. include telephones and natural gas. In all three industries, the underlying principle for historic change is that of "open access." Open access is not a new idea. Contract carriage for natural gas pipelines was debated when the 1935 U.S. Natural Gas Act was passed (giving the FPC regulatory authority over interstate gas markets). With open access, telephone lines, natural gas pipelines and electric wires become like toll highways. Any service provider can access the highway as may any customer. In this way, competition can be fostered even though the grids - telephone lines, pipelines and electric wires - remain managed as physical monopolies. The development of sophisticated information technologies is a major factor in making open access a reality.

At the national level, electricity restructuring is progressing in similar fashion to natural gas, the most immediate predecessor industry to experience transformation (although telecommunications transformation continues to evolve). Natural gas restructuring is also an important factor in the drive to restructure the electric power industry. Open access and unbundling for the natural gas industry has been a key element in development of gas-fired non-utility power generation. Since the gas industry already had experience with creation and implementation of information systems to

manage competitive sales of gas and with third party marketing, it was a natural transition for the industry to also participate in building these skills for electric power. These shared skills have led to a strong "convergence" between the natural gas and electric power industries.

As for gas, the FERC has ordered that open access be implemented for interstate transmission and wholesale power transactions, which directly affects the wholesale electricity market (bulk sales for re-sale to retail customers). Also as with natural gas, certain types of information must be made widely available with common standards for information platforms. Finally, utilities must separate or "unbundle" their transmission and marketing functions, much like the interstate natural gas pipelines have done, so that a competitive third party marketing industry can evolve and to ensure fair, nondiscriminatory access to transmission.

It is up to the individual state legislatures to determine the extent to which these initiatives should be extended beyond the FERC's jurisdiction, to both large and small retail commercial and industrial customers and individual households, and to wrestle with the details of implementation.

Restructuring and Re-regulation in Texas

In the early 1990s, Texas began examining restructuring the electric power industry. These have included measures designed to promote jobs and economic growth by ensuring low cost electricity. Almost all electricity consumed within the state of Texas is generated in the state and because of this it has been excluded from interstate commerce provisions. This has allowed Texas to operate differently than other states.

The FERC has the authority to regulate the transmission of electricity only in interstate commerce. In 1992, the U.S. Energy Policy Act or EPAct authorized creation of exempt wholesale generators (EWGs). In 1995, Texas Senate Bill 373 (SB 373) was enacted to restructure the wholesale electric industry and EWGs were authorized. The law required utilities to provide

unbundled transmission service on a non-discriminatory basis and establish an ISO. The PUCT authorized the ERCOT ISO, to be operational by July 1997. A Senate Interim Committee on Electric Industry Restructuring was also formed in 1997. The Committee continuously met with stakeholders to formulate the restructuring bill for Texas.

In May 1999, Texas Senate Bill 7 (SB 7) was passed to restructure the electric industry allowing retail competition. Base rates (excluding fuel) have been frozen for three years, and a six percent reduction (price-to-beat) has been required for residential and small commercial consumers for five years or until REPs affiliated with incumbent IOUs lose 40 percent of their consumers to competition. Utilities unbundled their integrated businesses into three separate categories - generation, transmission and distribution, and retail electric provider - and are limited to owning or controlling no more than 20 percent of the installed generation capacity within ERCOT. SB 7 also requires an increase in renewable generation and 50 percent of new capacity to be natural gas-fired. Following a pilot test, retail competition started on January 1, 2002 (more information on SB 7 and the Texas Electric Choice program can be found in Part 4 - Regulations and Policies).

State Initiatives (cont'd)

District of Columbia
Retail competition in 2001. Eight electricity suppliers and three aggregators certified, but only two suppliers and one aggregator providing service. As of 11/01, 3.1 percent of customers, representing more than 40 percent of demand switched.

Illinois
As of 1/1/01, all commercial and industrial customers eligible for retail access, and residential customers eligible in 5/02. 12 percent of ComEd's eligible customers - half of the company's load - switched.

Maine
Retail competition by 3/00. A market share cap of 33 percent for large IOUs in old service areas. Divestiture of generation assets by 3/00. 30 percent of generation from renewable energy sources.

Maryland
Three percent rate reduction for residential consumers, funding for low-income programs, disclosure of fuel sources by electric suppliers, recovery of stranded costs through a nonbypassable wires charge, and a three-year phase-in for competition beginning in 7/00 and completed by 7/02.

Massachusetts
Retail access and rate cuts of ten percent by 3/98 and another five percent 18 months later. Divestiture of generation assets encouraged.

Michigan
Retail choice for all customers by 1/02. Five percent rate reduction, frozen at least until 12/31/03. Rates for large C&I consumers capped through 2003, and small business consumers' rates capped through 2004.

New Hampshire
Five percent rate reduction on 10/01/2000 for residential customers. The full reduction of 15.5 percent. Residential rates capped for three years, and business rates for two years. PSNH to divest its generation assets by July 2001, and operate as a T&D utility, regulated by the PUC.

New York
Retail choice to be phased in beginning in early 1998 on utility-by-utility basis.

New Jersey
All consumers to shop for their electric supplier by 8/99; five percent immediate rate discount, and ten percent over the next three years. Recovery of utilities' stranded costs through a wires charge paid by consumers.

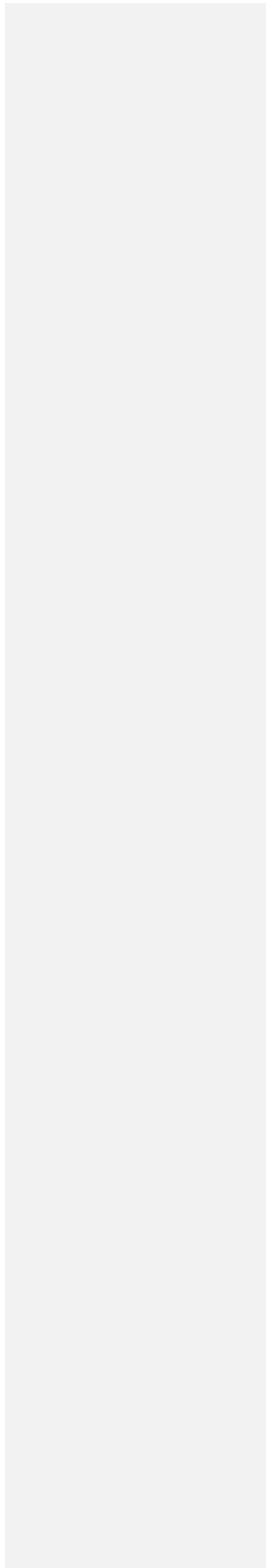
Ohio
Retail choice on 1/1/01 with five percent residential rate reductions and a rate freeze for five years. 15 percent of eligible customers switched in 2001.

Pennsylvania
One-third customer choice by 1/1/99; two-thirds by 1/1/00; final third by 1/1/01. As of 7/1/01, 591,596 customers were participating in electricity open markets, while in 4/01, 787,846 customers were participating.

Rhode Island
In 7/97, the first state to begin phase-in of statewide retail wheeling (for industrial customers). Retail access for residential consumers by 7/98.

Virginia
Creation of a regional transmission entity by 1/1/01; deregulation of generation by 1/1/02; phase-in of consumer choice between 1/1/02 and 1/1/04; rates capped through 7/07 for those who remain with the incumbent utility.

For more and updated information:
www.eia.doe.gov/cneaf/electricity/chg_str/regmap.html



Regulation & Policies: A Closer Look

In its early history, electricity was generated and used locally. A local utility sold nearly all of the electricity it generated to customers within the same community. Therefore, state legislators gave regulatory authority to municipalities while rural electrical systems operated under little or no direct state regulation. Although there was considerable federal regulation that developed, in Texas this localized view of regulation did not change until 1975.

The major changes in electric power regulation occurred in the 1930s, the 1970s and the early 1990s. In 1935, the Public Utility Holding Company Act (PUHCA) strengthened state regulation of electric power and caused the break up of large holding companies that had come to dominate the market. In 1978, several federal energy bills were passed under the National Energy Act which included new obligations for utilities. States were given primary responsibility for much of the implementation. In 1992, the Energy Policy Act (EPA) and actions by federal agencies encouraged additional competition in the wholesale electric power market.

In Texas, the Public Utility Regulatory Act (PURA) was passed in 1975, creating the Public Utility Commission of Texas (PUCT). The Commission had the primary responsibility of maintaining rates and services that were fair to consumers and utilities. The Commission's initial responsibilities included establishing service areas, certifying generation and transmission facilities and setting service standards. The four primary functions of the Commission have been rate-setting, certification of facilities, monitoring of regulated utilities for compliance with Commission rules and assisting the resolution of consumer complaints against utilities.

Today, electric power systems are intercon-

Development of federal electric power regulation and policy has been a long, complex process led by world events that changed perceptions about and, consequently, the behavior of energy markets. Of particular importance was the disruption of Middle East oil supplies in the '70s and the ensuing crisis atmosphere which led to sometimes conflicting federal initiatives. Results have included growth in electric power generation by non-utility businesses and elimination of federal price controls on natural gas well-head production.

Federal actions in the '90s have built on these '70s changes. The natural gas industry was restructured to encourage competition in interstate pipeline transmission, making it easier to use of natural gas for electric power. In the Energy Policy Act of 1992, Congress encouraged competition in wholesale bulk power, meaning that power exchanges between marketers, utilities, non-utility generators and others could take place, introducing

Overview

competitive pricing in the sale of electricity for re-sale to retail users. FERC has been implementing this mandate with Orders 888 and 889 in 1996 and Order 2000 in 1999.

Regulation at our state level is fairly recent. In 1975 Texas became the last state to establish a public utility commission. Basic functions of the PUCT have not changed much, but the ways of implementing its responsibilities have been influenced by national trends - attention to energy efficiency and conservation, market-based strategies and response to federal initiatives for wholesale market competition. The PUCT had to focus on retail competition as well since Senate Bill 7, passed in 1999, restructured the electric power industry in Texas and allowed all customers retail choice starting January 1, 2002.

nected, crossing state and even national boundaries. Over the last 20 years, federal regulations have moved toward allowing more non-utility companies to participate in the electric power business. There remains some uncertainty as to what roles federal and state regulators should play in controlling these new, competitive markets.

However, two issues are emerging. One is the extent to which regulators act as market facilitators, and thus have responsibility for providing and overseeing appropriate rules for competitive activity. The second, more recent issue is regulatory oversight of energy trading and marketing. These activities are essential to properly functioning natural gas and electric power markets. They help to link buyers and sellers, to "clear" market imbalances (moving energy from places where there is excess supply and therefore lower prices to locations where supplies are tight and prices are higher) and to manage the price risk volatility inherent in natural gas and electric power once they are subjected to competition and

Regulations & Policies

Non-Utility Participants Identified in Major Federal Legislation

Non-Utility Generator (NUG)

A general term encompassing all electricity generation that is not solely owned by utilities and generally not subject to rate regulation (includes IPPs, QFs and EWGs).

Independent Power Producer (IPP)

A non-utility power generating company that is not a qualifying facility (QF).

Qualifying Facility (QF)

A generator or small power producer that meets ownership, operating and efficiency criteria established by FERC pursuant to PURPA; and has filed with FERC for QF status.

Exempt Wholesale Generator (EWG)

A type of power generator identified by the EPAct which, unlike QFs, is not required to meet PURPA's cogeneration or renewable fuels limitations. Utilities are not required to purchase power from EWGs. FERC is authorized to order utilities to provide transmission service to EWGs on a non-discriminatory basis comparable to their own use of these facilities. FERC orders 888/889 address this issue.

become commodities. However, energy trading and marketing are complex, fast-moving activities. During 2001 and 2002, questions have arisen about the transparency associated with trading and marketing operations, corporate reporting on these operations and the adequacy of the market structures being designed by policy makers, regulators and industry to ensure that trading and marketing are undertaken without abuse. All of these issues are posing new challenges for U.S. electric power industry restructuring efforts, and for U.S. energy policy in general.

The Role of Federal Regulation of Electric Power

What began as a novelty in the 1880s was, by the 1920s, a necessity for modern society. At the turn of the century, following Thomas Edison's blueprint, the electric power industry consolidated into large holding companies that controlled local utilities. Local utilities had already begun to buy competitors and neighboring companies.

By 1927, there were 180 holding companies operating in the U.S. The number of operating companies had decreased from more than 6,300 to less than 4,500. By 1932, the eight large

History of Federal Regulation of the Electric Utility Industry

1920

Federal Water Power Act

The Federal Power Commission (FPC) was established to oversee licensing of hydroelectric power on federal lands. FPC later became the Federal Energy Regulatory Commission (FERC) which regulates many activities of electric utilities.

1978

National Energy Act

Five bills designed to respond to the crisis in world oil markets. Other actions were included in the National Energy Plan.

Powerplant and Industrial Fuel Use Act (PIFUA)

Prohibited the use of natural gas in new electric utility boilers and some industrial boiler applications. Certain geographic areas were excluded due to air pollution concerns if coal and oil use were increased.

Public Utility Regulatory Policy Act (PURPA)

Established Qualifying Facilities (QF's) as a new entrant to the electrical generation market. QF's could build smaller generation facilities free from PURPA regulation. Utilities were required to purchase electricity from QF's at the utilities' *avoided cost* (the cost the utility would incur to generate the equivalent amount of electricity).

Natural Gas Policy Act (NGPA)

Initiated a process of phasing out federal controls on wellhead prices of natural gas, which resulted in increased gas supplies and lower prices. The combination of PURPA and NGPA stimulated growth in gas-fired non-utility power generation capacity.

1935

Public Utility Holding Company Act (PUHCA)

Title I: Provided for the Securities & Exchange Commission to break up large holding companies which had become prevalent in the utility industry.

Title II: Extended to the Federal Power Commission the authority to regulate wholesale power sales by electric utilities. Utilities were allowed to charge prices based on the cost of operation while allowing for a reasonable return on their investment in capital.

Federal Power Act

This part of PUHCA allowed the Federal Power Commission to regulate transmission of electricity across state boundaries (interstate commerce). It also allowed FPC to regulate wholesale trade of electricity (electricity sales destined for resale).

Rural Electrification Act

This act provided low interest loans (primarily to electricity cooperatives) to ensure that electricity was provided to rural farm areas. This led to the rapid growth of cooperatives that served rural areas.

est holding companies controlled 73 percent of the investor-owned electric power business. Electric Bond & Share, a subsidiary formed by General Electric, was the largest, owning electric systems across the United States, including Texas, and in foreign countries as well.

PUHCA - 1935

In 1935, Congress moved to limit the size of these holding companies through passage of the Wheeler-Rayburn Public Utility Holding Company Act (PUHCA). This act required utilities owned by a holding company to serve an integrated, contiguous territory. Over the next ten years, PUHCA forced the realignment of holding companies across the nation. For example, Electric Bond & Share Company was required to divest of some of its utilities.

PUHCA authorized the Securities and Exchange Commission (SEC) to closely regulate

the financial and corporate activities of holding companies with utilities that operated in more than one state. The Federal Power Commission (now FERC) regulated rates, terms and conditions on the wholesale trade of electricity and transmission between states (interstate commerce). The wholesale market was mostly a small, localized activity that operated on a voluntary basis. PUHCA specifically excluded power generation and local distribution from its regulation.

The 1970s: Energy Crisis and Policy

In 1973, Arab oil producers embargoed sales to consuming countries in retaliation for policies pursued by the U.S. and other countries toward the Middle East. The embargo gave OPEC, formed in 1960 when world oil prices were low, effective control of world oil prices. The U.S. plunged into a period of extreme un-

1990

Clean Air Act Amendments (CAAA)

This act seeks to reduce annual sulfur dioxide (SO₂) emissions by 10 million tons by the year 2000 from the 1980 level and to reduce annual nitrous oxides (NO_x) emissions by 2 million tons by the year 2000 from the 1980 level.

1992

Energy Policy Act (EPAct)

This act created a new class of generators called Exempt Wholesale Generators (EWG's) who could generate electricity and sell it at market based rates free from PUHCA regulations. Utilities which owned transmission facilities are required to provide services to EWG's and other facilities on a comparable basis to their own transmission access. Utilities are also required to provide information on the availability of transmission and constraints on their system. Under EPAct, FERC allowed utilities to sell their electricity at market based rates if they opened their transmission system up to competition (open access).

1999

FERC Order 2000

FERC's third initiative to grid regionalization, Order 2000, calls for the voluntary creation of RTOs throughout the U.S. FERC wants to bring all transmission systems owned by regulated IOUs under regional control in order to eliminate the remaining discriminatory practices, meet the increasing demands placed on transmission systems and achieve fully competitive wholesale power markets. If Order 2000 can be successfully implemented, the U.S. grid will transform from a system owned and controlled mostly by vertically integrated utilities to a system owned and/or controlled by a few unaffiliated RTOs.

1996

FERC Orders 888 and 889

These rules issued by the Federal Energy Regulatory Commission implemented the intent of the EPAct to create a competitive, wholesale, bulk power market. Utilities under FERC regulation must provide nondiscriminatory open access for transmission to third parties, functionally unbundle their transmission and marketing functions and create information systems so that open access can be facilitated. Individual state legislatures and PUCs are responsible for open access at the retail level (sales for resale to ultimate consumers).

certainty and discord with respect to energy (thought to be no longer cheap or plentiful) and energy policy. Also during the 1970s, FPC regulation of gas prices led to perceptions of inadequacy of gas supplies and to high prices in intrastate markets where FPC regulations did not constrain prices.

For the first time since 1935, non-utility power generators were encouraged by federal policy to produce and sell electricity. PURPA promoted this by requiring utilities to purchase power from qualifying facilities (QFs).

Although PIFUA prohibited use of natural gas for power plants, PURPA actually stimulated gas-fired generation from non-utility generators.

Federal actions, in particular the five-bill National Energy Act that emerged from the Carter Administration's National Energy Plan, emerged in response during the crisis atmosphere. The National Energy Act included PIFUA, PURPA and the NGPA, all described below. Taken together, these laws sent confusing and contradictory signals for natural gas and electricity, which were to have profound impacts on the electric power industry and play a role in the eventual restructuring of both industries. Also as part of the National Energy Plan, the Department of Energy Organization Act in 1977 created that agency and established the Federal Energy Regulatory Commission to replace the Federal Power Commission created in the 1920 Water Power Act.

PIFUA - 1978

The Powerplant and Industrial Fuel Use Act (PIFUA) of 1978, passed at the same time as PURPA, prohibited the use of natural gas in new utility power plants (except in areas like Los Angeles where increased use of coal or oil would make air pollution problems worse). Similar restrictions were placed on certain large industrial boilers. The Act also prohibited use of natural gas in existing electric power plants starting in 1980, but this limitation was

removed in 1981.

PIFUA emerged out of widespread concern, following sharp natural gas curtailments in the eastern U.S. in 1976, that there were real physical shortages of natural gas. In fact, as noted above, federal control of wellhead prices for natural gas, which affected the price of gas in the interstate market, was later found to be the root cause of gas shortages in the 1970s. Because gas prices were artificially low in the interstate market, but higher in the unregulated intrastate markets, there was no incentive to place gas into the interstate pipeline system. In addition, because gas prices were held down by price controls at a time of rapid price rises in other fossil fuels, there was no incentive for producers to explore and drill for gas. PIFUA was an outcome of these policy distortions and contributed greatly to the development of coal and nuclear power generation capacity in the U.S. and Texas.

PURPA - 1978

The Public Utility Regulatory Policies Act (PURPA) almost directly countered PIFUA in implementation. Under PURPA, regulated and non-regulated utilities were required to consider eleven different rate design standards to determine if they were appropriate for implementation. These standards included such concepts as time-of-day rates, cost-of-service pricing, interruptible rates, prohibition of declining block rates and lifeline rates.

Two of the primary purposes of PURPA were (1) to encourage energy efficiency through expanded use of cogeneration and (2) to create a market for electricity produced from renewable fuels and fuel wastes. PURPA stipulated that all utilities engaged in the distribution of electricity were required to offer to purchase electricity produced by certain qualifying cogeneration and small power production facilities that used renewable fuels. These facilities were called "QFs" - qualifying facilities. Utilities had to offer to purchase electricity from QFs at a price that reflected the avoided costs. These were costs the utilities would have incurred if they had constructed new facilities and generated the electricity themselves. QFs

could use some of the electricity they produced to serve the electrical load of host industrial or commercial facilities, such as refineries, and sell the excess back to the utility, or sell their total output to the local utility. QFs also typically produced or “cogenerated” steam, which was sold to the host facility. QF owners were given exemptions to the PUHCA making it possible for a large number of non-utility companies to enter the electric generation business.

The paradox of PURPA was that it helped to stimulate growth in gas-fired power generation, which utilities then purchased under contract even as they were prohibited from using gas as a boiler fuel in their own facilities. Natural gas today accounts for most (more than 40 percent) of non-utility power generation in the

Federal energy policies today support greater reliance on market activities. They also seek to encourage efficiency and diversity in fuel sources and responsiveness to environmental issues.

U.S. In Texas, 92 percent of our non-utility production was natural gas-fired in 2000.

NGPA - 1978

The Natural Gas Policy Act (NGPA) was intended to remove the distortions associated with federal control of wellhead natural gas prices. The NGPA was the most contentious of the National Energy Plan elements and, as a result, the most complex and cumbersome. Federal oversight of natural gas prices, already an arduous task, was made even more so by the many categories of gas pricing created in the phase-out approach taken with the NGPA. The bottom line, however, was that federal price controls would end in 1985. It did not take until 1985 for the effects of the NGPA to be fully comprehended. A surge in exploration and production activity in the U.S. as a consequence of phased out price controls revealed that natural gas was indeed plentiful. A “bubble,” the excess of deliverable supply over

demand, almost immediately appeared, depressing natural gas prices. In spite of claims to the contrary, the bubble persisted, lending even stronger support to new thinking about the natural gas resource base in the U.S. More recently, the faster depletion of gas reservoirs and an inability to add significant amounts to gas reserves despite increased drilling, combined with higher demand mainly caused by new gas-fired power generation, have started to raise concerns about the adequacy of gas resource base. These new opinions about the natural gas resource base in the “Lower 48” – the contiguous states – combined with new energy security concerns in general has triggered new interest in developing natural gas supplies in Alaska and northern Canada and in importing increasing amounts of natural gas in the form of liquefied natural gas or LNG.

Federal Policy After the 1970s

What were the combined effects of the PIFUA, PURPA and NGPA along with other elements of legislation enacted by Congress at the height of the 1970s energy crises? Natural gas was removed from the domain of electric utility boiler fuels but at the same time its use by non-utility generators (NUGs) was encouraged. Utilities were forced to add coal and nuclear capacity while cheaper capacity was being developed by NUGs. Policies were enacted on the premise that natural gas was scarce while at the same time federal price controls, the source of the scarcity, were being dismantled. As changing market conditions, new policy initiatives and new thinking emerged regarding competitive markets for energy in the U.S., the 1970s laws were altered or repealed: PIFUA was repealed in 1987, natural gas wellhead price decontrol under NGPA was accelerated and finalized in 1989 through the Wellhead Decontrol Act. While PURPA remains on the books, it is being subsumed by new initiatives around the country and in Congress.

In the U.S. and other countries, exploration for oil spurred by the higher prices engineered by OPEC production quotas revealed that petroleum was abundant. As crude oil supplies

surged into the early 1980s, world prices collapsed. Natural gas prices remained low relative to oil, supporting rapid growth in non-utility power generation. The electric power industry became one where the utilities held expensive capacity, built to ensure long-term fuel diversity, that had been installed at considerable financial risk; where non-utility generation (particularly from lower cost gas-fired turbines) grew rapidly; and where fuel competition in a low price environment increased overall. Public policy attention became centered on two issues, environmental protection and encouraging competition.

Clean Air Act Amendments - 1990

Combustion of fossil fuels - coal, oil and natural gas - result in emissions of various substances that can pose a variety of environmental and health-related problems. The substances targeted most heavily in environmental regulation are the emission gases from fuel combustion. Sulfur dioxide (SO₂) and oxides of nitrogen (NO_x) are precursors to acid rain

Utilities are the second largest source of CO₂ emissions in Texas.

While no regulations currently restrict CO₂ emissions, the Clean Air Act Amendments of 1990 require monitoring and reporting.

deposition because, under the right set of conditions, they react with other chemicals in the atmosphere to form sulfuric acid and nitric acid, respectively. NO_x is also a major contributor to ground level ozone.

Carbon dioxide (CO₂) is colorless, odorless and nontoxic but contributes to a "greenhouse effect" as it accumulates in the atmosphere and causes infrared radiation reflected from the earth to become trapped.

With respect to combustion emissions, increasing concerns about air quality led to passage of the Clean Air Act in 1963 with substantial amendments in 1970. (The 1970 amendments are commonly referred to as the Clean Air Act). In 1970 the Environmental Protection Agency (EPA) was empowered to set enforceable air quality standards. In 1971 the EPA

established the New Source Performance Standards (NSPS) that directly affected new or modified coal-fired utility boilers. The standards were revised in 1979, but the most stringent revision came about with the Clean Air Act Amendments of 1990 (CAAA). The CAAA required a 10 million ton reduction in SO₂ emissions and a 2 million ton reduction in NO_x from 1980 levels. The reduction in SO₂ was set to occur in two phases, one that began in 1995 and another that began in 2000. The CAAA also created an innovative tradable emissions allowance program that led to a market for SO₂ emissions. The concept is that older utilities faced with higher marginal costs for additional SO₂ reductions could purchase their allowances in an open market from utilities (or nonutility generators) that produce less than their allowed emissions. Older facilities that are very expensive to retrofit could also be shut down, creating the opportunity for operators to sell all of their allowances in the open market. Consequently, vigorous activity in "emissions trading" has resulted, enabling a more efficient allocation of responsibility for pollution control.

The CAAA also left utilities with a variety of options for meeting environmental standards. One is to use natural gas which yields lower emissions of targeted pollutants. Utilities can also use lower sulfur coal, use blended coals or co-fire gas and coal. Utilities can use different combustion technologies to reduce NO_x or employ environmental equipment to reduce emissions before they are released into the atmosphere. The advantages for natural gas under the CAAA coupled with the EPAct provisions for non-utility generation and low natural gas prices meant that most new generation capacity has come, and continues to come, from NUG's using natural gas turbines.

EPAct - 1992

Like the National Energy Act in 1978, the Energy Policy Act of 1992 (EPAct) was concerned with energy efficiency and availability. Also like the 1970s, the EPAct emerged out of crisis, or perceived crisis, again associated with disruptions in Middle East oil supplies but this

time within the context of the 1991 Gulf War stemming from Iraq's invasion of Kuwait. The push for an energy bill continued even after world crude oil prices fell swiftly after surging during the confrontation. The legislative initiatives accompanied a U.S. Department of Energy study, National Energy Strategy (NES),

For electricity, the EPAct represented an historic re-thinking of the electric utility industry and how it should be regulated.

ward increasing U.S. energy options as well as language supporting more competitive energy markets.

For electricity, the EPAct represented an historic rethinking of the electric utility industry and how it should be regulated. It increased non-utility participation in electric power that had started with the PURPA, and it reformed the PUHCA to encourage a competitive wholesale market for electricity.

The EPAct created a new category of independent power producers called exempt wholesale generators (EWGs). These generators were not required to meet cogeneration or renewable fuels limitations in PURPA. Utilities were not required to purchase electricity from EWGs. However, utilities were required to provide transmission access to EWGs for wholesaling their power. In effect, EPAct paved the way for FERC's actions on open access for wholesale transmission and, indeed, EPAct encouraged the FERC to move forward with open access for electricity (as well as to continue to fine tune the open access environment created for natural gas on interstate pipelines in 1992).

FERC Orders 888/889 - 1996

With Orders 888 and 889, the FERC implemented the intent of Congress implicit in the EPAct, to create a competitive, wholesale, bulk

which the DOE was asked to prepare by then President Bush. As with the National Energy Act, the EPAct was just as contentiously debated. It contained provisions directed to-

power market. All utilities within the FERC's jurisdiction were required to open their wires and provide nondiscriminatory access to all third parties at comparable rates, terms and conditions. They had to provide both network and point-to-point service. The FERC has a reciprocity requirement that publicly owned utilities and co-ops, which are outside of FERC jurisdiction, and who take advantage of open access among the utilities that FERC regulates, must also provide comparable service. The FERC allowed recovery of stranded costs attributable to its rulemaking as long as they were demonstrated to be legitimate and verifiable, with recovery obtained by charging either an access charge or exit fees for bulk users that elect to leave a utility's service. Importantly, stranded costs in the wholesale market have not been nearly as large as the potential stranded costs associated with retail access, an issue for state PUCs.

As noted in the previous sections Part 1 - Facts on Texas Electric Power and Part 2 - History, under Orders 888/889 only transmission and marketing must be functionally unbundled and utilities must provide information systems for access to facilitate third party access.

FERC Order 2000

FERC's third initiative to grid regionalization is Order 2000 issued in December 1999, which called for the voluntary creation of regional transmission organizations (RTOs) throughout the U.S. FERC wants to bring all of the transmission systems under regional control in order to eliminate the remaining discriminatory practices, meet the increasing demands placed on the transmission system, and achieve fully competitive wholesale power markets. If Order 2000 can be successfully implemented, the transmission system will transform from a loosely interconnected system owned and controlled mostly by vertically integrated utilities to a system owned and/or controlled by a few unaffiliated RTOs or "transcos" (independent for profit or not-for-profit transmission companies) with decisions to add (or remove) transmission capacity made through those entities.

According to Order 2000, an RTO must be independent from market participants; have appropriate scope and regional configuration; possess operational authority for all transmission facilities under its control; and have exclusive authority to maintain short-term reliability (The FERC has been less specific with regard to transcos).

To achieve these goals, an RTO must administer its own tariff; employ a transmission pricing system that will promote efficient use and expansion of transmission and generation facilities; create market mechanisms to manage congestion; monitor markets to identify design flaws and market power; operate a single Open Access Same-Time Information System (OASIS); and serve as a supplier of last resort for all ancillary services required in Order 888 and subsequent orders among other functions.

During late summer, 2001, the FERC put forth a more assertive view, suggesting that it would encourage formation of only four RTOs: Northeast, Southeast, Midwest and West. In explaining its vision with regard to the four-RTO model, the FERC often mentioned ERCOT as a separate regional grid. However, many options are available to ERCOT with regard to possible combinations that could be made with surrounding RTOs as well as remaining independent. Subsequent to the FERC's proposal for four RTOs, administrative hearings and mediations have attempted to address concerns across the numerous stakeholders in all of the affected areas, including consumer groups and representatives. As these meetings have progressed, local concerns as well as issues associated with the formation of the RTOs (like transmission asset ownership, RTO structure and "governance" and congestion pricing) have resulted in a view that a larger number of RTOs may initially exist as various approaches for managing the many issues are experimented with.

FERC is expected to reach its final recommendations regarding the formation of RTOs in 2002. Meanwhile, some utilities and existing ISOs are already forming associations to coordinate the operations of their transmission systems. For example, after the PJM (Pennsyl-

vania-New Jersey-Maryland) ISO and Midwest ISO (or MISO) announced they would merge their operations in early 2002, the Tennessee Valley Authority (TVA), the nation's biggest public power producer, agreed to connect its 30,000 megawatts of generation with a network that spans 20 Midwest and Southwest states and one Canadian province. Southeast utilities Southern Co. and Entergy Corp. also agreed to join the grid formed by the combination of the MISO and Southwest Power Pool Inc. (SPP). Together, the four groups own or operate 150,000 miles of transmission lines and provide power for an area covering 1 million square miles. Nevertheless, these deals do not necessarily imply that merged areas or operations will be handled in the same manner as intended in FERC's RTO proposal.

As the debate regarding RTOs progressed, the FERC issued on July 31, 2002 a "notice of proposed rulemaking" (or NOPR) on standard market design (SMD). The intent is to harmonize rules across the RTOs in order to create a seamless, larger national grid and market. The FERC also hopes that the SMD proposal will help solve numerous issues and conflicts that have arisen from electric power restructuring efforts. However, the SMD proposal is very large, complex and contentious. As of this edition, it is not clear whether, and in what form, FERC's initiative will be implemented.

National Energy Policy Since EPAct

During 2000 and early 2001, a crisis atmosphere once again prevailed in the U.S. This was triggered by several events.

- After a severe collapse, worldwide oil prices surged, a result of efforts by OPEC to regain control of the global oil market. Prices have since moderated, after peaking at \$35 per barrel in nominal terms, a level not seen since the Persian Gulf War.
- Surging demand for natural gas, in large part due to the increased use of natural gas for electric power generation, and rising oil prices led to prices for natural gas never before seen in the U.S. Natural gas prices peaked well above \$10 per thousand cubic

feet, in nominal terms, at Henry Hub in South Louisiana, the main trading point for natural gas in North America. This meant prices in excess of \$40 per thousand cubic feet at “citygates” like Chicago, where natural gas from interstate pipelines enters local gas utility distribution systems.

- With both oil and natural gas prices rapidly rising, with accumulated demand for electric power in the U.S. at an all time high – the result of an unprecedented eight-year economic boom, with problems surfacing in many electric power restructuring programs undertaken by the states (in particular in California) and with fundamental problems revealed in electric power transmission (critical capacity shortages and severe congestion), electric power prices in the young national wholesale market reached levels that resulted in political responses from both states and the U.S. Congress. At one point, electric power trading at the California-Oregon border reached \$10,000 per megawatt-hour. The situation in California was acute, with chronic shortages, rolling blackouts and a high degree of conflict regarding causes, appropriate actions and federal and state policy and regulatory responsibilities and responses.
- Terrorist attacks on September 11, 2001 that destroyed the World Trade Center in New York City and a part of the U.S. Department of Defense’s Pentagon headquarters in Washington, D.C. lent new urgency and new attention to U.S. energy security. These concerns have become exacerbated as the “war on terrorism” became complicated by tensions surrounding a possible war in Iraq. The business failure in December 2001 of Enron Corp., long one of the most innovative and aggressive advocates for competitive energy markets and wholesale energy trading in the U.S. and worldwide, cast a new light on emerging electric power structures in the U.S. Enron’s collapse has had repercussions throughout the natural gas and electric power industries as FERC, SEC and Congressional and state investigations into Enron’s activities, and those of other energy

traders and generators of electricity, have added new uncertainties.

To address new U.S. energy security concerns, encourage development of diverse energy supplies and infrastructure, deal with environmental and conservation initiatives and attempt to provide some direction for emerging competition in electric power, the White House unveiled in Spring 2001 a National Energy Policy (NEP) document. Congressional action on the NEP since that time has resulted in legislation proposed in the House and Senate that must be reconciled through House-Senate conference if any new, final energy legislation is to emerge. As of this edition of the Guide, no final legislation has been achieved. The FERC is continuing its investigations into electricity market failure in California and reviewing problems in other states and regions. The myriad of investigations and inquiries on energy trading activities have raised questions about whether and how oversight should be conducted for energy trading operations and practices. Among the states, Texas is regarded as a key barometer for electricity restructuring.

Regulation of Electric Power in Texas

Policy changes at the federal level have had a tremendous impact on the Texas electric power industry since its inception. To better understand the current system of electric utility regulation in Texas, and the impact of federal initiatives over the years, a brief description of how the Texas system has evolved is helpful.

As described in the beginning of this chapter, electric utilities developed to serve a particular business and grew to serve a town or community. A utility sold all the electricity it generated to a local market. As a result, in the early 1900s the state legislature enacted statutes that granted the authority to regulate rates and services to local municipalities. Over the years, utilities expanded their operations to

provide service to many municipalities and developed integrated systems such that electricity generated at one point on that system might be consumed at a distant location on the system. The concept of local regulation did not change until 1975. And so, prior to 1975, municipalities regulated electric rates and services within their municipal boundaries while residents of rural areas had relatively little regulation.

Public Utility Regulatory Act (PURA) 1975

In 1975, the 64th Texas Legislature passed the Public Utility Regulatory Act (PURA) which created the Public Utility Commission of Texas (PUCT). The Commission was authorized to regulate the electric, telephone, water and sewer services in Texas. The legislature found that these utilities operated as monopolies and were not subject to normal competitive forces.

The use of regulation was established as the appropriate means for utility operations and development. The Commission was given the responsibility for assuring rates, operations, and services that are just and reasonable to consumers and utilities. In 1986, the agency's jurisdiction over water and sewer utilities was transferred to the Texas Natural Resource Conservation Commission, which is now called the Texas Commission on Environmental Quality (TCEQ). The PUCT now regulates the electric utilities, electric cooperatives (only wholesale transmission), river authorities and 58 local telephone companies. Municipal utilities are not governed by the PUCT, but are subject to service area certification by the Commission.

The Commission's initial duties focused on establishing each utility's service area, certification of facilities and setting just and reasonable service standards. The Commission was also charged with holding hearings on proposed utility rate changes, monitoring the management and affairs of public utilities, monitoring compliance with PURA and agency orders and rules, and investigating public utility mergers and sales of property.

The Commission's function and responsibilities have undergone several legislative changes since 1975. In 1983, the 68th Legislature made several changes to the PURA including requiring electric utilities to file a notice of intent with the PUCT before building new generating plants and to prove to the agency that they had considered other reasonable resource alternatives. In addition, the Legislature encouraged utilities to use alternative fuels, required the Commission to develop a long-term statewide energy forecast to be used in certification proceedings for generating plants, and required the agency to conduct management audits of each utility under its jurisdiction at least once every 10 years.

Legislative Changes in 1995

In 1995, the Texas legislature made several changes to PURA that would help develop a competitive wholesale electric market. Changes to PURA included exemption of power marketers and EWGs from the

In 1975, the Public Utility Regulatory Act (PURA) was passed by the Texas legislature. PURA forms the basic legislative authority for the PUC of Texas.

Commission's rate regulation, partial rate deregulation of electric cooperatives distribution, deregulation of wholesale rates of certain river authorities, development of an integrated resource planning process, flexible pricing for wholesale and retail sales, open nondiscriminatory wholesale transmission service, and repeal of the requirement to conduct the management audit every 10 years.

Although the basic activities of the PUCT did not alter much during its 20 years of existence, how the PUCT had gone about its responsibilities had been heavily influenced by national trends and strategies adopted and shared among all PUCs in the U.S. One of these trends had been the emergence of integrated resource planning (IRP) as a strategy for improving utility planning and reducing costs to customers. IRP or least-cost IRP, as it was sometimes called, was a process in which PUCs were heavily involved in decision making both before and after the fact. Utilities were required to make "prudent" investments and prudence reviews were often used as an after-the-fact mechanism for regulatory oversight. IRP evolved across the states in response to the large costs associated with new generation capacity additions, especially for nuclear facilities.

Similarly, demand side management (DSM) evolved in response to utility investments and concern about energy efficiency and conservation. DSM was generally a component of IRP and encouraged utilities to consider gains from conservation and efficiency improvements before undertaking new investments. Both IRP and DSM had been controversial, generating extensive debate about whether they created real benefits in excess of the costs associated with these policies. They had, nevertheless, affected how all PUCs undertook their basic activities.

Another area influencing PUC operations in the U.S. had been the notion of incentive rate making. Interest in developing rate structures that were more market oriented and less distorting to the behavior of regulated utilities as well as their customers had grown in the U.S. PUCs in every state have been looking at new ways of setting rates. Finally, a last area influ-

encing the Texas PUC is the general trend toward more efficient government operations.

Also in 1995, the Texas legislature made several changes to PURA that are particularly noteworthy and were in response to the EPAct. These include the following.

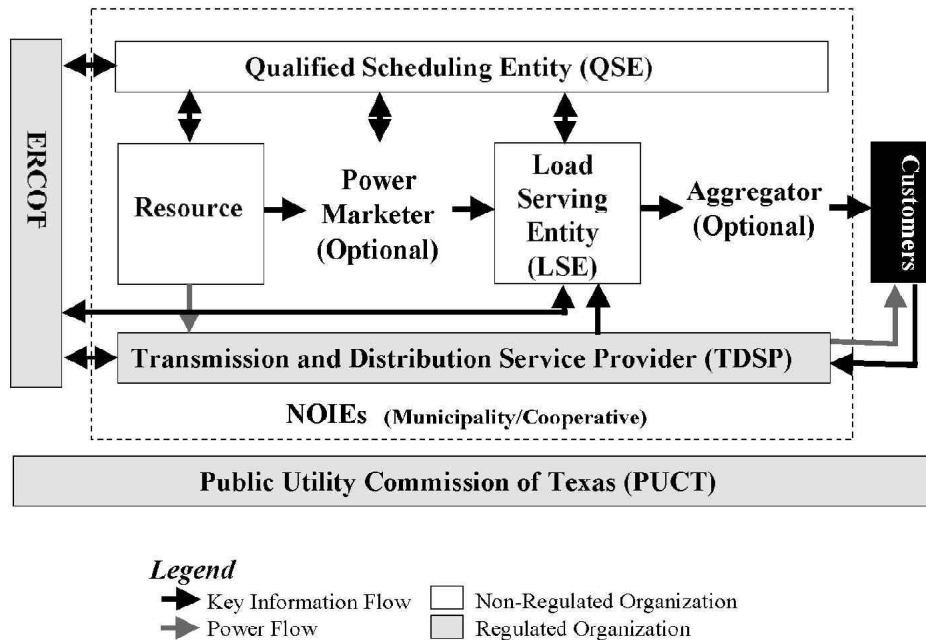
Senate Bill 373 (SB 373) was enacted to restructure the wholesale electric industry and authorize EWGs. Power marketers are businesses that sell but do not generate or transmit electricity. These businesses and EWGs were not defined as utilities in PURA and were authorized in SB 373 to sell only wholesale electric power in Texas. Power marketers and EWGs could be affiliated with a public utility and could sell power to that utility. However, they were required to register with the Commission and comply with reporting requirements.

SB 373 also required utilities to provide unbundled transmission service on a non-discriminatory basis and establish an ISO. The PUCT authorized the ERCOT ISO to be operational by July 1997. Utilities that own or operate transmission facilities had to provide wholesale transmission access at rates, terms, and conditions that were comparable to their own use of their system. The PUCT could require utilities (including municipal utilities) to provide access to transmission services to another utility, a QF, an EWG or power marketer.

Except for river authorities, wholesale rates were not deregulated, but a utility could request wholesale tariffs that were less than approved rates, but more than the utility's marginal cost approved by the regulatory authority (either the PUCT or city government). The PUCT had interpreted PURA such that the costs for these discounted rates could not be charged to other customers.

The PUCT had an IRP process and a statewide plan, as required in PURA. Starting in 1996, utilities were required to file an IRP every three years. If a utility needed to acquire new electricity sources, a competitive bidding process was required that included different sources of electricity. The utility itself or an affiliate could also bid, but an independent bid evaluator was required by the PUCT's substan-

ERCOT Competitive Market Participants



Source: ERCOT, The Market Guide, February 22, 2001

tive rules based on PURA. Nongenerating utilities had to follow this same process if they wished to increase their supply more than 25 percent or acquire more than 70 megawatts of new power from a supplier. There were also requirements for consumer participation in developing the utility's IRP.

River authorities and electric cooperatives were deregulated to some extent in 1995. Certain river authorities had wholesale sales to any purchaser within the authority's service area. River authorities could also create a corporation to sell electricity to any wholesale purchaser in the state and the corporation would not be treated as a public utility by PURA. Electric cooperatives providing retail electricity at distribution voltages could become exempt from rate regulation. This required a majority vote by voting members. Flexible retail rates could then be adopted (without Commission approval) which were as low as the lowest marginal costs of any of the cooperative's wholesale suppliers.

A utility could offer flexible retail pricing,

with retail tariffs or contracts that were less than their approved rates. These rates had to be greater than the utility's marginal cost, as approved by their regulatory authority (either the PUCT or city government).

Legislative Activity in 1997 and SB 7

In 1997, the Texas legislature considered a number of bills that would have restructured the electric power industry in Texas to allow entities other than local utilities to sell electricity in a retail market. One bill supported by the Texas

governor, the PUCT and investor owned utilities was introduced late in the legislative session but the session adjourned prior to action on the bill.

Following adjournment, the Senate Interim Committee on Electric Utility Restructuring was created to study issues and report back to the Senate before the next legislative session which began in January 1999. The seven-member committee conducted hearings around the state to gather information and better understand concerns of citizens and interested parties. The committee also visited other states in the U.S. as well as other countries that were experimenting with electricity restructuring and more competitive markets. The Texas House State Affairs committee also studied restructuring issues and held hearings.

By the close of the 1997 session, several issues emerged that affected the final formulation of Senate Bill 7 (SB 7), including the following:

- Cost savings to consumers. There were considerable concerns about whether small

(mainly residential) consumers would be able to benefit immediately with retail competition. Most of these concerns stemmed from the allocation of stranded costs and implications of stranded cost recovery on electricity prices. It was feared that without adequate, broad-based competition, cost savings from restructuring might not be achieved to offset stranded cost charges. Accordingly, SB 7 allowed for all net, verifiable, nonmitigated stranded costs to be recovered through a competition transition charge (CTC). Stranded costs, however, did not turn out to be a problem. In fact, “stranded benefits” were created in 2000 and 2001 due to high natural gas prices leading to high power prices and sustained value of coal and nuclear facilities – which many had expected to decline in worth in a competitive market. The ability for residential users to fully benefit from retail choice remains a concern.

- Property tax losses to counties, municipalities and school districts. In some parts of the state, there were (and still are) concerns that savings or other benefits (such as economic growth) from retail competition will not exceed lost property tax revenues as a result of write downs on utility assets (stranded costs). The most sensitive arena for debate was the structure for public school funding in Texas, which many thought might need to be revisited if economic benefits from electricity restructuring were to be achieved. Accordingly, SB 7 included mechanisms for reimbursement through the System Benefit Fund. So far, however, school districts have benefited through their new buying power achieved through aggregation as provided in SB 7. For example, as of this writing, Energy for Schools Aggregation (142 school districts) saved \$39.3 million and Texas Association of School Boards (180 school districts) saved \$30 million per year. Cities and local governments are also benefiting. For example, the City of Houston is saving \$32 million, the Public Power Pool (46 local governments) is saving \$36 million, the Cities Aggregation Project (71 cities) is saving \$10 million, and the South Texas Aggregation Project (40 cities) is saving \$4.3 million per year.
- Role of co-ops and munis. Many small co-ops and munis were concerned about the viability of their businesses in more competitive electricity markets. While these organizations would benefit from the flexibility and savings that could be achieved as they looked for competitive suppliers of electricity, co-ops and munis that were next to large IOUs and that were not able to provide the lowest cost transmission and distribution service would face competitive pressure. Although, with unbundling as stipulated in SB 7, competition from regulated wires businesses would not have been a major problem, munis and co-ops were given the option to opt out of retail choice. Thus far, no muni has chosen to offer retail competition, and only two co-ops expressed interest but have not formally offered retail competition yet.
- Market power of IOUs. Some policy makers, regulators and independent providers (generators and marketers) were concerned that the larger IOUs would be able to exert too much market power with retail competition. This concern was addressed in SB 7 by requiring unbundling of generation, T&D and retail activities by the state’s IOUs and, more importantly, by limiting the affiliated retail electric provider (REP) to a six percent discount for five years or until the affiliated REP loses 40 percent of its customers.
- Management and function of the ERCOT ISO. Throughout the U.S., as well as in Texas, there was (and still is) considerable debate about the FERC’s ISO (and now RTO) concept. The major arguments are: whether ISOs and RTOs should be structured as for-profit or non-profit entities; how they should be governed and whether industry stakeholders will have too much influence; whether for-profit “transcos” (companies that provide open access transmission) are better for market facilitation; whether the ERCOT ISO or RTO will perform reliably in a fully competitive market; and what the ERCOT ISO/RTO structure should be (for example,

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whether there should be multiple control areas). The decision was made to structure ERCOT as a non-profit ISO with a stakeholder board representing all market participants, operating as a single control area, and responsible for physical reliability of the system (see Part 2 for details on ERCOT).

- Increased transmission access to ERCOT.

This is a contentious, long-term issue. Making ERCOT less of an “island” in the national grid would have substantial impacts on existing industry stakeholders, especially the IOUs and large NUGs. Given the potential for increased integration of North American electric power markets, however, increased transmission access into and out of ERCOT is probably inevitable – as market participants seek to take advantage of larger regional markets and connections. How much transmission capacity will be required, where that capacity is to be located, at what cost for development and how the cost for new transmission capacity is to be allocated across the marketplace remain key issues.

After the lengthy investigation period, SB 7 was passed in May 1999. As discussed earlier, utilities must unbundle into three separate categories: generation, regulated transmission and dis-

tribution and retail electric provider (REP), using separate or affiliated companies. Utilities are limited to owning and controlling not more than 20 percent of installed generation capacity within ERCOT. Retail competition started on January 1, 2002. Rates were frozen for three years, and a six percent reduction from this frozen rate was required for residential and small commercial consumers. This will remain the “price-to-beat” for five years or until the REP affiliated with the incumbent utility loses 40 percent of its consumers to competition.

The bill requires a reduction of nitrogen oxides (NO_x) and sulfur dioxide (SO₂) emissions from “grandfathered” power plants over a two-year period. The law also requires an increase in renewable generation of 2,000 megawatts by 2009 and 50 percent of new capacity to be natural gas-fired.

A pilot program open to customers in the state’s IOU service territories was set to begin retail competition by June 1, 2001. Enrollment began in February 2001. A high level of interest in participating in the retail choice pilot program by nonresidential customers required most of the IOUs to conduct lotteries to choose the five percent of their customers who would be allowed to choose their electricity supplier. The residential participants were selected on a first-come, first-serve basis. However, the official opening of the pilot program was delayed twice (from the original date of June 1 to July 31) due to computer system problems experienced by the ERCOT ISO, which is in charge of recording customer switches from existing utilities to new retail providers.

No new retail provider offered service in areas served by Southwestern Electric Power Co. and Entergy Gulf States during the pilot program and, subsequently, no customers have requested service by an alternative supplier. In 2001, legislation delayed retail choice in the area covered by the Southwest Power Pool in the Texas Panhandle until 2007. The PUCT also accepted a settlement to delay implementation of retail access in East Texas. These delays will affect customers of Southwestern Electric Power Co. in Northeast Texas, a few customers of Southwestern Public Service Co. in the

Highlights of SB 7 and Texas Choice Program.

Senate Bill 7

- Utilities must unbundle into three separate categories: generation, regulated transmission and distribution and retail electric provider, using separate or affiliated companies.
- Utilities are limited to owning and controlling not more than 20 percent of installed generation capacity within ERCOT.
- Generators are required to reduce their nitrogen oxide and sulfur dioxide emissions from “grandfathered” power plants over a two-year period.
- Generators must more than triple the amount of power generated from renewable resources such as wind by January 1, 2009.
- ERCOT is defined as the ISO, responsible for coordinating the actions of market participants and ensuring system reliability.
- Municipals and cooperatives are not affected by the law, unless they choose to open their territories to competition.

Texas Choice Program

- Retail competition started on January 1, 2002.
- A six percent reduction from 1999 rates is mandated for residential and small commercial consumers (<1 MW). This will remain the “price-to-beat” until 2005 or until the affiliated REP loses 40 percent of its consumers to competition.
- Companies are allowed to adjust their rates twice a year due to fluctuations in the price of natural gas.
- As of July 2002, more than 40 companies are certified as REPs; 12 REPs are actively providing service to residential customers and 24 REPs are actively providing service to non-residential customers across Texas.
- As of July 2002, almost 100 companies are certified as aggregators; 28 are actively providing service to residential customers and 46 are actively providing service to non-residential customers. Others are self-serving entities for associations, restaurant chains, churches and so on.

Panhandle and customers of Entergy within the Southeastern Electric Reliability Council. Reasons cited include the lack of regional transmission organizations (RTOs), no retail electric suppliers and wholesale electricity markets in these areas that are not yet competitive.

It is early in the competitive era and the ERCOT region is blessed with comfortable reserve margins. As a result, the competitive market in Texas has not experienced major problems as many feared after the California crisis. However, delays with the start of the pilot program, ERCOT's difficulties with handling the switching data, withdrawal of REPs such as Shell and NewPower, news of potential gaming in congested zones, changes in the ERCOT board, concerns regarding Provider of Last Resort, or POLR, rules (See Part 5 - Major Issues) and the like have been frustrating for the market participants.

Nevertheless, as of November 2002, 48 companies are certified as REPs by the PUCT. According to the Texas Choice web site, 12 REPs are actively providing service to residential customers and 23 REPs are actively providing service to non-residential customers across Texas. Also, as of November 2002, more than 130 companies are registered as aggregators with the PUCT; 32 are offering service to residential customers and 50 are offering service to non-residential customers. Others are self-serving entities for associations, restaurant chains, churches and so on.

Not all of these companies are active in all parts of the ERCOT region. Currently, depending on the location, residential customers have three to nine REPs and six to 14 products from which to choose. Customers in most populated urban locations such as Houston and the Dallas-Ft. Worth area have more choices. For example, according to PUCT data, in Reliant (now CenterPoint) and TXU (now Oncor) territories there are nine REPs offering up to ten different products.

As of September 2002, about 456,000 customers had requested a retail switch. Given that there are more than nine million customers in ERCOT (eight million residential), these num-

bers are not very large, especially considering that the switch statistics include customers who may have switched more than once. CenterPoint (mostly Houston) has the largest percentage of residential customers served by non-affiliated REPs, with six percent. CPL has seen about 11 percent of its small commercial customers switch to a non-affiliated REP. However, when it comes to large customers (with peak demand of one megawatts or larger) that are not eligible for PTB, the switch rate is more than 80 percent in all territories. Overall, 40 to 50 percent of the load seem to have switched in ERCOT.

Meanwhile, improvements in ERCOT's computer systems and in communications between ERCOT and other market participants' systems increased the success rate for customer switching from 50 percent in early February to more than 90 percent in early June. Remaining problems include lost switches, rejected switches, switches done outside ERCOT protocol timelines, and usage data transfers, which leads to billing problems.

When price-to-beat (PTB) is compared with December 31, 2001 rates, the annual potential savings to residential customers is estimated to be about \$1 billion. Since some retail offers are below PTB, savings are likely to be higher. In addition, when savings to school districts, city governments and commercial and industrial (C&I) customers are considered, total savings are estimated in billions.

C&I customers switch actively to new retail providers, most often through energy service contracts that offer lower prices with associated incentives for energy efficiency and conservation. On the residential side, technical issues continue to delay switching and REP selections by new move-ins, frustrating new players in the market. Also, the PUCT continues to examine broad and important market issues such as transmission congestion, credit risk of REPs, generation adequacy (see Part 5 - Major Issues), POLR rules, lack of competition in non-ERCOT areas and consumer protection.

Basic PUCT Activities Before SB 7

While numerous changes were made to the

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PURA, the four basic activities of the PUCT did not change substantially between 1975 and 1995. These four basic activities include certification, rate-setting, monitoring regulated utilities for compliance with statutes and Commission rules, orders and service standards and assisting consumers in resolving complaints against regulated utilities.

Before a regulated utility could provide service to an area or construct new facilities (generation or transmission), it needed to obtain a certificate of convenience and necessity or CCN from the PUCT (the Texas Constitution prohibits non-exclusive franchises). Prior to 1996, two hearings were required, one for a notice of intent (NOI) and a second for the CCN. The hearings would identify the options the utility had considered for meeting the area's electrical needs. The action would need to be in compliance with the utility's long range energy forecast for its service area. The NOI process applied only to generating facilities but it was repealed in 1995 with the enactment of the Integrated Resource Planning (IRP) provisions. In 1996, utilities started to include new facilities in their IRP. In the case of a transmission line, the PUCT is required to take action within one year. Other actions or improvements have no time limit.

The PUCT was responsible for setting electricity rates outside of city limits for investor-

owned utilities, electric cooperatives and river authorities. City governments had the responsibility for rate setting inside city limits. These cases, however, were usually filed with both city government and the PUCT and cities generally utilize the PUCT process. Any appeals of city rates were consolidated into a single PUCT proceeding. The PUCT also reviewed appeals of municipal utility rates where customers were served outside of the city limits.

The PUCT set rates by determining a utility's revenue requirements and rate design. Revenue requirements were the amount required to cover reasonable and necessary operating expenses plus any new investment while providing an opportunity for the utility to earn a reasonable return (profit) on the utility's capital investments. In its determination, the PUCT needed to decide what was allowed to be included in a utility's rate base - the capital assets and expenditures incurred by utilities. Establishing what was to be included in the rate base was actually one of the most difficult aspects of regulation in any state. In setting rates, the PUCT considered management quality, operational efficiency, and conservation and demand-side management activities. The rate design included the ways that revenue requirements were spread among the various types of customers.

The PUCT monitored regulated utilities to ensure that they complied with legislative requirements and Commission policies, rules, orders and service standards. In addition, the PUCT monitored utility earnings and conducted management audits of the utilities.

The PUCT helped with consumer complaints against regulated utilities. The consumer affairs office responded to inquiries and complaints from the general public. In addi-

Comparison of PUCT Activities Before and After Senate Bill 7

	Before	After
Certification	IOUs needed CCNs for generation as well as T&D assets.	CCNs are now required for new generation units and new transmission lines (consistent with ERCOT system assessment).
Rate-setting	Responsible for setting electricity rates for IOUs.	Responsible for setting rates for T&D services.
Monitoring	Monitored activities of IOUs.	Monitors market activities of a variety of market participants.
Assisting Customers	Resolution of complaints regarding service quality, bill payments, etc.	Same plus educating the public about retail choice.
Overall	Fostering wholesale competition.	Fostering wholesale and retail competition.

tion, the office assisted consumers in resolving specific problems they might have experienced with regulated electric utilities.

Basic PUCT Activities After SB 7

As a result of all of the changes brought about by SB 7, the work of the PUCT is changing. As competition emerges, the large rate cases that consumed the agency in the past are giving way to more sharply focused proceedings aimed at protecting competitive markets and Texas customers.

In late 1999 and early 2000, the Commission adopted rules on service reliability, distributed power generation, utility codes of conduct, renewable energy, and the requirements for unbundling utility operations. Beyond 2002, the PUCT will continue to regulate rates but only for transmission and distribution service as the generation side is separated from the wires business. The Commission will continue to enforce rules on quality of service, customer protection, market power and reliability. The PUCT will also continue regulating utilities in areas of Texas where competition has not yet begun.

SB 7 also repealed PURA Chapter 34, which required the Commission to implement IRP programs. This repeal is generally well received by the market participants as many believe that SB 7 allows the market to determine resource planning and continues to encourage renewables and DSM services as intended originally by the IRP programs. On the transmission side, the ERCOT ISO evaluates the system and puts out reports about the need for new facilities. T&D utilities that are willing to invest in new facilities will have to show that their plans are consistent with ERCOT's assessment.

SB 7 also requires the PUCT to develop a consumer education program to inform consumers, including low-income and non-English-speaking consumers, about changes in the provision of electric service and about the customer choice pilot program. The four-year education campaign, beginning in fiscal year 2001, will be designed to provide customers with the information necessary to make informed decisions relating to the source and type of electric services available.

Major Electric Power Issues

Consumer Issues

All of us are electricity consumers and, as such, are familiar with issues that directly affect us. For most people this comes down to the cost (our monthly bills) and reliability (do we get our electricity all or most of the time). However, other consumer issues arise as changes occur in the electric power arena. These issues have been described as large versus small consumers; or industrial versus residential consumers.

Small Consumers and Residential Customers

There are many more residential consumers than any other customer class - more than eight million Texas households. In 2000, these customers purchased 37 percent of Texas electricity and paid 45 percent of the total electric bill.

Customers with special needs and problems include low-income households, renters and multifamily households, and the elderly. These groups have received special consideration by utility regulators and electric utilities in the form of rate setting, weatherization programs and special programs that allow other customers to contribute to the cost for those less able to pay.

The Monthly Bill

Small consumers cost utilities more per customer to serve. In Texas, the primary issue for these customers is their total electric bill, not the rate. This has to do with the customer's control over their own expenses. If bills increase quickly for reasons beyond their control, residential customers are dissatisfied. Residential consumers, and many small businesses, prefer predictable costs that fluctuate within a certain range and that change relatively little over time.

Many of the issues facing the electric power industry are present in day-to-day operations and are taking on added importance as the industry becomes more competitive. Some of these include consumer issues, environmental concerns, economic development, financing, integrating non-utility generation into the Texas and U.S. energy mix, stranded costs, financial performance, and the regulatory process.

In Texas we have many different customers, and each group of customers has different needs and requirements. Smaller customers, like households, need electricity to meet basic requirements of lighting, heating and cooling. We are accustomed to receiving our electricity on demand, but our bills tend to be somewhat higher than for the U.S. as a whole because of the amount of electricity we use for summer cooling. Low income and rural customers have particular sets of problems in terms of service and ability to pay. Large users, businesses and factories, always want lower energy prices to be more competitive. Large commercial and industrial customers had more supply options than households until retail choice was introduced with SB 7 starting January 1, 2002. Now, we can all choose our electricity suppliers.

Energy, in general, is vital to economic development in the U.S. and Texas. Electricity has played a role

Overview

both in our overall quality of life and in the performance of the economy. However, although energy is important, it is just one factor among many that influences the pace and direction of economic development. It may be desirable for energy markets to be as accessible and competitive as other markets that provide inputs to economic development.

Environmental protection is increasingly important in the U.S., and the electric power industry is affected by our preferences for cleaner air, higher efficiency use of energy and other values. An array of options exists for use of cleaner fuels to generate electricity, especially renewable energy sources like solar and wind, for new technologies that continue to reduce the generation cost of electricity and for more flexible electricity systems that can serve a variety of customer needs and encourage conservation.

Finally, introducing competition into the electric power industry has posed a host of issues for both utilities and non-utility generators. Financial implications, transmission access and pricing and the much discussed "stranded cost" problem are some of the issues being considered.

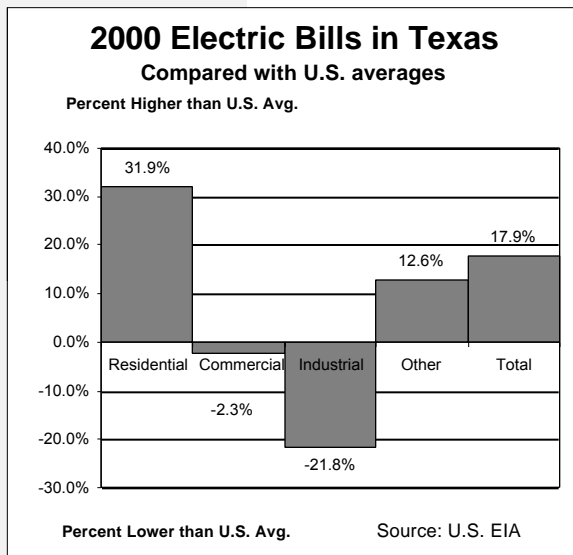
Reliability

Reliability is also a major concern for all customers. Although outages are familiar to customers, their expectations are that such outages will be quickly remedied, unless there are unusual circumstances such as major storms or natural disasters.

Obligation to Serve

An important issue affecting the small consumer more than other customer groups is the "obligation to serve" issue. As part of the "regulatory compact" between utilities and the state of Texas, utilities had an obligation to serve all consumers on demand. This meant having the capability to bring electricity to

Major Issues



current and future customers as it is needed. After SB 7, electricity supply is competitive. While the wires companies are still regulated and obligated to provide service in their territories, customers can be first dropped to a provider of last resort (POLR) if they fail to pay their bills. If they

fail to pay POLR bills, their service can be terminated. There are provisions for protecting those who cannot afford to pay. A consideration for consumers is how expensive power provided by POLRs might be.

Social Concerns

In Texas, as elsewhere in the U.S., the almost universal availability of electricity for everyone has been built into our regulatory system. For low-income households, electric utility programs have been created to help assure that electricity is available at as low a cost as possible.

Of the 20.8 million people in Texas in 2000, roughly 16 percent lived in poverty, an estimated 825,000 households that use electricity. This population and those living on fixed incomes are less able to afford increases in electricity costs. Under the System Benefit Fund provision of SB 7, about 500,000 low income customers are receiving discounts.

Renters and Rental Housing

Of the eight million residential customers, almost 37 percent are renters. Most rental units are now individually metered, but renter households have little control over the choice of appliances or energy savings improvements that could be used to better manage electricity

costs. In addition, income levels in rental households typically are lower than the average household.

Consumer Protection

Although all electricity customers need consumer protection provisions, small consumers are more likely than large industrial or commercial electricity customers to lack the resources or capabilities to adequately protect themselves. Over the years, consumer advocate groups have emerged in all of the states to intervene in the regulatory process on behalf of small customers.

Rural Issues

Texas is a big state, with huge swaths of rural areas that are remote from electric power facilities that serve large cities and towns. For this reason, it was important to consider the effect of restructuring on the rural areas of the state. The Rural Electrification Act of 1935 in effect pioneered the concept of universal service - the concept that electricity was a fundamental commodity to which all citizens should have access. Today, even though some cooperatives are large and serve suburban metropolitan areas, most rural customers still receive their services from cooperative systems. Cooperatives face similar risks as utilities in a competitive environment, but since they operate as non-profit entities they may face additional challenges from a changing electricity market. In recent years, financial resources including federal funds for co-ops started to decline. As discussed in Part 4, co-ops were allowed to opt in retail choice and, thus far, only two co-ops are expected to participate in retail competition.

Large Electricity Consumers

Cost and economic competitiveness are key issues for Texas industrial and large commercial customers that consume large amounts of electricity. These customers have considerable leverage in the electricity market. They are relatively easy to serve, their loads are more predictable and they sometimes have the option of generating their own electricity (e.g., cogen-

eration). Large customers also have strong incentives to increase efficiency and reduce their consumption of electric power. With retail choice, most C&I service contracts include these benefits.

Cost Issues

Texas industrial customers enjoy a cost advantage of roughly five percent over the average U.S. industrial customer (4.42¢ per kWh versus 4.64¢ in 2000). However, electricity costs are a significant factor for many Texas industries and they believe that lower rates may be possible. As a result, competition and access to alternative sources of electricity are important issues for these customers.

Economic Competitiveness

Texas industrial and commercial activities must compete in an international marketplace. Opportunities for lowering electricity costs can improve the competitive status of Texas industries, as well as attract new industries to the state. While rates are lower in Texas than other large states, it is overall costs that are important. Texas and U.S. industries enjoy a distinct

cost advantage over many of our international trading partners (see table of international electricity prices for industry), but global competitive forces are driving other countries to pursue policies that lower industrial electricity costs.

Reliability

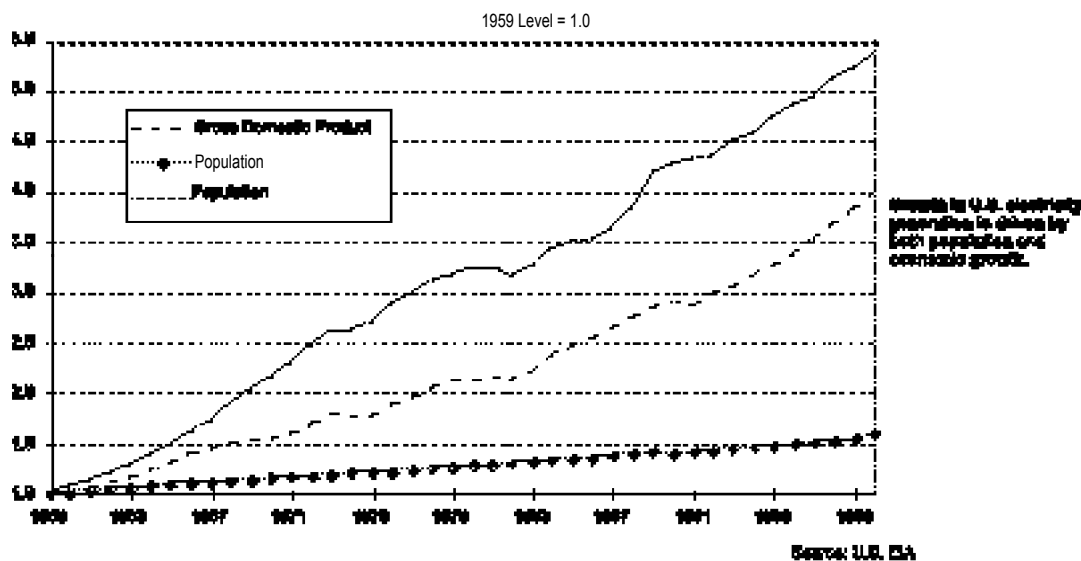
With the advent of and increasing reliance on electronic controls and information systems, the reliability of electric power plays a larger role. Even small outages (less than a second) can disrupt industry processes, adding to the cost of production and operation.

Sample of Worldwide Electricity Prices for Industrial Users

	Year	U.S. \$/kWh
Japan	1999	0.143
Germany	1999	0.057
Spain	1999	0.056
OECD	1998	0.063
Turkey	1999	0.079
OECD Europe	1998	0.065
Netherlands	1999	0.061
United Kingdom	1999	0.064
France	1998	0.047
United States	2000	0.046
Australia	1997	0.056
Texas	2000	0.044
Sweden	1997	0.034
Canada	1994	0.038
Mexico	1999	0.042

Note: OECD = Organization for Economic Cooperation and Development
Source: International Energy Agency

Growth of U.S. Electricity Generation, Population and the Economy
1959 to 2000



Self Generation

Large electricity users sometimes have the option of generating their own electricity. This potential affects the relationship between industry and utilities, especially when self-generators want to sell their excess power to the utilities. Industrial cogeneration, the majority of self-generation, provides fuel efficiencies per kWh that are about double conventional generation. Also, investment costs per kWh for cogeneration are usually one-half to three-fourths what they are for conventional electricity generation.

Economic Development

How important is electricity to economic development in the U.S.? The answer is “very,” but in a surprising way. Electricity growth is driven both by household growth and growth in the overall economy, as measured by Gross Domestic Product (GDP).

Growth in the electric power industry in the U.S. is influenced both directly and indirectly by population growth and general economic performance. The direct effects come from demand for electricity as households are added or we add new appliances or businesses and industries expand. The indirect effects come from the contribution that electricity makes to our life-styles and quality of life and technology development.

At the same time, electricity has been an essential input for industrial and economic performance in the U.S., although there are other things that are equally or more important. Much of the improvements in productivity is due to increased automation and computerization, which depend on reliable supply of electricity. When both household and economic growth is taken together, they account for most if not all of the net growth in the U.S. electric generation capacity.

Texas accounts for almost eight percent of the U.S. GDP and about eight percent of total U.S. population. The relationships between electricity growth, population growth and general economic performance are similar to the nation as a whole. Like the U.S., electricity in

Texas is a factor in economic performance, but not the only one. Electricity costs are important, but so are the costs for land, labor, materials, transportation and other factors. Employment in electric utility services, the most easily obtained measure of jobs linked to the electric power industry, is only about one-half percent of the state total nonfarm employment - quite small. However, we also have jobs tied to companies that provide equipment, materials and services to the electric power industry, and jobs in electric power services outside of the utility companies themselves. Texas has a growing number of businesses that independently market, broker and manage the provision of electricity to industrial and commercial customers all over the U.S. Finally, Texas electric utility companies and independent generators and marketers are engaged in developing and managing electric power all over the world, although these activities are being cut back due to current financial problems of the industry and problems in some regions of the world, like Latin America.

The link between electricity and economic development can play a role within the state of Texas as cities and regions compete for business and job growth. Electricity costs vary widely, and are influenced by a number of factors. For example, electricity from nuclear generation or electricity service to remote locations can result in higher costs. When it comes to where businesses or people locate within Texas, however, electricity cost is just one of many factors that are evaluated.

Environmental and Energy Policy Issues

Environmental concerns are a prominent part of every industry today and electric power is no exception. Coal and lignite are taken from underground and strip mines. Natural gas wells are drilled to provide fuel to generate electricity. Power plants that use fossil fuels emit pollutants that are subject to state and federal regulations. Transmission lines are spread across the state, affecting human and natural environments. These activities are monitored and regulated, but because of the

size and scope of the industry there will continue to be concerns about electric power and its environmental effects.

Fuel Choices => environmental

Power plants use various fuels that are linked to problems like acid rain, urban ozone, global warming and waste disposal. Each fuel has environmental advantages and disadvantages. Coal, one of the lowest priced fuels, requires considerable treatment of emissions to meet environmental standards and its use triggers concerns about global warming. Natural gas, a more expensive fuel, burns cleaner than coal but can contribute to ozone formation in urban areas. Wind and solar power which require relatively high capital costs, produce no direct emissions and have virtually no fuel cost, but they can be unsightly or impact wildlife. Nuclear power plants emit no combustion gases but have raised the issue of long-term disposal of spent fuel and are a focus for security post September 11.

Coal and lignite were the fuels used to generate about 37 percent of Texas electricity in 2000. Almost 52 percent was from natural gas with about ten percent from nuclear power. Less than one percent was from hydroelectric power or renewable fuels (wind, solar, or biomass). Some predictions call for electricity from coal to increase over the next 20 years. Texas uses more coal for electricity than any other state in the U.S. with the possible exception of Ohio. However, 27 states generate a greater share of their electric power from burning coal.

In 1971, natural gas dominated the state's electricity production, generating 99 percent of all electricity. But in response to natural gas price volatility related to a perceived natural gas shortage, public policy mandated that utilities eliminate the use of natural gas even in existing plants and use alternative fuel sources for future generating needs. Utilities in Texas in the 1970s began to diversify their fuel sources using coal and nuclear power (see Part 4, Regulations and Policies).

It is important to note that natural gas dominates generating capability among Texas utilities - 71 percent versus 20 percent for coal in

early 2002. These ratios represent a significant change since 1997 when gas accounted for 61 percent and coal for 30 percent of capacity. Coal dominated the amount of electricity actually generated - 49 percent versus 37 percent for natural gas. With the anticipation of restructuring, much more gas-fired generation capacity has been built since 1998-99, eventually leading gas to be the dominant fuel both for capacity and generation.

Air Pollution => environmental

Acid rain, urban ozone, particulate emissions and global warming are the four primary air pollution concerns for the electric power industry (also see Part 4, Regulations and Policies, for our discussion of air pollution issues associated with electricity in the 1990 Clean Air Act Amendments) although emissions of substances such as mercury especially from coal-fired plants will likely receive more attention. The EPA Emissions Trend Report shows that for 1995, Texas electric power generation accounted for 43 percent of sulfur dioxide (SO₂) emissions (associated with acid rain) and 21 percent of oxides of nitrogen (NO_x) emissions (associated with ozone formation). However, with natural gas increasing its share in power generation and implementation of acid rain programs, overall SO₂ emissions from power generation declined about 20 percent between 1997 and 2001. Texas also reduced its NO_x emissions by 16 percent between 1990 and 2000.

Another emission from combustion of fossil fuels is carbon dioxide (CO₂). Although not officially considered a pollutant, there are concerns that it may contribute to global warming. In 1999, CO₂ emissions from utilities accounted for 33 percent of Texas CO₂ emissions (U.S. EPA website yosemite.epa.gov/oar/globalwarming.nsf/content/emissionsStateEnergyCO2Inventories.html).

Power plants contribute relatively little to emissions of volatile organic compounds



(VOCs - associated with ozone formation and mainly produced by vehicles and industrial operations), carbon monoxide, nitrous oxide (a greenhouse gas and oxide of nitrogen), or methane (a greenhouse gas). Because of effective control devices, power plants contribute relatively little to the problem of particulates.

Acid Rain: Acid rain refers to precipitation which has a high acidity level that poses a risk to human and ecosystem health. SO_2 emissions from burning coal (or any fuel containing sulfur) reacts with water vapor and becomes an acid. The acids may mix with water, fall to the earth, or combine with dust particles. These may damage plants, marine life, or human health, including increasing mortality rates of humans. SO_2 is subject to federal and state air quality standards.

Urban Ozone: Power plants produce a substantial portion of NO_x as a product of combustion. These oxides react with VOCs in the presence of sunlight to produce ozone. Ozone has various nonfatal effects on human health and some types of vegetation. NO_x and VOC emissions are subject to federal and state air quality standards.

Global Warming: Background or natural greenhouse gases keep the earth's temperature within a certain range by capturing part of the sun's heating effect within the earth's atmosphere. Some fear that enhanced global warming will result from increased levels of CO_2 and other greenhouse gases in the atmosphere, leading to increased temperatures, changes in precipitation and other harmful effects. CO_2 and NO_2 are two greenhouse gases produced by fossil fuel (coal, natural gas, and petroleum) power plants.

Natural gas has much higher hydrogen content than coal. As a result, it has about 60 percent of the carbon content of coal and, as such, produces less CO_2 . According to the EPA, in 2000, coal-fired units produced almost twice as much CO_2 as non-coal units in Texas despite the fact that gas-fired power accounted for 52 percent and coal-fired power for only 37 percent of total generation. Nationwide, CO_2 emissions from coal-fired units account for nearly 80 percent of total CO_2 emissions associated

with power generation.

Particulates: Although power plants contribute relatively little to this problem, particulates are the subject of increasing concern for the impacts on human health. Particulates are associated with other pollutants, such as SO_2 from power plants, and are likely to be subject to future air pollution control strategies. The EPA has recently adopted new standards for fine particulates ($\text{PM}_{2.5}$). Monitoring equipment has been installed to determine if Texas locations are in violation of these standards.

Transmission Lines and Stations => environmental

Development of new transmission lines, expansion of existing lines, and construction of new distribution facilities is often met with public resistance. Environmental concerns are part of the reason given for this resistance.

Transmission lines may require intrusion on natural areas, be visible from scenic areas or intrude on residential neighborhoods. They may destroy or disrupt wildlife habitat. Solar and wind power facilities supported by environmental groups have faced similar public reactions.

There has been ongoing public concern about the health effects of high voltage power lines. The National Research Council (1996) has found that there is "no conclusive and consistent evidence" that electromagnetic fields cause any human disease or harmful health effects. Despite these findings, this issue will likely continue to be an environmental and health concern for the general public.

Related Energy Policy Issues => environmental+energy

Environmental concerns are also linked to energy issues such as the use of alternative fuels to generate electricity and energy efficiency. Alternative fuels are defined in different ways, but are often simply alternatives to conventional fuels. There are usually environmental or energy-related benefits associated with alternative fuels. For example, natural gas used as a transportation fuel is considered an alternative that can be cleaner than conventional gasoline, but natural gas for power gen-

eration is not considered to be an alternative fuel (it is considered by many to be a cleaner fuel, however).

Alternatives for power generation include hydroelectric power, solar electricity, wind energy, biomass energy and geothermal power. The fuels for each of these are available at little or no cost; they are often renewable fuels; and they may produce little if any direct emissions. Proponents argue that the environmental costs of conventional electric power are not reflected in the cost of electricity produced. If these costs (externalities) were included, alternative fuel electricity could be very competitive (see *Texas Renewable Energy Resource Assessment*, July 1995, Texas Sustainable Energy Development Council).

Hydroelectric power is produced as water moves from a higher to lower level and pushes a turbine. Texas has about 471 megawatts of installed hydroelectric capacity which produced about 0.4 percent of Texas electricity generation in 2000. Considerable opposition exists to developing more hydro power, not only in Texas but throughout the U.S.

Solar electric power can be produced through various technologies. Costs have declined substantially and in some applications, solar electricity is economically competitive. Texas has good solar resources available to a large portion of the state; the best resources,

however, are not near major populated areas. Solar panels and large solar arrays face environmental and community opposition similar to placement of other large electric power

facilities.

Wind energy technology is available today at competitive prices (advanced wind turbines). Wind resources are fairly site specific. The best areas include the Texas Panhandle,

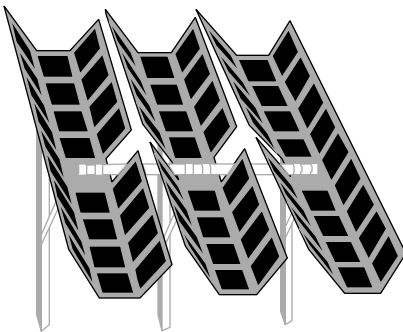
Gulf Coast and areas in the Trans-Pecos region of west Texas. With the requirement of renewable power in SB 7, there has been increased interest in wind power. Today, there are more than 1,000 megawatts of wind power capacity in Texas as compared to about 50 megawatts in 1997, and more capacity is expected.

A key consideration for wind and solar resource development is that the areas of best potential in the state are far from urban populations. Transmission access is one of the major impediments to developing these fuel sources for widespread use.

Biomass energy is produced from conversion of plant and animal matter to heat or to a chemical fuel. It encompasses the widest range of technologies including converting garbage to methane, burning materials to produce heat to generate electricity and fermenting agricultural wastes to produce ethanol. Biomass resources from urban waste are more available in populated areas of Texas, while agricultural-based fuels are strongly associated with rainfall distribution as well as agricultural production. Many biomass energy approaches rely on renewable fuels. Because of the differences in these technologies, it is difficult to generalize on the environmental issues associated with them.

Geothermal power relies on the heat energy in the earth's interior. Texas has a variety of geothermal resources, mostly located in the eastern half of the state and some along the western portion of the Rio Grande. Most resources could not be used for electricity production. However, heat from these resources could be used as a substitute for heat from an electrical source. The economics and environmental effects of such applications limit their viability.

While the benefits of cleaner, alternative energy sources for electricity are appealing, they do pose operational considerations for the management of electricity services. For one thing, they are "intermittent" power sources (the sun does not shine at night, the wind is variable), and peak availability of alternative energy sources does not always coincide with peak demand. Options like solar and wind



Major Issues

cannot provide consistent power production, in contrast to the coal and nuclear facilities that are usually used for “base load” (the units operate continuously providing a consistent power base). Many solar technologies tend to be implemented in conjunction with natural gas turbines. In addition, both solar and wind require large amounts of acreage when deployed for large-scale power generation and extensive use of materials (steel and other products) that require considerable energy to produce.

Technological advances are such that some success in integrating wind-generated electricity has been achieved. Likewise, hydro facilities provide a readily available power reserve (interrupted only by periods of extreme drought). Solar poses more of a problem, because some form of storage is required. Scientists are experimenting with a variety of storage solutions, like letting daytime heat accumulate in fluids like molten salt so that turbines can continue to operate after sunset. However, it will be some time before the economics of utility-scale renewable technologies

become favorable. The operating cost of new natural gas turbines has dropped by half or more during the past decade, so that electricity from most renewable energy technologies is usually 150 to 400 percent more expensive than natural gas-fired turbines with the range dependent upon the age of gas turbine and the price of natural gas (*Comprehensive Review of the Northwest Energy System*, December 1996). The cost of wind power,

however, has fallen significantly to about four cents per kWh within the last decade and costs are expected to drop another 20 to 40 percent over the next ten years.

What many renewable technologies (and some small scale technologies like natural gas microturbines and fuel cells) do offer are options for users in remote locations or localized solutions for energy demand. An isolated community can distribute electricity to its residents “off-grid” (meaning that there does not have to be a connection to a transmission system). Or, excess power from location-specific generation, including cogeneration, can be distributed “on grid.” Distributed and off-grid generation bear significant implications for the future.

Energy Efficiency and Conservation => environmental+energy

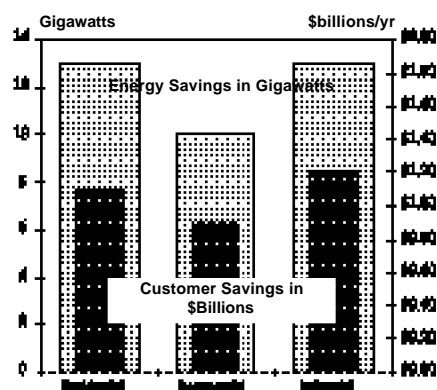
Energy efficiency and conservation are two sides of the same environmental and energy policy coin. The impacts of the environmental issues discussed above are all reduced by simply using less electricity. New electricity demand is met through energy savings rather than the provision of more electrical power.

Energy efficiency usually applies to technological improvements that reduce electricity needs, such as more efficient electric motors, low energy lighting and automatic sensors that turn lights off in unoccupied spaces, improved insulation and high efficiency refrigeration. Cogeneration can provide an energy efficient means to sequentially produce both power and useful thermal energy (steam/chilled water) from a single fuel. Technology improvements have substantially increased fuel efficiency and lowered capital costs during the last decade.

Reduced energy use also includes changes in operations and behavior that result in less electricity consumption. These include strategies such as shifting industrial and commercial processes to off peak hours, or using electric power at night to chill water that would then be used to cool buildings during the day, offsetting other demands for electricity.

Utilities have implemented energy efficiency and conservation efforts through programs

Hypothetical Energy Savings from Efficiency Improvements Year 2010



This analysis shows an estimate of the potential for saving 36 Gigawatts of electric energy through demand reduction.

Source: Texas Energy for A New Century, Texas Sustainable Energy Development Council, August 1995

called demand-side management (DSM). Like other DSM programs around the U.S., utilities in Texas helped customers to reduce electricity use by providing energy audits and information on energy saving appliances and habits (“bill stuffers”). Other initiatives used in some states include offering rebates to customers who install energy saving appliances, compensating utilities that reduce electricity load through efficiency programs by allowing them to earn a higher rate of return or encouraging customers to reduce peak-period demand (i.e., installing devices such as trips on swimming pool filter motors that reduce a customer’s load during daily peaks in demand).

Utility spending on DSM programs in the U.S. increased from about \$900 million in 1989 to almost \$3 billion in the mid-1990s. In contrast, DSM spending in Texas decreased during the 1990s (*Senate Interim Committee on Electric Utility Restructuring*, 1998). Some estimates are that increased efficiency in Texas could replace all projected increases in electricity demand in the residential and commercial sectors, and that efficiency could offset 43 percent of total projected energy demand. These estimates are probably high, given that not all savings may be technically or economically achievable.

The drive to encourage efficient use of electricity has had a powerful impact not only in the U.S. but worldwide. Historically, the most active use of DSM applied to utility operations has been in California, the Northwest and Northeast. However, with market restructuring and retail competition, utility DSM efforts have largely been phased out. Nevertheless, SB 7 has an energy efficiency provision that requires each utility to provide incentives sufficient for REPs to acquire additional cost-effective energy efficiency equipment equivalent to at least ten percent of the utility’s annual growth in demand.

Many economists argue that if costs and benefits are correctly measured, electric utilities may be spending much more on efficiency programs than the value of benefits obtained. Indeed, one of the main arguments for electricity restructuring has been the encouragement

of new demand side technologies with new businesses to provide these technologies in the marketplace. Strategies like marginal pricing, which force customers to pay more of what it actually costs to provide electricity, may be more effective for rationing electricity use. REPs in locations where retail choice is allowed provide an array of energy efficiency services, including inspection of the site for potential energy savings, installation of energy efficient equipment and insulation, monitoring of energy usage, and so on. If retail choice becomes more widely adopted, REPs may provide more of these services to a wider range of customers, including residential users.

With the growing attention to efficiency and conservation, new businesses have emerged and existing ones have grown creating numerous opportunities. These businesses include everything from companies that research, develop and manufacture energy saving devices (like lighting and building materials, automatic/remote thermostat controls, advanced real-time meters, storage devices, etc.) to those that provide independent audits and information services. REPs can definitely benefit from commercialization of these technologies and are actively pursuing some in Texas. Thus, energy efficiency can generate economic benefits in a competitive environment.

Financing and Operations

To generate over \$233 billion in annual revenues from U.S. electricity sales and nearly \$21 billion in Texas alone has required big investments. Likewise, policies to make the electric power industry more competitive have big financial and operational impacts on these investments.

Electricity Investments and Technology

Transmission and distribution costs have been most heavily impacted over the years by inflation (which affects the cost of labor and materials), interest rates (which affects the costs for utilities to borrow money), dealing with environmental concerns (costs associated with environmental studies and mitigation) and other factors. In contrast, the costs associ-

ated with generation have generally declined due to technology improvements, including those for alternative electric energy sources, and lower costs for conventional fuels.

The impact of technology innovations has had a significant impact on generation costs. Improvements in natural gas turbine design have made gas much more competitive with coal. New turbines are essentially jet engines that use a pressurized mixture of gas and air to spin the turbine. New “combined-cycle” turbines take excess heat generated from the gas turbine and use it to power a conventional steam turbine. This combination has pushed turbine efficiencies beyond 50 percent, and continued improvements are expected in coming years. New turbine designs are relatively cheap, modular and can be brought on-line quickly. Gas derived from coal or biomass can also be used to drive combined-cycle turbines. Turbines using higher pressures and efficiency gains in performance are improving rapidly.

Because of the development of turbine technologies and improvements in alternative energy technologies (mainly in solar panel and wind turbine design), the costs for electricity generation from natural gas (so long as fuel cost do not rise appreciably) and alternative fuels are on a downward trend, while flexibility and ease of installation are on an upward trend. Where investments of billions of dollars were a matter of course for nuclear and coal facilities, it is likely that the financial requirements of the electric power industry in the future, including Texas, will be much different. It is clear that for the electric utilities, especially those that have invested heavily in coal and nuclear facilities, the advent of cheaper, more flexible turbine design and generation alternatives means that competitive pressure everywhere in the electric power industry is likely to increase.

The Challenge of Integrating

As noted previously, because ERCOT is a separated grid, much of the Texas electric power industry has not been subject to regulation by the FERC. But FERC actions on a number of issues have impacted both PUCT

and power industry decisions. If, as expected, ERCOT becomes increasingly linked to surrounding portions of the U.S. grid, FERC actions will grow in importance to the Texas marketplace.

Non-Utility Generation

In Part 4 - Regulations and Policies, a revolution in the U.S. electric power industry was described, fostered by the PURPA and later the EPAct. Non-utility generation has played a significant role in reducing costs of technologies for natural gas, solar and wind generation. However, the process of integrating non-utility capacity has posed a significant challenge to utilities and PUCs. Under PURPA, which encouraged the growth of non-utility generators, non-utility generators that meet defined conditions must be classified as “qualifying facilities” (QFs). Power purchases from QFs were based on the cost that utilities would avoid in not building new generation capacity. The complex issues of making this system work have been evident in Texas and the rest of the nation.

Shift to Competitive Bidding

Under PURPA, utilities had an obligation to buy power from QFs (if capacity was needed and the price was lower than the utilities’ avoided cost). This made it possible for a large number of non-utility companies to enter the electric generation business as owners of QFs. The regulations governing QF procurement in a number of states forced utilities to buy too much QF capacity at too high a price. In response to this problem, many states shifted from the administrative determination of avoided cost-based prices, at which utilities had to buy all QF power that was offered (if capacity was needed), to competitive bidding programs in which utilities estimate their capacity needs and then put these needs out for competitive bids. As QFs’ business expanded, industries and interest groups argued that this process should be opened to all potential electricity suppliers, not just QFs. They argued that utilities’ most effective role was as portfolio managers for retail customers (principally resi-

dential and small commercial). Within this role, utilities would examine all sources of generation - QFs, non-QF independent power producers (IPPs), DSM (conservation), third-party utility suppliers and utility-owned generation. They would then choose the most cost-effective power mix. However, after SB 7 unbundled old utilities into separate generation, T&D and retail entities, existing PURPA contracts are transferred to either affiliated PGCs or REPs.

Use of Antitrust Laws

QFs were covered by PURPA, but IPPs' sales or sales by utilities with excess capacity were subject to FERC regulation at the wholesale level and outside of ERCOT. The ratemaking principles were consistent with the regulation of a legal monopoly franchise and prudent investment standards, but incompatible with the QFs' contracts or for IPPs' speculative market entry.

Some wholesale customers complained about being captive to regulated tariffs of the local utility. They wanted the option of acquiring bulk power from other utilities. In any event, municipal distribution companies required access to the utility's transmission grid to "wheel" generation to the distribution system and to integrate dispersed generating facilities.

At the time PURPA was enacted, utilities were not required to provide transmission network access. FERC could order "wheeling" only if it did not affect competitive relationships. Wholesale customers turned to antitrust laws to get access. Municipal utilities used the nuclear power licensing process to open up transmission systems on reasonable and non-discriminatory terms and conditions. Municipal and cooperative utilities also brought suits under antitrust laws to obtain access to "essential" transmission facilities. Once utilities began offering transmission service to some wholesale customers, FERC used its authority to bar undue discrimination to extend these services to others. By the mid-1980s, distribution utilities were able to meet much of their requirements from competing suppliers, rely-

ing on their host utility as a backup.

The wholesale market in Texas developed at a rapid pace since 1995. Significant participation by new entrants and the opportunity for future entry helped establish a healthy wholesale market, which is expected to increase the chances for success of the retail competition initiated by SB 7.

Emergence of Coordination Market

U.S. utilities, including those in Texas, have routinely engaged in hourly energy exchanges, using low cost electricity from a generator in one control area that might otherwise have come from a more costly generator. Over time, the range of products available in the coordination markets has also expanded. Longer duration contractual arrangements emerged and vertically integrated utilities came to rely on medium term capacity and thereby defer new generation construction. These longer term capacity and energy contracts were significantly different from the very short term coordination arrangements from which they emerged. This coordination market grew during the 1970s and 1980s in response to growing regional differences in marginal operating costs and supply / demand balances. A major reason is that FERC did not apply rigid cost of service formulas to regulate these rates (see page 59 for a description of cost of service ratemaking).

FERC's Role Integrating Non-Utility Generation

In 1988, FERC began to reconsider its pricing regulations in an effort to encourage entry of IPPs (not QFs) into the electricity sector and to encourage utilities with excess capacity to sell it to third parties under long term contracts. As a result, IPPs and unregulated utility-affiliates making power sales outside of their retail service territory have had little difficulty obtaining market-based pricing authority from FERC.

During this time, the FERC accommodated entry of power brokers seeking to arrange power transactions between sellers and purchasing utilities with such transactions having a minimum of regulatory obligations. Utilities

and utility affiliates seeking market-based pricing authorization to sell in or near their service areas are required to provide adequate “open access” transmission service to other buyers and sellers. This is the essence of the FERC’s Orders 888 and 889.

Absent statutory authority to require utilities to provide nondiscriminatory transmission service prior to the EPAct, FERC began to encourage utilities to “voluntarily” file open access transmission tariffs. FERC then conditioned its approval of mergers between vertically integrated utilities on their filing of open access transmission tariffs and the availability of market-based pricing.

Then FERC placed a ceiling on the price that a utility could charge for transmission service to third parties. This price was equal to the average embedded cost of transmission facilities per megawatt of system peak load. The political and regulatory difficulties of building major new transmission facilities are generally thought to cost more than the revenues from selling temporarily excess transmission capacity.

A study by FERC showed that the cost of transmission is highly dependent on the voltage used. Since capacity increases with the square of the voltage, the use of high voltage upgrades effectively reduces cost. The FERC has been encouraging the formation of RTOs which would take responsibility for (1) regional transmission facility planning, (2) the provision of information about transmission capacity and costs, and (3) ultimately, comprehensive regional transmission service pricing. FERC provided the details of RTOs in Order 2000, discussed in detail in Part 4.

Major FERC Policies on Transmission Access

Major actions which have affected transmission access include the following:

- Requiring utilities to publish detailed information about the availability of transmission capacity on their systems and related operating characteristics of their bulk power facilities.
- Expanding the range of transmission services that utilities must be prepared to offer

from point-to-point service to a full range of services that are “comparable” to services that the integrated utility provides to itself.

- Allowing wholesale customers to file for “generic” tariffed transmission service even in the absence of a specific buyer and a specific seller.
- Encouraging the formation of RTOs to deal with transmission planning, operations, and pricing issues on a comprehensive regional basis.

Unfinished FERC Business

The FERC has increased transmission access, but has much left to do with regard to transmission and ancillary services pricing. These issues are especially important in the U.S. where many transmission owners operate portions of the synchronized AC system in which property rights are poorly defined and associated external and “free ride” problems are rampant.

Control areas are responsible for balancing loads and resources, maintaining frequency and voltage, providing spinning reserves, dispatching in response to transmission constraints, providing emergency support and coordinating operations with interconnected control areas. Based on Order 2000, FERC has been working on an RTO model that would address these issues.

Transmission owners are also getting ready by establishing industry standards in cooperation with FERC so that when the RTOs are formed, they can be operated reliably and efficiently in a consistent manner at least within each region.

How existing FERC policies get implemented, and how the FERC’s unfinished business get done, are contingent on resolution of the FERC’s SMD proposal (see Part 4 - Regulations and Policies).

Related Generation Cost Issues

Generation costs are being driven down by technological advances, lower fuel costs (not guaranteed to last) and competition, but electricity rates vary widely around the U.S. and between wholesale and retail markets. This ap-

parent disparity can be understood by considering changes in electric power policy.

First, the U.S. added nearly 100,000 MW of nuclear capacity during the 1970s and 1980s to meet growing base-load demand and in response to state and federal laws and policies that dictated fuel diversification. In many cases, nuclear capacity was much more costly to build than anticipated. In spite of fears that nuclear units would not operate at high reliability levels, capacity factors for nuclear units have been trending up. Where once many experts believed that nuclear units would be converted to other fuels, the outlook for continued operation of nuclear units is more optimistic.

Next, currently there is substantial excess generating capacity in many parts of the U.S. due to slower growth in demand and rapid expansion of NUG capacity. The price of generation services in the wholesale market reflects this excess capacity and is often below the long-run marginal cost of expansion.

Third, utilities in some areas of the country (especially California and the Northeast) were required to purchase too much QF capacity at too high a price under long-term take-or-pay contracts. These costs have been borne largely by retail customers.

Fourth, utility energy conservation programs that provide subsidies to customers to use electricity more efficiently have both reduced demand for electricity and led to higher prices. Utilities have been allowed by regulators to pass through the costs of DSM programs or recapture expenses through higher rates of return.

Finally, as mentioned before, efficiency improvements of combined cycle natural gas turbines have significantly reduced long-run marginal electricity costs. The abundant supply and low prices for natural gas throughout the U.S. for much of the last decade was highly visible in the emerging wholesale electricity market. As a result, electricity prices across much of the U.S. were generally influenced by accessibility to natural gas or natural gas-fired wholesale power although in parts of the country prices are still dominated by either coal

based (Midwest) or hydro based (Northwest) generation. Recent spikes in the price of natural gas, which may reflect changing fundamentals with respect to natural gas supply and deliverability, may diminish the cost advantage for gas-fired power.

In a nutshell, most of the base load nuclear and coal capacity added during the last twenty years was done to ensure service to retail customers. These investments have been found to be prudent. Today, these long term investments may seem questionable, but recall from Part 4, Regulations and Policies, that utilities were constrained to fuels other than natural gas.

“Stranded Costs” or “Stranded Benefits”?

The debate about retail wheeling in the U.S. and Texas largely has been about whether to extend the FERC’s policy of open access in the wholesale market down to the retail level. The major issues centered on who would pay for generation and generation-related financial commitments that might not be fully recoverable when public policy was changed to allow for electricity to be sold at unregulated market prices. These commitments included investments in power plants, long-term power purchase and fuel obligations and other costs that were deferred for future recovery, all of which were reviewed by regulators, found to be reasonable and prudent and have been included in rates.

Many utilities, regulators, legislators and consumers were concerned about whether a credible mechanism could be found to pay for these stranded costs in the transition to more competition. Industrial customers and some independent suppliers and marketers hoped that utility shareholders would pay for a large fraction of these costs. Utilities and power generators, however, agreed with FERC Order 888, which states “[t]he recovery of stranded costs is critical to the successful transition to a more competitive market.” A reasonable opportunity to recover stranded costs was believed to be consistent with honoring past commitments, including the regulatory compact of providing service to all customers in exchange

for a reasonable opportunity to earn a reasonable return on investments that state PUCs found to be prudent and subsequently included in rates. Many representatives of small retail customer interests opposed retail wheeling because they were concerned that the burden of stranded costs would be shifted to “captive customers” who would then be unable to take advantage of retail competition opportunities.

Many proponents of retail wheeling have viewed it as an opportunity to get utilities out of the “taxation by regulation business” and focus their attention on producing electricity as cheaply as they can. While this has appeal to some, it must be recognized that state and municipal governments receive substantial revenue from utility sources, such as gross receipts taxes, local and state franchise taxes, property taxes and sales taxes.

As states began to move forward with competition, a critical question was “how big is the stranded cost problem?” It was not easy to define. In the mid-1990s, estimates from Moody’s Investors Service ranged widely, from \$100 billion to \$300 billion for the U.S. and from \$1 billion to \$10.3 billion for Texas. The PUCT’s *Report to the 75th Legislature* (January 1997) estimated a range of a negative \$3 billion (stranded benefit) to \$22 billion (stranded cost). The Senate Interim Committee 1998 report estimated that stranded costs range from a negative \$9.8 billion to \$18 billion. The range of stranded costs is dependent on several factors, including the projected market price of electricity, the projected cost of fuel, what assets are included, whether only wholesale competition or both wholesale and retail competition take hold and the isolation of stranded costs as opposed to other costs associated with the transition to greater competition. For example, the PUCT calculated stranded costs at \$1 billion in 1998, \$3.7 billion in April 2000, -\$1.5 billion in August 2000 and -\$2.2 billion in spring 2001 with the last two estimates reflecting benefits.

The FERC, having jurisdiction over most wholesale rates, ruled in Order 888 that full recovery of prudently incurred wholesale

stranded costs will be provided by customers seeking other generating service providers. As noted above, the FERC viewed stranded cost recovery to be essential for successful transition to open access. Retail stranded cost determinations were to be made by state PUCs and legislators, although the U.S. Congress considered pursuing legislation that would impact how much of the cost would be born by shareholders versus ratepayers. Most states, including California and Texas, adopted a competition transition charge (CTC) for the recovery of stranded costs when they passed restructuring legislation. In Texas, the CTC was originally set at \$0 by the PUCT because the market values of assets were greater than their book value (as indicated by the estimates of stranded benefits provided earlier). In California, however, CTC caused problems for utilities that were not allowed to pass fluctuations in wholesale prices on to their retail rates until they fully recovered their stranded costs. Utilities which recovered their stranded costs sooner were able to adjust their retail rates during California’s crisis, at least until the rates were refrozen by the State Legislature.

It is important to note that not only utilities were impacted by the transition to greater competition. Many NUGs undertook the risk of developing facilities under contract terms that were thought not to survive in more competitive markets.

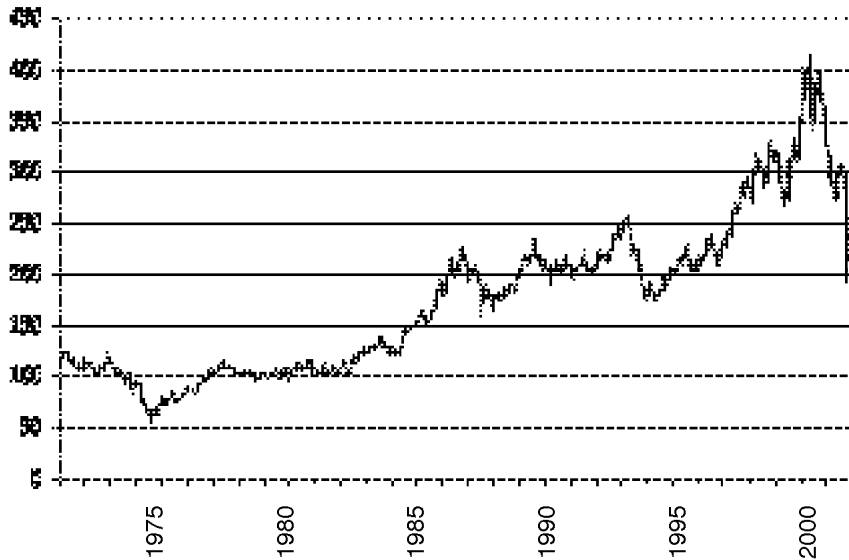
Today, the issue of stranded costs has faded somewhat as assets once thought to be vulnerable to market competition have retained their value. In particular, nuclear and large coal-fired power generation plants proved to be critical to the U.S. power system as demand soared during 2000-2001. The switch from stranded costs to stranded benefits also was due in part to high natural gas prices leading to high power prices.

Financial Performance of Utilities

Under regulated rates, the utility industry has traditionally been considered as a safe and reliable investment target. Many feared that the electric utility industry would experience negative financial impacts from the transition

Dow-Jones Averages for Utilities

1971 to 2002
(through Nov. 11, 2002)



to competition. Certainly, bond and equity markets discounted the utility sector on the basis of increased competition and the cost of transition. For example, the Moody's Investor Services estimate of stranded costs also noted that the industry's current equity was \$165 billion. This makes the low stranded cost estimate 60.6 percent of equity and the high estimate 181 percent of equity, a huge impact for utilities. Reflecting the uncertainties created by the introduction of competition, Standard & Poor's Corporation downgraded four public power entities and two public power projects (all in California) in 1996. In 1997 and 1998 more than 20 utilities were downgraded. After the California crisis and the collapse of Enron, more utilities as well as IPPs and power marketers were also downgraded. Enron's problems created the belief that most companies, especially trading/marketing firms and IPPs, have been carrying too much debt to finance power plants and/or their trading activities.

Nevertheless, revenues for the U.S. industry as a whole rose from \$198 billion in 1993 to \$233 billion in 2000. Historically, about 17 percent of total revenues has been retained as net operating income; about 14 percent has been

paid in taxes; and almost 60 percent has been used to cover operating and maintenance expenses.

As California's energy crisis and the immediate impact of the Enron's bankruptcy fade, many power companies are returning to more conservative growth and earnings forecasts. Some are reducing their dependence on volatile trading activities and they are diversifying, especially into natural gas. Integrated utility companies ap-

peared to be doing much better than IPPs in this new environment until recently. Increased scrutiny of debt loads incurred by utilities as they created and expanded their non-regulated businesses has led to growing credit problems for IOUs in Texas and across the U.S.

Issues in the Regulatory Process

The way in which we have regulated utilities in the U.S. has long been an issue. Texas has not been immune to the consequences of our particular regulatory system. Some opponents of retail choice want to maintain the utility as an entity that has a "public service obligation fulfilled with private sector efficiency." In the U.S. we have relied on regulators to serve as a substitute for competitive efficiency through rate regulation reviews of utility costs and by disallowing costs that are not prudent, necessary or efficient. With SB 7, Texas unbundled the integrated utilities. As a result, generation and retail have become competitive businesses that are not subject to rate regulation. Rates for access to the T&D network, though, remain regulated by the PUCT.

The traditional method of regulation has been "cost of service ratemaking" (already

mentioned in this chapter and in Part 4 - Regulations and Policies). To determine a utility's revenue requirements, PUCs must determine the "allowable" operating costs of a utility (e.g., maintenance and other operating costs) and the "capital related" charges. The latter is the "rate base" upon which a utility is allowed to recover depreciation, interest costs and the cost of capital associated with equity investments in transmission and distribution facilities. (Note that the FERC also has traditionally used cost of service ratemaking for interstate pipelines and electric utility transmission facilities.)

Most of the controversy over rates in rate hearings turns on which operating costs should be "allowed," which should be "disallowed" because they are unnecessary, which capital investments should be included in the rate base and what, in the end, the appropriate "fair rate of return" or "just and reasonable rate of return" on investment should be.

PUC hearings provide a framework for the regulatory process. PUCs may penalize a utility for incurring unnecessary operating costs or for making "inefficient" investments. While the rules governing these decisions may be vague and subject to controversy, PUCs across the U.S. follow very similar practices in evaluating the financial and accounting information that is reported by utilities.

One of the major criticisms levied against traditional cost of service or "cost plus" rate making is that it provides poor incentives for cost minimization, in particular because a bias may be created in favor of capital expenditures. Some have speculated that because utilities earn more revenue as the rate base grows, they have historically emphasized capital expenditures rather than more efficient ways of delivering services. Evidence of this is mixed.

An area that had been especially targeted in this regard is nuclear energy. Many controversies occurred in Texas over the inclusion of nuclear facility costs in utility rate bases and the extent to which customers should be charged. The PUCT conducted fully litigated prudence reviews of nuclear and other plant construction expenditures and, where appropriate, imprudent costs were disallowed, re-

sulting in recovery only of prudent expenditures in rates.

Cost of service rate making is in the process of changing as other methods of regulating utilities become more widely used and, of course, as it becomes limited to T&D service in restructured markets including Texas. In general, PUCs (and the FERC) are moving toward "market-based pricing" in regulatory decision making. Incentive rate making, price caps and other techniques are increasingly used as regulators strive to make utilities and their customers more responsive to market dynamics and encourage efficient use of resources.

In addition, with the restructuring of the industry, the PUCT no longer deals with the review of generation projects although new T&D facilities will still have to be subject to rate adjustments. But, as ERCOT will provide the guidelines for the type, capacity and location of new T&D facilities needed, the review of proposals for these projects should be more straightforward.

Another big issue has been rate design. Utilities typically have a large number of tariffs available to customers that fall into different size and voltage classes. Marginal costs to serve smaller customers (typically residential and commercial) are different when compared with other classes of customers. This reflects the fact that smaller customers take power at lower voltages, require costly low-voltage distribution investments and have low load factors. Marginal costs to serve very large customers tend to be low reflecting the fact that they take power at high voltages and have higher load factors. Increasingly, U.S. utilities are offering larger customers time-of-day rates and interruptible rates.

Because the marginal costs of providing electricity service to a variety of customers under a variety of conditions are different, there has been considerable debate about how regulators and utilities should set prices. The evidence on this is mixed. As electricity systems were built, it helped to have large volume customers on the system which allowed utilities to more easily and economically extend ser-

vice to smaller customers. This became more difficult to do as the U.S. industry has had to respond to global competition and as industrial customers came to enjoy many more electricity supply options.

In addition, regulators used to prefer pricing schemes to benefit small users that did not accurately reflect the cost of serving different size customers. This caused large users to pay rates larger than the marginal cost of serving them. This preference has played a role in pushing industrial users toward non-utility options for electricity. The gap between residential and industrial rates has grown over the years, reflecting a gradual move toward pricing electricity service to more accurately reflect the marginal cost of providing power to all customers as well as changing fundamentals in

the electric power industry.

Regulators, including those in Texas, strive to avoid price distortion subsidies. However, some price distortion is always possible (an artifact of regulation as a substitute for competition). With the start of retail choice at all customer levels, REPs are expected to provide competitive market prices, more reflective of marginal costs of serving each customer type, and hence remove potential price distortions. At the same time, the PUCT is relieved of the burden of designing rates for different customer types, and reviewing and monitoring these rates. In today's competitive market, the PUCT's most important task is to ensure that consumers are protected against potential market power practices.

Future Trends

What lies ahead for the electric power industry in Texas and the U.S.? If the recent past is prologue, then we can be assured that the industry will continue to become more competitive and that some changes will take place (perhaps extreme, perhaps not). Electricity will remain an important component of our daily lives, perhaps increasingly so as we move deeper into the Information Age. And there is sure to be conflict about how to best provide electricity to all users, how best to facilitate consumers' desires for choice and how to manage all of this while protecting the environmental and social values that are important to us.

We can strive to consider what the future will hold in today's decision making, but that is often not possible. Looking back at the historic changes in telecommunications, airlines, trucking, banking and natural gas, there are many things that could have been done differently. Perhaps the best we can do is to watch the key trends and try to anticipate the actions of today with the needs of tomorrow. Here are four key trends to watch in the electric power industry in Texas and the U.S.

Technology Changes

The electric power industry has often been criticized as a "low technology" industry, but nothing could be farther from the truth. In this document we have discussed a number of technologies that are vastly changing the way electricity is produced, delivered and priced. We have learned in the U.S. that we have an enormous capacity to research, develop and deploy new technologies that make our lives better and push our economy forward. Future expectations for electric power should be no different, but the outcomes may take a different form. Utility spending on R&D may be affected by increased competition, but new R&D arrangements are likely to emerge.

Texas' recently restructured electric power industry provides for one of the most advanced competitive electricity markets in the U.S. with even the smallest customers having

For more than 100 years, electricity has been developed and electric service provided using a public-private model of a regulated, private franchise monopoly. As we consider altering this model, what can we expect?

Technology will not remain static. New developments, encouraged by more competitive markets, will emerge to change how electricity is provided and change our lives as a result. Financial pressures will grow as competition increases, but creative solutions will arise to spur energy entrepreneurship.

The electric power industry is reorganizing in response to these trends, and this pattern will continue. The landscape for electric power probably will look very different in the future than it does even today or

Overview

did in the 1930s.

The changes evident in Texas and the U.S. today are taking hold around the world, creating challenges for many societies and economic opportunities for our own industries.

Since the early development of the electric power industry in the U.S., we have witnessed the power of society to adapt and move forward with new technologies. The central question today is whether we will lay the right policy groundwork for what the future holds. To do this, we all need to be as well informed as we can be.

the choice of their retail electricity providers. The restructuring bill in Texas (SB 7) calls for 2,000 megawatts of new renewable generation capacity to be added by January 1, 2009 - largest requirement to date by any state. Several hundred megawatts of new wind power capacity have already been built in West Texas. This environment is very conducive for Texas to become a center of innovation in energy technologies. In addition, the long history of the energy industry in the state created a sophisticated community of energy suppliers and users. The state also provides a favorable investment environment for startup businesses. Finally, organizations such as the Houston Technology Center, STARTech Foundation and The Austin Technology Incubator as well as the PUCT are working together towards the goal of establishing Texas as a national energy technology center.

New Generation Technologies

In addition to the advances in natural gas turbine design, new ways to achieve clean combustion of coal and fuel oil and improvements in alternative energy technologies, there are technologies on the horizon that may completely change the industry. Often discussed are fuel cells, which use electrochemical reac-

tions - like automotive batteries - to produce electricity. Auto manufacturers are aiming to have first models with these batteries available by 2005. Most promising are fuel cells that can use natural gas as feed stock for producing hydrogen. Fuel cells are smaller and modular and could be used to power individual buildings or neighborhoods with none of the noise and unsightliness of traditional generating stations. Fuel cells, improved solar technologies and other developments may lead to a "decentralizing" of electric power systems, allowing small scale applications and resolving many of the potential reliability problems that customers fear. HARC as well as others around the world are testing home fuel cell units.

Further into the future, economic nuclear fusion technologies may finally be achieved. Unlike nuclear fission, fusion is the combination of atoms to produce heat. Fusion is a long sought technology that holds tremendous promise of clean, renewable energy, if it can be achieved. Pebble-bed modular reactor (PBMR) technology (still based on fission), on the other hand, may yield its first commercial reactor by 2007. PBMR reactors are fuelled by several hundred thousand tennis-ball-sized spheres, known as pebbles, each of which contains thousands of tiny "kernels" the size of poppy seeds. As compared to pressurized-water reactor (PWR) technology used in more than half of the world's existing reactors, PBMR reactors are smaller and can be built faster. Proponents also argue that they are safer and cheaper. Both claims are challenged by critics.

Given the abundance of coal resources in the U.S. and the recent concerns about natural gas resource base and prices, there is an increasing interest in technologies that may help lower the emissions from coal-fired generation. Today, more than half of the nation's electricity is generated from coal, but many plants are nearing retirement. Older plants with higher emissions will need to be replaced. Neither renewable nor gas-fired generation may be sufficient to substitute for all of the coal-fired capacity. The development of clean coal technologies is one of the goals of President Bush's

National Energy Policy. The Department of Energy has been running a program on these technologies and there are an increasing number of utilities and generators who are looking into them.

Microturbines, solar power (either as large collector farms or photovoltaic cells on buildings), ocean power (using either the tidal currents of waves) are other technologies that are being watched closely by the investor community.

Many of these technologies discussed here are not new. All are dependent on favorable economic and market conditions. A benefit of competition is that it will accelerate introduction of new technologies.

Transmission, Distribution and Storage Technologies

As electricity travels over the transmission grid, much of it is lost (sometimes upwards of 10 percent). This is because the materials typically used in transmission wires can only withstand a certain amount of heat. New, superconducting materials may change that. At research centers around the world, including the Texas Center for Superconductivity at the University of Houston, scientists are developing new materials that can withstand levels of heat and stress beyond anything achievable with traditional metals. These materials, if they can be economically developed for applications like electricity transmission, will dramatically reduce the amount of electricity that must be generated and allow electricity to be efficiently transported over long distances. Experiments with short-distance high voltage lines that use superconducting materials have produced encouraging results.

For electricity to be more easily managed, new ways of handling electricity are needed that take advantage of superconducting materials and devices. One such technology is the use of superconducting devices for instantaneous management of electric power. Researchers the Houston Advanced Research Center have studied small superconducting switches and much larger superconducting energy storage devices for transmission en-

enhancement applications. HARC (with a private and public sector consortium and the State of Texas) has examined the technical and economic feasibility of applying these technologies to constraints in the Texas transmission system. Such devices would enable various power management services such as stability enhancement, increased transmission capacity, voltage and frequency control and other quality enhancements for a transmission company or utility.

In a recent conference on energy technologies held at the University of Houston by STARTech and Houston Technology Center, several participants, including investment bankers and venture capitalists, identified storage technologies as the "holy grail" of all energy technologies. In particular, flywheel technology seems to be most advanced. A Texas company, Active Power, developed the first commercially viable flywheel energy storage system and has distribution deals with companies such as Caterpillar, GE and Invensys.

Information Technologies

The sophistication of electronic information systems is one of the most important factors in the drive to restructure industries like natural gas pipelines and utilities and electricity transmission and utilities. These information systems have removed many of the barriers to common carriage by allowing real-time management of energy flows and exchanges.

Electronic bulletin boards and software systems required by the FERC for pipeline transportation and electricity transmission include information on capacities, prices, transactions and other variables. This information is necessary to facilitate a properly functioning marketplace. It also facilitates the development of "secondary" markets so that holders of excess capacity on pipelines or transmission grids can release or resell that capacity. This prevents many of the kinds of disruptions and shortages that have posed serious problems in the past.

Finally, the advent of information systems for natural gas and electricity has supported the growth and effectiveness of new busi-

nesses, independent third party marketers of gas and power. These companies - they may be entirely unaffiliated or they may be "nonjurisdictional" or unregulated affiliates of gas pipelines or gas or electric utilities - act as intermediaries in a complex marketplace. Using electronic information, they are able to package services and build flexible arrangements and contractual terms between suppliers of gas and electricity and end users.

The development of electronic information systems has been one of the most important factors in the re-conceptualization of what constitutes monopoly in gas or electricity service. These tools have enabled the separation of the commodities, gas and power, from the physical systems used to deliver them to customers. The result is that the scope of regulation can be narrowed to the physical systems, where before it applied to both the systems and the commodities (which were not commodities since there were not separate markets for the exchange of gas and electricity). This has been a critical step in the evolution of both the natural gas and electricity industries.

Financing

Technological change and adaptation need to keep up with changing consumer preferences in the type and delivery of energy systems. This will mean continued financial pressure on the electric power industry. Two areas are worth watching: how the industry will raise capital and how the industry and its customers will protect themselves against risk and uncertainty.

Capital Needs and Resources

Financial capital will continue to be required, especially for research and development on new energy technologies and for the new systems that will be necessary to manage electricity production and flows in a more competitive environment. Large companies and utilities will continue to draw from internal sources (cash flow) and be able to access national and world capital markets. But how will smaller, entrepreneurial enterprises compete for funding in a deregulated/restructured world, and

one in which government funds will be increasingly scarce?

One solution will be to access equities markets through public offerings. Energy related offerings have grown rapidly over the years, and the interest in technology-based enterprises should help to support a healthy capital market for energy entrepreneurs. Another solution will be capital provided by major companies seeking to enter niche markets with an eye to the future. Financial resources may be directed to start-up companies or large organizations may joint-venture to establish their own new product lines. Solar power has benefited already from these trends.

After the California crisis and the collapse of Enron, the issue of financing new generation plants has gained a new perspective. In the competitive environment, new generation capacity has been built mostly by IPPs (or NUGs) that usually did not have the same asset ownership as integrated utilities. As demand continued to increase in the 1990s and increased volatility in electricity prices provided decent returns for gas-fired peaking plants, these companies did not have any problems using project financing. Especially after the collapse of Enron, Wall Street analysts and rating agencies began to pay closer attention to these companies' balance sheets (as well as those of many other energy companies). IPPs, for the most part, were found to carry high debts with respect to their equity. As a result, credit ratings of some IPPs were downgraded to "junk" status. Companies are now restructuring and some will likely continue building power plants, but financing conditions in the future may be less favorable.

Small scale and rural energy needs in Texas could be financed using a familiar strategy, establishment of special utility districts. More than any other state, Texas has allowed the use of special districts to support development. Bond financing through these districts has typically provided for water and sewer infrastructure, but they could also be used for energy infrastructure. The economic crisis suffered by Texans after the 1986 crash in world oil prices caused many municipal utility dis-

tricts to go into default. However, the mechanisms subsequently put into place ensure better reporting and financial solvency.

Risk Management

When gas and electricity become commodities, they also become subject to considerable volatility in pricing. In the case of electricity, this is complicated by the diurnal or daily patterns of electricity use and the need for pricing to reflect fluctuations in demand and supply. Risk management has emerged as a powerful, though often not well understood, mechanism for managing volatility.

Risk management encompasses the array of financial instruments and the strategies used to implement them. Futures contracts, options, derivatives and swaps are some of the instruments that risk managers use. The basic principle is to separate the sources of risk in order to deal with them in a systematic way. For example, an electricity supplier or consumer who is concerned that the price today may be higher or lower than what it will be at some time in the future, an important source of risk, can enter the futures market to hedge against either possibility.

Risk management is not new. Ancient civilizations used futures contracts for grains and other traded goods. In the U.S., we have long had futures markets for agricultural commodities, minerals like copper and, since the early 1980s, oil. Natural gas and electricity are relative newcomers. As risk management instruments have become both more sophisticated and more complex, problems have arisen recently for both suppliers and customers, some so serious that firms experienced liquidity crises or bankruptcy. The issues, however, lie not with the instruments but when they tend to be used speculatively. Too often, firms attempt to use risk management instruments to supplement income generation rather than strategically to reduce exposure in commodities markets. For example, Enron's collapse is usually associated with the company's aggressive use of these instruments in their flagship trading operation and the aggressive accounting practices employed in recording the value of these

trades.

When risk management instruments are used correctly, however, they are a powerful and important tool for both suppliers and customers in more competitive energy markets. For example, the inability of California utilities to engage in long-term contracts forced them to buy continuously from the spot market in order to comply with their "obligation to serve." Combined with the retail rate freeze and hence the inability to pass on wholesale price fluctuations to customers, Pacific Gas & Electric had to file for bankruptcy and a state bail-out was needed to prevent Southern California Edison from doing the same. If the utilities were allowed to manage their price risk through long-term contracts (which is what the Department of Water Resources did for the state), these problems could have been avoided.

During the incredible summer 1998 heat wave, some electric power contracts soared to thousands of dollars per megawatt-hour. This event triggered a surge in defaults among independent power marketers, shut downs of trading risk management operations (including at least one large utility), and a great deal of worry among consumers, regulators, policy makers and some suppliers that this was a portent of what competitive markets would be like. However, after extensive investigations, it appears that a root cause was lack of transmission access that would have caused capacity shortages in key regions (especially the Midwest) to be resolved. The lesson - risk management practices for electric power need work, but they are no match for non-competitive bottlenecks.

Industry Reorganization

The previous sections capture another important trend in the U.S., and again Texas is not immune. The dramatic changes in technology and financial pressures stemming from competition are forcing a fundamental reordering of the utility industries. This is being manifest in the convergence of utility industries and resulting merger and acquisition activity as companies seek new strategic partnerships and

critical mass.

Convergence of Utility Industries: What Happened to the One-Stop Shop?

If a householder or business receives cable television, telephone and fax, data connection (the Internet), electricity, natural gas and water and sewer services then is it unlikely to think that one organization could supply any combination or all of these needs? That was the question driving strategic planning in the utilities industries as electric power restructuring unfolded. It came as utilities positioned themselves to grow in new directions and with new markets, as competition across industry lines increased, as consumer preferences (including the desire for convenience) changed and as providers sought to make the most of their infrastructure investments and billing and data processing capabilities.

One of the most important lines of convergence for Texas has been between natural gas and electricity. Changes in the U.S. electric power industry are likely to have profound consequences for natural gas suppliers, pipeline companies and marketers, all of which are important businesses for the Texas economy. At least for the foreseeable future, customers will continue to require both gas and electricity. Direct use of gas is more efficient for heating and may be also for cooling, but gas cannot drive a home computer (yet)!

Some of the rationale for convergence stems from industry trends. The first companies to enter the power marketing business were those that already had gas marketing expertise. Indeed, the electric power industry has gained much experience from natural gas firms although today we have retail choice in electricity but not yet in gas. Another important factor is that gas has been the fuel of choice for meeting most of the growth in electricity demand. This is due to the highly favorable cost for combined cycle units for new capacity additions. While low heat rate (high efficiency) combined cycle units are used for base load along with coal-fired and nuclear units, high heat rate (low efficiency) gas-fired steam plants supplied the peak load. As a result, the mar-

ginal cost of power has been closely related to the price of natural gas. It is also much easier and cheaper to turn a gas-fired plant on and off than a coal-fired plant. Daily use of gas by electric utilities fluctuates just as daily use of electricity does. And marketers can move gas and electricity interchangeably from one location to another, reducing price differentials across energy types and regions. Industry experts often refer to "gas by wire," meaning that customers can receive natural gas in the form of gas-fired electric power. Similarly, customers can receive "power by pipe," choosing to take gas directly. Lastly, as already noted, natural gas and electricity overlap at the end user level. A householder can, for instance, choose a natural gas clothes dryer or an electric one, and a single firm could profit from either decision whereas competing ones could not. While our future fuel mix for electricity will depend on relative fuel prices, many companies are gambling that gas will have a comparative advantage and are building strategies around the synergies between gas and electricity.

All of these complex forces led to the idea of a "one stop shop" for energy, or the "Btu store." Customers would be able to secure all of their energy needs, whether it is gas, coal, oil, electricity or an alternative, from one organization. The one stop shop would consolidate billing and marketing, creating many additional efficiencies. Companies pursuing this strategy believed that it would lead to a critical mass in the marketplace, allowing them to package many different kinds of customers in many different locations, generating revenues in multiple ways from the same assets.

Countering the idea of the one stop shop was the notion that as energy systems became more decentralized, niche markets would dominate. In this view of the future, large companies that offer many different services would not necessarily have an advantage over those that narrowly defined their scope and carefully targeted their customer audiences. These competing views of the future lent an extra set of challenges and another layer of complexity to electricity restructuring.

So where do things stand today? Most of the companies aggressively pursuing strategies to offer multiple products and services to end users have either postponed, dismantled or shelved their business concepts or the companies themselves were subsumed in mergers and acquisitions. Spanning the "last mile" to end users to combine energy and information proved to be more difficult and expensive than previously realized. The collapse of technology and telecommunications companies, the latter of which (along with many utilities and natural gas pipelines) had invested in a vast surplus of fiber optic cable capacity, has postponed indefinitely the concept of multiple products. Aggressive development of gas-fired power generation capacity has left surpluses (a good thing for end user prices) although retirement of old gas-fired units started to deplete the surplus. Financial constraints and scrutiny for the host of companies pursuing new business models has delayed innovation while these organizations work to improve financial reporting, deal with related issues and respond to increased regulatory oversight, and the potential for further exertion of regulatory authority.

Mergers, Acquisitions and Combinations

The efforts of companies to position themselves for the future led to merger and acquisition (M&A) activity beyond anything previously experienced in the utility industries. Investors once looked to the utilities for safe havens from stock market cycles and steady dividends as a consequence of the regulatory compact - that in exchange for their investments, utility companies were given an opportunity to earn a reasonable return. M&A activity changed investor perceptions and expectations on an almost daily basis. From 1992 to April 2000, 35 M&As were completed between IOUs or between IOUs and IPPs. Twelve additional mergers have been announced and are now pending stockholder or Federal and State government approval. The size of IOU mergers, in terms of value of assets, is also increasing. Between 1992 and 1998, only four mergers were completed in which the combined assets

of the companies in each merger were greater than \$10 billion. More recently, eight mergers completed in 1999 or 2000, or pending completion, each have combined assets greater than \$10 billion.

A second category of M&A activity includes electric utilities and natural gas companies. Increased competition pressured these entities to combine operations in order to become more efficient, to diversify products, to share expertise and experience in energy markets, and to take advantage of the growing use of gas-fired power plants. From 1997 through April 2000, 23 such mergers involving companies with assets valued at \$0.5 billion or higher have been completed or are pending completion.

In its Policy Statement for reviewing public utility mergers, the FERC demonstrated that it will more closely scrutinize the impact of mergers on competition in the wholesale electric market. While the Policy Statement narrows the focus of the FERC's inquiry, it increases antitrust review by adopting the analysis outlined in the Department of Justice/Federal Trade Commission's 1992 Horizontal Merger Guidelines. Using those Guidelines, the FERC will assess the increase in market concentration, requiring a hearing for those mergers exceeding certain thresholds. The Policy Statement, however, adopts the Guidelines' generic threshold levels rather than higher levels, suggested by many industry experts that are more appropriate for the electric utility industry. Accordingly, many mergers may not pass initial screening, at least as to some products during some time periods, and will be set for hearing. Apart from the FERC's authority, the focus of review will be at the state level. PUCs will likely face considerable activity from intervenors either opposed to or in favor of proposed M&As or combinations.

In states where the industry restructuring called for the unbundling of integrated utilities into generation, T&D and retail marketing companies, competitive pressures and new market realities are leading companies to look for ways to cut costs as well as gain competitive advantage. In this environment, in lieu of a full M&A or combination, firms may seek

strategic alliances, partnerships or joint ventures not only with traditional industry players but also with technology firms, marketing outfits and such that allow them to develop and market services. In any case, the corporate landscape has already changed considerably, and will continue to do so.

Globalization

While the changes in Texas and the U.S. may be overwhelming, we are not alone. Around the world, reliance on markets to provide energy services has been a growing trend. Companies in Texas and elsewhere in the U.S. have played a critical role in providing technology and financial capital as countries seek to liberalize energy markets and reduce government ownership and control of energy services. Our energy companies have discovered that their skills and expertise at home are transferable elsewhere, speeding the transition to internationalization.

The current, agonizing changes in the energy merchant businesses – wholesale trading and marketing and IPP activity – along with financial disruptions and setbacks in regions like South America where these companies have been active has introduced a new turn of events in international activity. Many U.S. companies recently have shut down their operations overseas and focused back on the U.S. markets, in part because they did not realize the gains they expected in the restructured markets of Latin America and Europe. In part, this is because these markets have become quite competitive, which put pressure on prices, and hence on returns. Another, larger factor has been the difficulty of building sustainable markets in countries where governments still retain heavy influence in their energy sectors.

Canada most closely parallels the U.S. experience. The two countries have moved in close unison, with Canada often in the lead to restructure the natural gas pipeline industry and encourage greater competition among natural gas utilities. Although in Canada natural gas reserves are considered provincial crown assets, in both countries exploration and production is carried out by many competing companies.

Recent Events Texas Companies

Credit rating issues impact the major IOUs' exposure as well as the "energy merchants" with total in the billions of dollars.

Reliant Energy separates into *Reliant Resources* and *CenterPoint Energy*.

Enron declares bankruptcy.

Enron's trading business acquired and subsequently downsized by *UBS Warburg*.

NewPower goes out of business.

AEP transfers two of its REPs (*WTU Retail Energy* and *CPL Retail Energy*) to *Centrica*.

Shell quits the retail market.

Other Events

PG&E declares bankruptcy.

National Grid Group (power-transmission) acquisition of *Lattice* (gas-pipeline) in UK.

E.ON (Germany) acquisition of *Powergen* (UK).

Exelon Corp. acquisition of *Sithe New England Holdings*.

Constellation Energy Group acquisition of *NewEnergy* from the *AES Corp.*

Future Trends

Canada and the U.S. comprise a common market for gas trade. Electricity trade already exists between the two countries and there are possibilities for this activity to increase. Canadians, watching U.S. electric power restructuring, began to mimic and again in some cases to lead the process. Alberta and Ontario have been the two most active provinces. Although Alberta appeared prone to experiencing problems similar to those of California in the early days of reform, its market is now fully functional.

Of great interest was how the huge provincial crown companies, Ontario Hydro and Hydro-Québec, would be treated with regard to the prospects for privatization. Ontario Hydro was broken up and mostly privatized after the restructuring of the sector in 1998. Its Hydro One Inc. subsidiary remained wholly-owned by the provincial government until recent efforts to privatize it. The Communications, Energy and Paperworkers Union of Canada and the Canadian Union of Public Employees stopped the sale of Hydro One in April 2002. The Ontario Superior Court of Justice ruled that the government does not have legal authority to relinquish public control of the corporation, by offering its shares for sale to private investors. In addition, price caps were placed on electricity prices in October 2002, essentially halting reform. There is little restructuring activity in Québec and Hydro-Québec remains a powerful integrated utility with significant exports to the U.S. and increasing activity worldwide.

Western Europe is moving in a similar direction taken by the U.S. and Canada. Britain actually has been much more aggressive in restructuring its electricity sector than we have in the U.S. But state ownership of utilities was common practice in Europe. This system had to be dismantled before other steps could be taken to introduce competition. The European Community (EC) has formulated directives to liberalize member country electricity markets, with a goal of achieving 30 percent of the market open to competition by independent power suppliers in ten years. The EC has also issued directives to liberalize natural gas markets. On

November 25, 2002, energy ministers from member countries announced that retail markets for electricity and gas will open by July 2007.

The issues in Western Europe include sensitivities to sovereign preferences (countries in which state-owned monopolies dominate electricity and natural gas service are trying to protect these enterprises) and concerns about energy security (Europe has been much more vulnerable to supply shocks than we have, energy prices are higher and domestic reserves of natural gas are not significant outside the North Sea). Many of the same consumer, environmental and financial issues that we see here prevail in Europe.

In emerging markets, the commitment to free market energy is much more variable and the results will be much more difficult to predict. In Latin America, Chile and Argentina have been the leaders in encouraging privatization and private investment in electricity and natural gas (as well as other economic sectors), while Mexico and Venezuela, characterized by their rich natural resource endowments, have moved more slowly and unevenly. Brazil, because of its size and population will be closely watched. Opportunities for wheeling electricity exist between the U.S. and Mexico, between Mexico and Central America and within the "Southern Cone," which includes Argentina, Chile, Brazil and smaller countries in the Mercosur free trade region. Economic collapse in Argentina in 2001-2002 and repercussions throughout the region have slowed both reforms and investment.

The story is similar in Asia, South Africa, Central and Eastern Europe and the Former Soviet Union. In all cases, much of the impetus for restructuring markets comes from general economic reforms, the need for private investment to build infrastructure and create jobs and the need to generate good will among the industrialized countries.

All emerging markets face similar constraints. Their economies traditionally have been highly centralized and dominated by government intervention and ownership. Corruption and poverty are pervasive. Prices tend

to be controlled by the governments so that distortions and inefficient use of energy are rampant. Political and financial instability remain a problem. Social backlash to reform initiatives is always a possibility as witnessed in Argentina and the myriad of market issues faced in the U.S. these past two years have had global repercussions. Nevertheless, in spite of these enormous constraints, even the most disadvantaged nations seem at least interested in trying to adapt to the prevailing trends. Almost surely, at some point in the future, countries that make the effort to embrace market principles and private sector participation in energy development will enjoy the payoff. Many countries from Eastern Europe to Southeast Asia continue with their restructuring efforts based on these expectations.

Conclusions

Is there a reason to be optimistic? The answer is a resounding "yes." Will change in the Texas and U.S. electric power industries be difficult? The answer is also "yes." However, if people are well-informed at all levels - suppliers, customers, policy makers, researchers - then we have a better chance of making the best decisions that we can.

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Basic Economic Principles

To understand the electric power industry in Texas, and the issues we face, it helps to be familiar with a few economic terms.

Market

The U.S. is a “mixed economy,” meaning that we depend on private markets for the provision of goods and services but with government involvement. A “market” is simply the free interaction between many buyers and sellers, exchanging information about price and cost. It can be a place, like the New York Stock Exchange or the Chicago Board of Trade. Or, a market may be more diffuse, encompassing many institutions and places as well as the rules that actors follow, like energy markets.

A market is like a bidding process where buyers disclose the amount they are willing to pay for a good or service while sellers disclose the amount they are willing to accept. This process is called “price discovery” and it is very important to the proper functioning of a marketplace. Adam Smith, generally regarded to be the father of modern economic thought, described the process of price discovery in *The Wealth of Nations*, published in 1776, to be like an “invisible hand.”

For markets to function properly, it is necessary to have “property rights,” meaning that there is a recognition of ownership, and legal and institutional protection for property rights. In this way, when buyers and sellers engage in contracts for the purchase and sale of goods or services, it is clear who owns the good or service, who is taking title to the good or service, that there are laws protecting the sanctity of the contract and that, if there were a dispute, the parties would be able to seek a fair remedy. Finally, for markets to function properly, resources — particularly labor and capital inputs exclusive of land — must be mobile with no or few barriers to mobility.

Marginal Cost

This is one of the most important criteria in guiding the behavior of firms and individuals in a properly functioning marketplace. Once a firm has accumulated all of the inputs necessary to produce a good or service — land, labor, machinery, etc. — the per-unit cost to produce a small increase of the good or service is the “marginal cost” faced by the firm. In a properly functioning marketplace, the price that buyers discover they must pay should equal the marginal cost faced by the seller. When that happens, the right information is being communicated and the market “clears,” that is, there is no shortage or surplus. In the utility industries, not all customers are the same. In addition, marginal costs vary in the short run and long run, by season and during the day (even minute-by-minute)

The marginal costs for utilities to serve residential customers are often higher than for customers that use larger volumes of electricity. Think of it this way. Let’s say that in order to add 10,000 kWh of residential load a utility company has to hook up 100 households. It has to spend more to do this (install more meters, set more billing services, etc.) than it does to add one new 10,000 kWh customer.

Economies of Scale

Some industries tend to be dominated by monopolies because of the technical nature of the industry. The utility industries — electricity, gas, telephone, water and sewer — are examples. Once a company has the transmission and distribution systems to bring electricity to customers, it is much cheaper (the marginal cost is much lower) for that company to add customers than for a competing company to build new, duplicate facilities and provide service to those same new customers. In other words, the existing utility company can add many more customers and generate much more output than the amount of new inputs that may be required. This is called “economies of scale.”

Economies of scale create “barriers to entry.” The high costs that new firms face to enter an industry relative to the sunk costs (costs that

cannot be recovered if the firm stops operating) that existing firms have already made are such that potential new entrants may be discouraged. Technology change can alter these relationships. For instance, electricity generation is no longer considered an activity with monopoly attributes. It is relatively easy for new competitors to enter the power generation industry. Advantages of high efficiency, new generation plants may outweigh benefits from existing generators that have some economies of scale.

Profit and Producer Surplus

All businesses desire to earn a “profit.” Profit is basically the difference between all costs faced by a firm and the revenue that the firm generates from sales. Producers face a minimum price at which they are willing to sell their goods or services. The market price is usually higher than the minimum, because of what consumers are willing to pay — competition among consumers “bids up” the price. The difference between what the producer is willing to take in order to at least break even and what consumers are willing to pay is called economic rent or “producer surplus.” It is a different concept than profit, because it takes into account the dynamics of a competitive marketplace.

Consumer Surplus

Likewise, consumers are willing to pay a price for a good or service that is generally more than what they actually end up paying in the marketplace. This is because competition among sellers “bids down” the market price. The difference between what consumers are willing to pay and what they actually pay is “consumer surplus.”

Market Failure and Welfare Loss

As discussed above, both producers and consumers have a surplus when the market clears, or is in equilibrium. “Welfare” for the society as a whole is equal to the sum of producer surplus and consumer surplus.

The equilibrium is efficient if the economy’s scarce resources are being used to yield the

largest possible value (or, lowest possible cost). Changes in market conditions, however, can shift the market to an inefficient equilibrium. Then, we have loss of welfare.

“Market failure” is a general term used to describe a wide range of reasons for the market to yield an inefficient equilibrium.

For example, sellers may accumulate too much power, with the ultimate situation being one of monopoly (only one seller). In this case, part of consumer surplus is transferred to the producers. Markets may also fail because buyers accumulate too much power, with the ultimate market power being the case of one buyer (monopsony). In this case, producer surplus is transferred to the consumers.

Alternatively, markets may fail because of “information asymmetries,” meaning that one side has more information than the other and can use that to an advantage.

There may be social costs of producing a good or service other than the private costs and these social costs may not be reflected in the market price. This is called an “externality,” and it is the typical situation for many environmental issues. For example, the social cost of air pollution in terms of health and safety effects are above and beyond the private cost associated with the activity that generates pollution, whether it is driving a car or operating a power plant.

Markets can fail because property rights break down or are impossible to determine. For example, how do we decide who owns the stock of fish in the world’s oceans? Or, how do we best manage the production of a natural resource like petroleum? These are called “common pool” problems because the boundaries are arbitrarily established.

When market failure happens, the prices that we see for goods and services are not what they would be if the market was functioning properly, and consequently we suffer a loss in social welfare.

Government Failure

When government steps in to regulate market failure, either real or perceived, this often creates a new and different set of problems,

sometimes worse than the market failure itself! This is called “government failure.” It happens because it is difficult, indeed impossible, for government to know what prices should be and how to correct the price distortions that arise from market failure.

Utility Regulation

Regulation is most often an attempt to recapture welfare loss (in this case, lost consumer surplus from monopoly provision of utility services) and transfer it back to consumers by substituting regulatory oversight for competition. However, this is a difficult thing to do. The tradition of utility regulation in the U.S. rests on the granting of franchise monopoly licenses, in recognition that economies of scale exist, and control of monopoly power via the allowed rate of return or profit that a utility can earn. In return for the opportunity to earn a just and reasonable rate of return, the utility is obligated to serve all customers within its franchise service area. In practice, utility regulation is very expensive because of the amount of time and cost incurred by utilities in supplying information and for regulators to evaluate the information and make a determination. In addition, regulation has often been used to generate welfare gains for specific groups of customers.

Contestability

Economists have learned that in industries characterized by monopoly there are intermediate solutions between a competitive marketplace, which may not be achievable because of the tendency for monopoly power to develop for technical reasons, and regulation of monopoly franchises. The most powerful idea is that of “contestability.” Simply put, monopoly power may be more constrained than it would appear to be because of the potential for competition to develop and for new entrants to contest the existing monopolist. Knowing that there is a potential for competition, the monopoly supplier may actually charge a price for the good or service that is close to the price that would be realized in a properly functioning, competitive marketplace.

In the utility industries, the idea of contestability is most easily put into practice where large users are concerned. Because of changes in technology that allow competing suppliers to emerge and the volumes that large users take, giving them some influence in the marketplace, competition can easily emerge. In the electric utility industry, this is the case with nonutility generators and the growing wholesale market for electricity. The notion of contestability has led to a new regulatory philosophy that the amount of market failure due to monopoly can be limited by reliance on competition everywhere possible, reducing the amount and cost of regulation to society.

Glossary

Affiliate

- a. An Entity who directly or indirectly owns or holds at least five percent of the voting securities of another Entity; or
- b. An Entity in a chain of successive ownership of at least five percent of the voting securities of another Entity; or
- c. An Entity that has at least five percent of its voting securities owned or controlled, directly or indirectly, by another Entity; or
- d. An Entity that has at least five percent of its voting securities owned or controlled, directly or indirectly, by an Entity who directly or indirectly owns or controls at least five percent of the voting securities of another Entity or an Entity in a chain of successive ownership of at least five percent of the voting securities of another Entity; or
- e. A person who is an officer or director of another entity or of a corporation in a chain of successive ownership of at least five percent of the voting securities of an Entity; or
- f. An Entity that actually exercises substantial influence or control over the policies and actions of another Entity; or
- g. Any other Entity determined by the PUCT to be an Affiliate;

Aggregator: A person joining two or more customers, other than municipalities and political subdivision corporations, into a single purchasing unit to negotiate the purchase of electricity from retail electric providers. Aggregators may not sell or take title to electricity. Retail electric providers are not aggregators.

Ancillary Services: Those services, described in Section 6 of the ERCOT Protocols, necessary to support the transmission of energy from Resources to Loads while maintaining reliable operation of transmission provider's transmission systems in accordance with Good Utility Practice. May include load regulation, spinning reserve, non-spinning reserve, replacement reserve and voltage support.

Annual Transmission Planning Report: A report prepared at least annually by ERCOT, as required by the PUCT rules, regarding the status of the ERCOT System including identification of ERCOT System existing and potential Congestion, which includes identification of current and recommended construction of Transmission Facilities.

Balanced Schedule: An Energy and Ancillary Service schedule submitted to ERCOT by a Qualified Scheduling Entity that consists of projected interval Obligations and projected interval Supply, and that includes Qualified

Scheduling Entity Obligations for Transmission and Distribution Losses. A Balanced Schedule must have aggregate Supply equal to aggregate Obligations, by Settlement Interval.

Balancing Energy: Balancing Energy represents the change in zonal energy output or demand determined by ERCOT to be needed to ensure secure operation of ERCOT Transmission Grid, and supplied by the ERCOT through deployment of bid Resources to meet Load variations not covered by Regulation Service.

Bilateral Contract: A direct contract between the power producer and user or broker outside of a centralized power pool or power exchange.

Btu (British Thermal Unit): A standard unit for measuring the quantity of heat energy equal to the quantity of heat required to raise the temperature of 1 pound of water by 1 degree Fahrenheit.

Bundled Utility Service: All generation, transmission, and distribution services provided by one entity for a single charge. This would include ancillary services and retail services.

Capacity: The amount of electric power delivered or required for which a generator, turbine, transformer, transmission circuit, station, or system is rated by the manufacturer.

Cogenerator: A generating facility that produces electricity and another form of useful thermal energy (such as heat or steam) used for industrial, commercial, heating, or cooling purposes. To receive status as a qualifying facility (QF) under the Public Utility Regulatory Policies Act (PURPA), the facility must produce electric energy and "another form of useful thermal energy through the sequential use of energy," and meet certain ownership, operating, and efficiency criteria established by the Federal Energy Regulatory Commission (FERC).

Combined Cycle: An electric generating technology in which electricity is produced from otherwise lost waste heat exiting from one more gas (combustion) turbines. The exiting heat is routed to a conventional boiler or to a heat recovery steam generator for utilization by a steam turbine in the production of electricity. This process increases the efficiency of the electric generating unit.

Commercially Significant Constraint (CSC): A constraint in the ERCOT Transmission Grid that is found, through the process described in Section 7 of the ERCOT Protocols, to result in Congestion which limits the free flow of energy within the ERCOT market to a commercially significant degree.

Competitive Retailer (CR): Municipally Owned Utility or an Electric Cooperative that offers Customer Choice and sells electric energy at retail in the restructured electric power market in Texas; or a Retail Electric Provider (REP) as defined in 25.5 of the PUCT Substantive rules.

Competitive Transition Charge: A non-bypassable charge levied on each customer of a distribution utility, including those who are served under contracts with non-utility

suppliers, for recovery of a utility's transition costs.

Congestion: The situation that exists when requests for power transfers across a Transmission Facility element or set of elements, when netted, exceed the transfer capability of such elements.

Congestion Zone: A grouping of busses that create a similar Shift Factor on CSCs.

Control Area: An electrical system, bound by interconnect (tie line) metering and telemetry, which continuously regulates, through automatic generation control, its generation and interchange schedules to match its system Load, regulates frequency, and meets all applicable Control Area requirements.

Direct Current Tie, DC Tie: Any non-synchronous transmission interconnections between ERCOT and non-ERCOT electric power systems.

Dispatch: The act of issuing Dispatch Instructions.

Dispatch Instruction(s): Specific command(s) issued by ERCOT to QSEs or TDSPs during the course of operating the ERCOT System.

Distribution Losses: The difference between the energy delivered to the Distribution System and the energy consumed by Loads connected to the Distribution System.

Distribution Service Provider: An Entity that owns and maintains a Distribution System for the delivery of energy from the ERCOT Transmission Grid to the Customer.

Distribution System: That portion of an electric delivery system operating at under 60 kilovolts (kV) that provides electric service to Customers or Wholesale Customers.

Divestiture: The stripping off of one utility function from the others by selling (spinning-off) or in some other way changing the ownership of the assets related to that function. Stripping off is most commonly associated with spinning-off generation assets so they are no longer owned by the shareholders that own the transmission and distribution assets.

Electric Cooperative

- a. A corporation organized under Chapter 161, Texas Utilities Code, or a predecessor statute to Chapter 161 and operating under that chapter;
- b. A corporation organized as an electric cooperative in a state other than Texas that has obtained a certificate of authority to conduct affairs in the State of Texas; or
- c. A successor to an electric cooperative created before June 1, 1999, in accordance with a conversion plan approved by a vote of the members of the electric cooperative, regardless of whether the successor later purchases, acquires, merges with, or consolidates with other electric cooperatives.

Electric Service Identifier (ESI ID): The basic identifier assigned to each Service Delivery Point used in the registration and settlement systems managed by ERCOT or another Independent Organization.

Emergency Electric Curtailment Plan: A plan which provides an orderly, predetermined procedure for maximizing use of available Resources and, only if necessary, curtailing demand during electric system emergencies while providing for the maximum possible continuity of service and maintaining the integrity of the ERCOT System.

ERCOT Region: The geographic area under the jurisdiction of the PUCT that is served by TDSPs that are not synchronously interconnected with electric utilities outside the state of Texas.

ERCOT System: The interconnected combination of generation, transmission, and distribution components in the ERCOT Region.

ERCOT System Load: The sum of all HVDC interconnections and Generation Resources metered at the point of its interconnection with the ERCOT System at any given point in time.

ERCOT Transmission Grid: All of those Transmission Facilities which are within the ERCOT Region.

Futures Market: Arrangement through a contract for the delivery of a commodity at a future time and at a price specified at the time of purchase. The price is based on an auction or market basis. This is a standardized, exchange-traded, and government regulated hedging mechanism.

Hedging Contracts: Contracts which establish future prices and quantities of electricity independent of the short-term market. Derivatives may be used for this purpose.

Independent Power Producers: Entities that are also considered nonutility power producers in the United States. These facilities are wholesale electricity producers that operate within the franchised service territories of host utilities and are usually authorized to sell at market-based rates. Unlike traditional electric utilities, Independent Power Producers do not possess transmission facilities or sell electricity in the retail market.

Load: The amount of electric power delivered at any specified point or points on a system.

Load Profile: A representation of the energy usage of a group of Customers, showing the demand variation on an hourly or sub-hourly basis.

Load Serving Entity: An Entity that provides electric service to Customers and Wholesale Customers. Load Serving Entities include Retail Electric Providers, Competitive Retailers, and Non-Opt In Entities that serve Load.

Market-Based Pricing: Electric service prices determined in an open market system of supply and demand under which the price is set solely by agreement as to what a buyer will pay and a seller will accept. Such prices could recover less or more than full costs, depending upon what the buyer and seller see as their relevant opportunities and risks.

Market Participant: An Entity that engages in any activity that is in whole or in part the subject of these Protocols, regardless of whether such Entity has executed an Agreement with ERCOT.

Market Segment: The Segments defined in Article 2 of the ERCOT Bylaws. The segments are:

- a. Independent REPs,
- b. Independent Generators,
- c. Independent Power Marketers,
- d. Investor Owned Utilities,
- e. Municipals,
- f. Cooperatives, and
- g. Consumers.

Merit Order: The ranking of Resources as a direct function of the monetary bid from those resources.

Metering Facilities: Revenue Quality Meters, instrument transformers, secondary circuitry, secondary devices, meter data servers, related communication Facilities and other related local equipment intended to supply ERCOT settlement quality data

Municipally Owned Utility (Muni): A utility owned, operated, and controlled by a municipality or by a nonprofit corporation, the directors of which are appointed by one or more municipalities.

Net Generation: Gross generation minus station auxiliaries or other internal unit power requirements metered at or adjusted to the point of interconnection at the Common Switchyard.

New Renewable Facilities: Renewable energy generators placed in service on or after September 1, 1999. A New Facility includes the incremental capacity and associated energy from an existing Renewable Facility through re-powering activities undertaken on or after September 1, 1999.

Non-Opt In Entity (NOIE): An Electric Cooperative or Municipally Owned Utility that does not offer Customer Choice.

Non-Spinning Reserve Service (NSRS): A service that is provided through utilization of the portion of off-line generation capacity capable of being synchronized and ramped to a specified output level within thirty (30) minutes (or Load that is capable of being interrupted within thirty (30) minutes) and that is capable of running (or being interrupted) at a specified output level for at least one (1) hour. Non-Spinning Reserve Service (NSRS) may also be provided from unloaded on-line capacity that meets the above response requirements and that is not participating in any other activity, including ERCOT markets, self-generation and other energy transactions.

North American Electric Reliability Council (NERC): The national organization that is responsible for establishing standards and policies for reliable electric system operations and planning, or its successor.

Obligation: Total Obligations scheduled by a QSE that are comprised of energy Obligations and Ancillary Services Obligations where:

- Energy Obligations = Load + losses + energy sales + energy exports; and
- Ancillary Services Obligations = ERCOT allocated An-

cillary Services Obligations (which may be self-arranged) + Ancillary Services sales (to ERCOT or to other QSEs)

Open Access: A regulatory mandate to allow others to use a utility's transmission and distribution facilities to move bulk power from one point to another on a nondiscriminatory basis for a cost-based fee.

Out of Merit Order (OOM): The selection of Resources for Ancillary Services that would otherwise not be selected to operate because of their place (or absence) in the bidding process for that service.

Outage: Removal of a Facility from service to perform maintenance, construction or repair on the Facility for a specified duration.

Parallel Path Flow: Electricity flows over transmission lines according to the laws of physics. As such, the power generated in one region may flow over the transmission lines of another region, inadvertently affecting the ability of the other region to move power.

Postage Stamp Allocation: The pro rata allocation of charges (or payments), which spreads to designated, Entities based on a pro rata share (of actual or estimated consumption).

Power Generation Company: An Entity registered by the PUCT that:

1. generates electricity that is intended to be sold at wholesale;
2. does not own a transmission or distribution Facility in this state other than an essential interconnecting Facility, a Facility not dedicated to public use, or a Facility otherwise excluded from the PURA definition of "electric utility"; and
3. does not have a certificated service area, although its affiliated electric utility or transmission and distribution utility may have a certificated service area.

Power Marketer: An Entity that:

1. Becomes an owner or controller of electric energy in this state for the purpose of buying and selling the electric energy at wholesale;
2. Does not own generation, transmission, or distribution Facilities in this state;
3. Does not have a certificated service area; and
4. Has been granted authority by the Federal Energy Regulatory Commission to sell electric energy at market-based rates or has registered as a power marketer.

Price-to-Beat (PTB): The bundled rate a Retail Electric Provider that is affiliated with an Entity required to unbundle its electric services, and offer Customer Choice, must charge to residential and small commercial Customers upon initiation of Customer Choice, as further described in Section 39.202 of PURA and PUCT rules.

Provider of Last Resort (POLR): The designated Competitive Retailer as defined in the PUCT Substantive Rules for default Customer service, and as further described in Section 15.1, Customer Switch of Competitive Retailer.

Pumped Storage Hydroelectric Plant: A plant that usu-

ally generates electric energy during peak-load periods by using water previously pumped into an elevated storage reservoir during off-peak periods when excess generating capacity is available to do so. When additional generating capacity is needed, the water can be released from the reservoir through a conduit to turbine generators located in a power plant at a lower level.

Qualified Scheduling Entity (QSE): A Market Participant that is qualified by ERCOT in accordance with Section 16, Qualification of Qualified Scheduling Entities and Registration of Market Participants, to submit Balanced Schedules and Ancillary Services bids and settle payments with ERCOT.

Rate Base: The value of property upon which a utility is permitted to earn a specified rate of return as established by a regulatory authority. The rate base generally represents the value of property used by the utility in providing service and may be calculated by any one or a combination of the following accounting methods: fair value, prudent investment, reproduction cost, or original cost. Depending on which method is used, the rate base includes cash, working capital, materials and supplies, and deductions for accumulated provisions for depreciation, contributions in aid of construction, customer advances for construction, accumulated deferred income taxes, and accumulated deferred investment tax credits.

Reactive Power: The product of voltage and the out-of-phase component of alternating current. Reactive Power, usually measured in megavolt-amperes reactive, is produced by capacitors, overexcited generators and other capacitive devices and is absorbed by reactors, underexcited generators and other inductive devices.

REC Program: The Renewable Energy Credit trading program, as described in Section 14, Renewable Energy Credit Trading Program, and PUCT Subst. R. 25.173.

Replacement Reserve Service: A service that is procured from Generation Resource units planned to be off-line and Load acting as a Resource that are available for interruption during the period of requirement.

Resource: Facilities or Load capable of providing or reducing the need for electrical energy or providing Ancillary Services to the ERCOT System, as described in Section 6, Ancillary Services. This includes Generation Resources and Loads acting as Resources.

Resource Plan: A plan provided by a QSE to ERCOT indicating the forecast state of Generation Resources or individual Loads each acting as a Resource, including information on availability, limits and forecast generation or Load of each Resource.

Responsive Reserve Service: Responsive Reserve consists of the daily operating reserves that are intended to help restore the frequency of the interconnected transmission system within the first few minutes of an event that causes a significant deviation from the standard frequency.

Retail Electric Provider (REP): A person that sells electric energy to retail Customers in this state. As provided in PURA §31.002(17), a Retail Electric Provider may not own or operate generation assets. As provided in PURA

§39.353(b), a Retail Electric Provider is not an Aggregator.

Scheduling Process: The process through which schedules for energy and Ancillary Services are submitted by QSEs to ERCOT as further described in Section 4, Scheduling.

Settlement Interval: The time period for which a Market Service is deployed and financially settled. For example, the currently defined settlement interval for the Balancing Energy Market Service is 15 minutes.

Settlement Meter: Generation and end-use consumption meters used for allocation of ERCOT charges and wholesale and retail settlements.

Spinning Reserve: That reserve generating capacity running at zero load and synchronized to the electric system.

Stranded Benefits: Benefits associated with regulated retail electric service which may be at risk under open market retail competition. Examples are conservation programs, fuel diversity, reliability of supply, and tax revenues based on utility revenues.

Stranded Costs: Prudent costs incurred by a utility which may not be recoverable under market-based retail competition. Examples are undepreciated generating facilities, deferred costs, and long-term contract costs.

Supply: Total supply scheduled by a QSE that is comprised of Energy Supply and Ancillary Services Supply where:

- Energy Supply = Resources + energy purchases + energy imports; and
- Ancillary Services Supply = Resources + Ancillary Services purchases (including purchases through ERCOT) + Ancillary Services imports

System Benefit Fund: The fund established by the PUCT to provide funding for Customer education programs, programs to assist low-income electric Customers; and the property tax replacement mechanism provided by Section 39.601 of PURA.

System Congestion Fund: ERCOT's accounting fund from which payments for resolving Congestion are disbursed and to which ERCOT credits Congestion-related receipts from QSE's representing Loads.

System Operator: An Entity supervising the collective Transmission Facilities of a power region that is charged with coordination of market transactions, system-wide transmission planning, and network reliability.

TDSP Metered Entity: Any Entity that meets the requirements of Section 10.2.2, TDSP Metered Entities.

Technical Advisory Committee: A subcommittee in the ERCOT governance structure reporting to the Board of Directors as defined by the ERCOT bylaws.

Total Energy Obligation: The total energy Obligation for a Qualified Scheduling Entity during a Settlement Interval, including the energy from the Balanced Schedule and integrated energy of instructed Ancillary Services.

Total Transmission Capacity: The maximum power that

may be transferred across a transmission corridor while maintaining reliability of the ERCOT System.

Transmission Access Service: Use of the TDSP's Transmission Facilities for which the TDSP is allowed to charge for the use through tariff rates approved by the PUCT.

Transmission Congestion Right (TCR): A financial hedge against the cost of 1 MW flowing across a particular Commercially Significant Constraint, in a single direction, for 1 hour.

Transmission and/or Distribution Service Provider (TDSP): An Entity that owns or operates for compensation in this state equipment or Facilities to transmit and/or distribute electricity, and whose rates for Transmission Service, distribution service, or both is set by a Governmental Authority.

Transmission Facilities: The following Facilities are deemed to be Transmission Facilities:

1. Power lines, substation, and associated Facilities, operated at 60 kV or above, including radial lines operated at or above 60 kV.
2. Substation Facilities on the high side of the transformer, in a substation where power is transformed from a voltage higher than 60 kV to a voltage lower than 60 kV or is transformed from a voltage lower than 60 kV to a voltage higher than 60 kV.
3. The direct current interconnections with the Southwest Power Pool (SPP), Western System Coordinating Council (WSCC), Comision Federal de Electricidad, or other interconnections.

Transmission Losses: Difference between energy input into the ERCOT Transmission Grid and the energy taken out of the ERCOT Transmission Grid.

Transmission Service Provider: An Entity under the jurisdiction of the PUCT that owns or operates Transmission Facilities used for the transmission of electricity and provides transmission service in the ERCOT Transmission Grid.

Wholesale Customers: Non-Opt-in entities receiving service at wholesale points of delivery from an LSE other than themselves.

Zonal Congestion: Congestion that can be resolved by deployment of Balancing Energy Services by Congestion Zones, including CSCs and any Operational Constraints underlying or essentially parallel to CSCs.

This glossary is based on glossaries available at www.ercot.com and www.eia.doe.gov. For more definitions, please refer to these sites.

- Andrews, Clinton J., editor. 1995. *Regulating Regional Power Systems*. Westport, Conn: Quorum Books.
- Bradley, Robert L., Jr. 1996. The Origins of Political Electricity: Market Failure of Political Opportunism? *Energy Law Journal* 17: 59-102.
- Brennan, Timothy J., et al. 1996. *A Shock to the System: Restructuring America's Electricity Industry*. Washington, D.C.: Resources for the Future.
- Dismukes, David, Allan Pulsipher and Kimberly Dismukes. March 1996. *Restructuring the Electric Utility Industry: Implications for Louisiana: Phase I: Background and Overview*. Baton Rouge, Louisiana: Center for Energy Studies, Louisiana State University.
- Enholm, Gregory B. and J. Robert Malko. 1995. *Reinventing Electric Utility Regulation*, Vienna, Virginia: Public Utilities Reports, Inc.
- Energy Information Administration. March 2002. *Inventory of Electric Utility Power Plants in the U.S. 2000*.
- Energy Information Administration. January 2002. *Electric Sales and Revenue 2000*. Washington, D.C.: U.S. Department of Energy.
- Energy Information Administration. December 2001. *Annual Energy Outlook 2002*. Washington, D.C.: U.S. Department of Energy.
- Energy Information Administration. August 2001. *Electric Power Annual 2000, Volume I*, Washington, D.C.: U.S. Department of Energy.
- Energy Information Administration. October 2000. *The Changing Structure of the Electric Power Industry 2000: An Update*. Washington, D.C.: U.S. Department of Energy.
- Energy Information Administration. 1995. *Performance Issues for a Changing Electric Power Industry*.
- ERCOT. February 22, 2001. *The Market Guide*.
- ERCOT. circa 1990. *ERCOT: The Texas Connection for Reliable Electricity*. Austin, Texas: ERCOT.
- ERCOT. September 1993. *The ERCOT Bulk Electric System: What It Is and How It Works*. Austin, Texas: ERCOT.
- Flavin, Christopher and Nicholas Lensen. 1994. *Power Surge*. New York: W. W. Norton & Company, Inc.
- Foss, Michelle Michot and Gürcan Gülen. Summer 2001. *Electricity Industry Restructuring in Texas: A White Paper* (available at www.powertochoose.org).
- Foss, Michelle Michot. September 17, 1996. *Energy Utility Deregulation: Implications for Customers*. Presentation to Federal Reserve Bank Facilities Managers Conference. Richmond, Virginia.
- Foss, Michelle Michot, Pratt, Joseph A., Conine, Gary, Stone, Allen and Robert Keller. May 1998. *North American Energy Integration: The Prospects for Regulatory Coordination and Seamless Cross-Border Transactions of Natural Gas and Electricity*. IELE White Paper.
- Foss, Michelle Michot. Unpublished manuscript. *U.S. Natural Gas in the 21st Century: Adjusting to the New Reality*. University of Houston, dissertation.
- Fuldner, Arthur H. 1996. *Upgrading Transmission Capacity for Wholesale Electric Power Trade*, Worldwide Web: <http://www.eia.doe.gov/cneaf/pubs_html/feat_trans_capacity/w_sale.html>
- Gee, Robert W. and Kenton C. Grant. 1995. Regulation in the Lone Star State, from *Reinventing Electric Utility Regulation* by Enholm and Malko. Vienna, Virginia: Public Utilities Reports, Inc., 273-285

Further Readings

- Gervais, Marc . July 1993. *Electricity Supply and Demand into the 21st Century*. Washington, D.C.: U.S. Council for Energy Awareness.
- Gülen, Gürcan and Michelle Michot Foss. Forthcoming. *Electricity Restructuring in the U.S. A Status Report*. IELE White Paper.
- Gülen, Gürcan. October 2002. *A Comparative Look at Capacity Schemes*. IELE Working Paper, presented at the 2002 USAEE Conference in Vancouver.
- Gülen, Gürcan. June 2002. *Demand Side Response and Dynamic Pricing*. IELE Working Paper. Versions published in the Proceedings for the 2002 IAEE International Conference in Aberdeen and USAEE Dialogue.
- Gülen, Gürcan and Michelle Michot Foss. June 2002. *Mean Reversion and Volatility in Energy Prices: Implications for Policy*. IELE Working Paper, presented at the 2002 IAEE International Conference in Aberdeen.
- Hoecker, James J. October 4, 1994. *New Directions for the Electric Industry: A View of Emerging Competition*. Presentation to the Edison Electric Institute and Western Coal Council (St. Louis).
- Hoffman, Matthew. 1994. The Future of Electricity Provision. *Regulation* 1994(3): 55-62.
- Hogan, William. May 2000. *Regional Transmission Organizations: Millenium Order on Designing Market Institutions for Electricity Network Systems*. Working Paper. Harvard Electricity Policy Group.
- Hogan, William. November 17, 1994. *Reshaping the Electricity Industry*. Presentation to the Federal Energy Bar Conference (Washington, D.C.).
- Joskow, Paul L. and Richard Schmalensee. 1983. *Markets for Power*. The MIT Press: Cambridge, Mass.
- Joskow, Paul. 1994. *Competition in the U.S. Electric Power Sector: Some Recent Developments*. MIT, Center for Energy and Environmental Policy Working Paper 94-008. October.
- Kozloff , Keith Lee and Roger C. Dower. December 1993. *A New Power Base: Renewable Energy Policies for the Nineties and Beyond*. Washington, D.C.: World Resources Institute.
- Lower Colorado River authority. 1995. *Electricity 101*, Austin, Texas: LCRA.
- Adib, Parviz and Candice Clark. August 1996. *Regulatory Reform, Texas Style: The Electric and Telecommunications Industries*. Texas Business Review, University of Texas Bureau of Business Research.
- Public Utility Commission of Texas. June 18, 2002. Presentation to the Electric Utility Restructuring Legislative Oversight Committee.
- Public Utility Commission of Texas, Market Oversight Division. December 2000. Project No. 22209. *2000 Annual Update of Generating Utility Data*.
- Southern States Energy Board. April 1996. *Emerging Competitive Issues Relating to the U.S. Electric Utility Industry: A Primer*.
- Texas Comptroller of Public Accounts. December 1996. *Deregulation Sparks: Electric industry faces overhaul in new era of competition*. *Fiscal Notes*. Austin, Texas.
- Texas Sustainable Energy Development Council. August 1995. *Texas Energy for a New Century*. Austin, Texas: Texas Sustainable Energy Development Council.
- Texas Legislature. May 1999. Senate Bill 7.
- TU Electric. undated. *The Pathway of Power*.
- U.S. Federal Energy Regulatory Commission. April 24, 1996. *Fact Sheet: Electric Utility Restructuring*.

Virtus Energy Research Associates. July 1995. *Texas Renewable Energy Resource Assessment*. Austin, Texas: Texas Sustainable Energy Development Council.

Vogel, Carole. April 18, 1996. *Texas Transmission Access and Pricing Rules*. Presentation for the Natural Gas Association of Houston. Houston, Texas.

Vu, Mia. December 12, 1996. *Convergence of Gas and Electricity Markets*. Presentation to the International Association for Energy Economics-Houston Chapter (Houston).

WEB SITES:

www.powertochoose.org

www.puc.state.tx.us

www.ercot.com

www.ferc.gov

www.eia.doe.gov

www.epa.gov

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