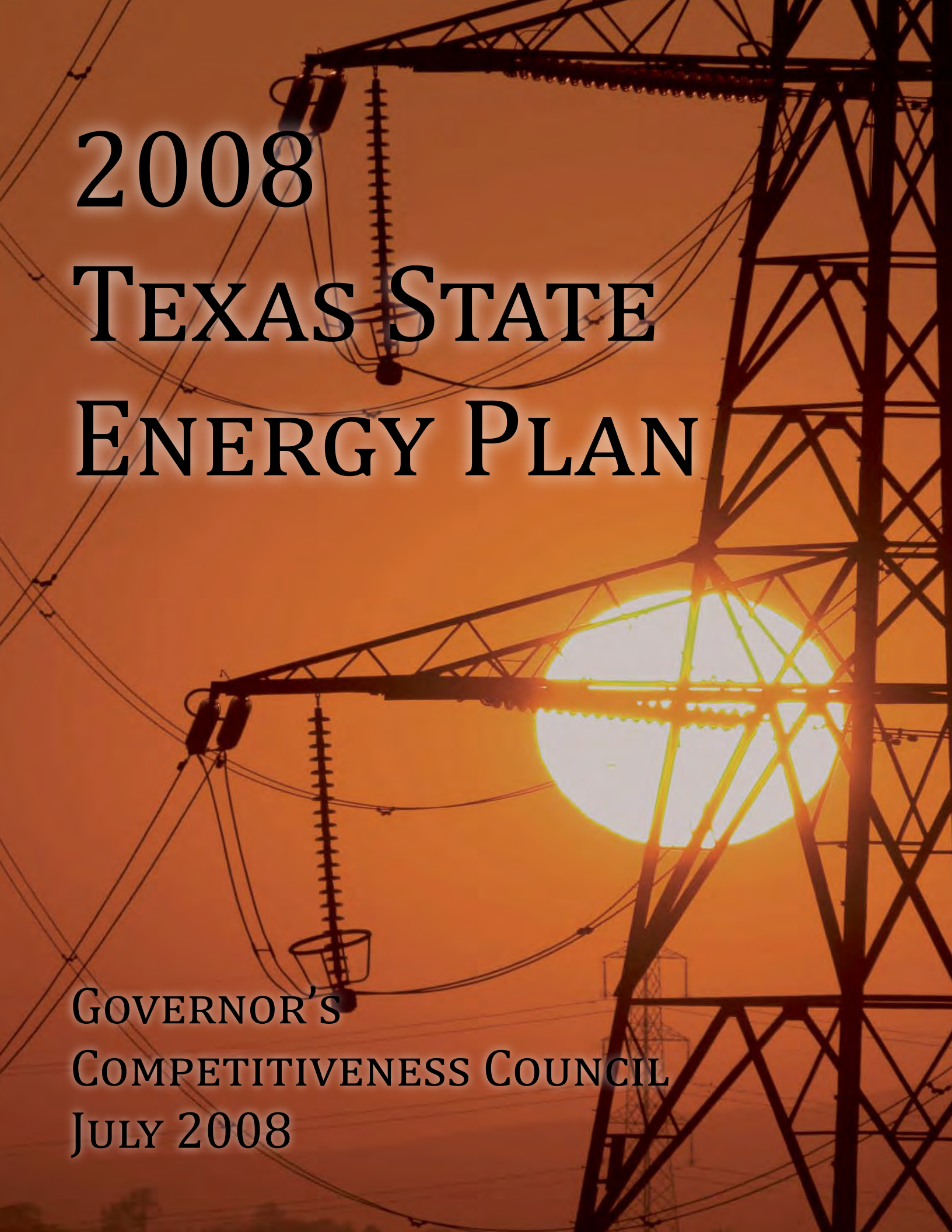

2008 Texas State Energy Plan

Governor's Competitiveness Council

July 2008

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ACRONYM/ ABBREVIATION	TERM
ACEEE	American Council for an Energy Efficient Economy
CCN	Certificate of Convenience and Necessity
CCS	Carbon Capture & Storage
CREZ	Competitive Renewable Energy Zones
DR	Demand Reduction
DSM	Demand-Side Management
EE	Energy Efficiency
EILS	Emergency Interruptible Load Service
EOR	Enhanced Oil Recovery
ERCOT	Electric Reliability Council of Texas
KSAs	Knowledge, skills, and abilities
NRC	Nuclear Regulatory Commission
PGC	Power Generation Company
PUC	Public Utility Commission
PURA	Public Utility Regulatory Act
PV	Photo-voltaic
QAP	Qualified Allocation Plan
REP	Retail Electric Provider
RPS	Renewable Portfolio Standard
RRC	Railroad Commission of Texas
SBF	Systems Benefit Fund
SERC	Southeastern Electric Reliability Council
SPP	Southwest Power Pool
SPS	Southwestern Public Service Company
STEM	Science, Technology, Engineering, and Math
SWEPCO	Southwestern Electric Power Company
TCEQ	Texas Commission on Environmental Quality
TDU	Transmission and Distribution Utility
TEA	Texas Education Agency
TEF	Texas Enterprise Fund
THECB	Texas Higher Education Coordinating Board
THSP	Texas High School Project
TWIC	Texas Workforce Investment Council
TWC	Texas Workforce Commission
WECC	Western Electricity Coordinating Council

Texas routinely tops the list of the best places to live and work, and the business climate in Texas is consistently ranked the best in America. Texas is home to more Fortune 500 companies than any other state, is the number one exporting state in the country, and continues to have an economy that outpaces the rest of the nation. Texas welcomes the entrepreneurial spirit and recognizes businesses that build, relocate, or expand in Texas bring jobs and prosperity to all Texans.

In November 2007, Governor Rick Perry established the Governor's Competitiveness Council by appointing 29 public and private sector leaders, and charged them to identify issues affecting Texas' competitiveness in the global marketplace and to make recommendations for how Texas can continue to achieve long-term sustained economic success. As noted by Governor Perry when he established the Council:

> *To remain competitive in the 21st Century global economy, Texas must create a seamless system of opportunity and innovation, starting when young Texans enter grade school and continuing until they graduate from college, qualified for jobs that will keep our state at the forefront of the global market.*

Because of the attractive business climate, the quality of life, and the immense opportunities offered to Texans, Texas' labor force is growing twice as fast as the nation as a whole. The population of the state is also expected to double by 2050.

This robust economic environment and population growth brings with it an increase in demand and the challenge of meeting the energy needs of the state. Due to global market demand, the costs of all forms of energy (including natural gas, electricity, and gasoline) have increased dramatically in the past several years, and Texans have had to dedicate a growing portion of their household income toward these increased costs. Texas companies, competing in the global marketplace, also need adequate, reliable, and reasonably priced energy. Without access to such energy, the economic prosperity of Texas and its citizens is threatened.

Texas is at a crossroads in planning its energy future. This Energy Plan proposes a road map to guide Texas toward a future with a reliable energy supply that is balanced and competitively priced. It further proposes to give residential customers the tools they need to better manage their energy consumption.

The fuel mix used to generate electricity in Texas is heavily weighted toward natural gas. Texas producers are doing their part to meet this increased demand. They have invested billions of dollars to produce more natural gas. The Barnett Shale gas field alone is generating thousands of jobs and tens of billions of dollars in investment. Even with this increased investment by Texas producers, North American demand still far outpaces supply, resulting in higher prices for this critical commodity.

Texas' heavy reliance on natural gas has resulted in significantly increased electricity costs. Texas' competitive wholesale market is responding to these factors by attempting to provide a diverse mix of new generation. Yet, in order to reduce the impact of natural gas on Texas electric rates, a substantial amount of new non-gas baseload generation (as much as 25,000 megawatts) is needed. However, because of the pending threat that federal legislation will extort heavy penalties on companies that generate electricity with conventional coal technology, generation companies are increasingly reluctant to invest in new conventional coal-fired power plants at the scale necessary to positively impact power prices.

Texas has established a strong, competitive electric market. All future changes to the current structure should be evaluated against the following core principles:

- State policy should continue to focus on providing reliable, competitively priced electric service to all customers by strengthening the competitive marketplace, by removing artificial barriers to competition, and by providing legal and regulatory stability within that market.
- State policy should not artificially impede investment in the electric sector by private companies. Doing so will hinder the development and adoption of new technologies.
- In enacting the recommendations in this plan, or in any proposed legislative or regulatory change, the state should be mindful of the costs such a change will impose on all residential, commercial, and industrial customers.
- State policy should continue to recognize that residential electric customers need to be educated in order to make informed decisions about their energy purchasing needs.
- State policy should recognize that a growing energy demand can be met either by increasing power generation, by encouraging energy efficiency and customer demand-response, or by a combination of both.
- The state should not create new mandates for any particular generation technology, as poorly crafted subsidies can have far-reaching and unintended consequences that may result in higher costs to consumers.
- Financial assistance from the state in the form of tax incentives or innovation prizes, however, may at times be appropriate to help lower barriers to new technologies that are not yet commercially viable, but such assistance should be limited in scope and duration with a defined, known cost to taxpayers.
- ERCOT, under the direction of the PUC, should continue to oversee the management of the grid and provide the basic transmission infrastructure necessary for competition in the power generation and retail electricity markets to flourish. With regard to wind related transmission, the PUC should continue to be responsible for devising and implementing a cost-effective plan that maintains reliability as soon as possible.
- The state should ensure that market abuse and manipulation are not tolerated.
- The state should guarantee that the electric grid is secure and redundant to the extent necessary to maintain reliability.
- The state should ensure that the K-12 and higher education systems meet the workforce needs of a growing Texas energy market.

This plan approaches the challenges Texas companies and customers are facing with energy in a multifaceted way. It seeks to remove any barriers in the competitive market that prevent sound economic decisions. At the same time, it creates incentives to encourage the deployment of renewable or clean energy. It also recognizes the increasingly important role that energy efficiency demand-response will play in reducing the amount of energy used.

In all, this plan provides 37 recommendations to remove barriers to facilitate the market solutions and innovation that Texas will need to address the significant challenge of providing the energy needed to fuel Texas' vibrant economy. These recommendations are:

Wholesale Market Recommendations:

- ✓ Recommendation 1: Recognizing that the combination of incentives and competitive market forces in place in Texas resulted in more rapid investment in wind energy than in any other state, Texas should promote the competitive marketplace by neither increasing nor removing the mandates for renewable energy.
- ✓ Recommendation 2: The Legislature should repeal the presumption in PURA in favor of gas-fired plants in order to ensure that a diverse mix of resources is developed in Texas.
- ✓ Recommendation 3: Texas should not institute any new power plant permitting processes, as this would insert costly delay, erect barriers to entry, and eliminate the ability for Texas' competitive marketplace to respond quickly to changing market signals. Legal and regulatory certainty is critical for the competitive marketplace to function. Numerous states have lengthy and costly permitting processes for wind, and gas- and coal-fired generation; Texas has avoided this by permitting only emission and water aspects of generation plants.
- ✓ Recommendation 4: To encourage the development of nuclear power in Texas, the TCEQ should expedite necessary water and wastewater permits associated with new nuclear power plants. While all design and site permits reside with the Nuclear Regulatory Commission, ensuring that these state permits do not delay development is critical.
- ✓ Recommendation 5: The state should establish a partnership between institutions of higher education and industry to research opportunities regarding the entire nuclear fuel cycle, including recycling spent fuel. France obtains 75 to 80 percent of its electric power from nuclear generation facilities, but in the United States, continued uncertainty about nuclear waste disposal remains an ongoing uncertainty for nuclear plant developers, and exploring possibilities to recycle spent nuclear fuel may help resolve this issue.
- ✓ Recommendation 6: The state should establish an innovation prize or prizes, funded with private-public revenue, for the commercialization of large-scale energy storage.
- ✓ Recommendation 7: The PUC and ERCOT should study whether an additional operating reserve service to help manage the intermittency of wind energy or other alternative energy sources would be a cost-effective solution to more reliably integrating these energy resources to the grid. Such a service could be provided by quick-start natural gas units, demand-response by customers, or storage solutions.
- ✓ Recommendation 8: To encourage development of new solar energy, the Texas Department of Housing and Community Affairs should amend their Low Income Housing Tax Credit Application QAP to offer additional points to applicants who install alternative energy sources including solar panels, solar water heaters, or other solar products in their developments.
- ✓ Recommendation 9: The state should provide a sales tax exemption for the purchase and installation of solar generation systems.
- ✓ Recommendation 10: State policy makers should bring a Texas perspective to federal carbon policy debates. Texas needs to participate actively in the carbon discussion and educate Washington decision makers on the economic value of Texas' energy production to the nation.

- ✓ Recommendation 11: Americans will bear significant costs, and Texans will bear a disproportionate share of that cost, should the federal government decide to impose draconian, costly carbon regulation. Retail customers should be further educated on electric competition, efficiency, and the costs and benefits of fuel mix choices. The state should form a private-public partnership among industrial and large commercial energy customers, petroleum and generation companies, chambers of commerce, the PUC, the TCEQ and the RRC to educate the public on the cost of carbon regulation to Texans. This partnership should inform its work by conducting a study highlighting the cost of carbon regulation versus environmental benefits to Texans.
- ✓ Recommendation 12: In order to incent the development of clean coal technology, the state should create a state innovation prize, funded with private-public revenue, for the large-scale deployment of a mine mouth clean coal generating facility that uses Texas lignite as its primary fuel and captures nearly all carbon emission for storage underground or use in enhanced oil recovery or other market driven beneficial use.
- ✓ Recommendation 13: The state should provide a five-year sales tax exemption for the equipment used to capture and store carbon dioxide from facilities that use Texas lignite as a fuel source.
- ✓ Recommendation 14: Texas should identify and resolve barriers to accelerating development of in-state natural gas assets, including Barnett and other shale assets. Issues related to the proximity of the Barnett shale to major metropolitan areas and transport of gas from the region to markets must be considered. Texas should also explore and develop partnerships with other jurisdictions to gain access to potentially undervalued resources. As part of this exploration and development, Texas should address the federal ban on accessing all onshore and offshore resources.

Transmission and Distribution Recommendations:

- ✓ Recommendation 15: In order to proactively address the addition of significant wind capacity, the PUC should expeditiously conclude the CREZ proceeding, select a transmission plan, and issue needed CCNs for CREZ transmission lines. The current transmission development schedule may not allow for construction to commence before the third or fourth quarter of 2009. The PUC should rapidly complete the remaining tasks so transmission construction can begin in earnest.
- ✓ Recommendation 16: The state should encourage onshore and offshore wind generation along the Texas Gulf Coast. While the development of these resources should be balanced with concerns related to migratory birds and other ecological conditions, coastal wind resources appear to have much smaller incremental transmission need due to their proximity to the existing transmission grid, and are expected to have energy production that more closely aligns with peak demand.
- ✓ Recommendation 17: The PUC should require ERCOT and the transmission utilities to study dynamic line ratings in West Texas to show available transmission capacity more accurately and allow for more efficient use of transmission facilities.
- ✓ Recommendation 18: The PUC should identify and resolve any legal or regulatory issues that prevent the development of merchant transmission investments that could provide additional privately funded transmission.
- ✓ Recommendation 19: The Governor should request that the PUC, institutions of higher education, ERCOT, and relevant industry evaluate new conductors and propose sites where these technologies could provide value.

- ✓ Recommendation 20: The Governor should direct the PUC to study whether alternate forms of rate regulation for transmission and distribution utilities would be appropriate to meet these goals and identify whether any statutory impediments exist to implementing such regulation.
- ✓ Recommendation 21: The state should partner with higher education institutions and corporations to develop and promote advanced transmission and distribution technologies and incent investment in the research and development of such technologies.

Energy Efficiency and Demand-Response Recommendations:

- ✓ Recommendation 22: The state should require TDUs to deploy advanced meters, with an appropriate cost recovery mechanism to ensure that TDUs earn a reasonable return on this investment. The PUC should have the authority to require deployment of advanced meters as rapidly as possible.
- ✓ Recommendation 23: The PUC should ensure that ERCOT incorporates the most cost-effective means of ensuring that all retail customers have the option to be settled on 15-minute interval data in order to receive the full benefits of changes in consumption behavior and generation from solar panels and other distributed sources.
- ✓ Recommendation 24: If the PUC study indicates a greater potential for cost-effective energy efficiency reductions, the state should raise the energy efficiency goals to the higher levels contemplated under current law.
- ✓ Recommendation 25: The PUC should incorporate additional messages about the benefits of energy efficiency, conservation, and demand-response programs into its customer education campaign. The state should fully provision this campaign using the System Benefit Fund.

Retail Market Recommendations:

- ✓ Recommendation 26: The state should resist efforts to re-regulate the market and instead adopt the recommendations in this plan, while retaining the oversight of the PUC and ERCOT over the market.
- ✓ Recommendation 27: The PUC should revisit its certification requirements for REPs and evaluate whether current standards are adequate given the significant change in natural gas and wholesale electricity market conditions since market opening.
- ✓ Recommendation 28: The state should reinstitute funding for the PUC's customer education efforts, and the Governor should direct the PUC to incorporate the topics addressed in this plan into the education campaign.

Workforce Recommendations:

- ✓ **Recommendation 29:** Texas should continue to invest in programs designed to generate interest in math and science. The state should increase the scale of successful programs that produce qualified math and science teachers in order to support more rigorous STEM education. Acquainting students with energy industry career options through online tools will also enhance interest and engage learners in STEM fields.
- ✓ **Recommendation 30:** Texas needs to increase high school completion rates and ensure that high school graduates are college- and workforce- ready. The state must adopt model curricula aligned with college and workforce requirements to reach higher standards.
- ✓ **Recommendation 31:** Texas needs to increase the number of postsecondary graduates with knowledge and skills that meet industry needs. The state should encourage colleges and universities to align their STEM curricula with energy workforce needs.
- ✓ **Recommendation 32:** Texas should improve the flexibility of its technical education and training system in response to industry needs across the state, regardless of service area boundaries. The state should examine ways to allow community and technical colleges to deliver training where employees are regardless of the college's location.
- ✓ **Recommendation 33:** The state should continue the Skills Development Fund, which supports training programs that respond directly to the workforce needs of Texas employers. This is an effective tool for helping to retrain workers and in meeting the needs of industry in a "just-in-time" manner.
- ✓ **Recommendation 34:** The energy industry should look to the military and declining industries to expand its workforce. Texas should work with the military to align occupation certification requirements so that re-training programs recognize the existing skills and training of armed forces personnel. The state should also focus on retraining workers from declining industries to enable their transition to high-need occupations.
- ✓ **Recommendation 35:** The state should create a Workforce Supply-Demand Database. Texas needs accurate data to assess the current and future workforce gaps between supply and demand in priority industries and occupations. This would require a collaborative effort among private industry, the THECB, the TWC, the TEA, and other relevant stakeholders.
- ✓ **Recommendation 36:** The state should establish a Texas Center for Workforce Innovation and Competitiveness to promote and support skills pipeline initiatives. The urgency of skills pipeline challenges calls for establishing an intermediary that can facilitate workforce partnerships in support of economic development priorities in regions across Texas. The center should house staff from the TEA, the TWC, the THECB, and the TWIC.

Governance

- ✓ **Recommendation 37:** The state should create a council of member agencies or designate an official tasked with coordinating energy functions.

The Texas electric market is like no other. Texas has sole jurisdiction over the electricity market in the vast majority of the state because 85 percent of Texas' electricity usage occurs in an electric grid, ERCOT, which lies solely within the state. Therefore, Texas is subject to limited federal jurisdiction. This allowed Texas to restructure the wholesale and retail electricity markets within ERCOT comprehensively and cohesively into a competitive marketplace, overseen by the PUC.

As a result of the move to a competitive electric market, Texas has seen an explosion in investment in generation facilities, and is widely regarded as having one of the most successful electric markets in the world. However, because the ERCOT electric grid lies entirely within the state, Texas has a limited ability to import electricity from other regions. Unlike other states that rely on neighboring regions to provide power instead of investing in new generation facilities, electricity demand in Texas must be met by generation facilities in Texas.

These competitive markets position Texas well to continue to meet the energy needs of a growing, vibrant state with efficient market-based solutions and investment. However, global and national energy trends, since the restructuring of the market, have significantly impacted the electricity market in recent years.

- NATURAL GAS PRICES—When retail competition started in 2002, the price of natural gas was around $2 per MMBtu, leading to significantly lower electricity prices than during regulation. However, by June 2008, the price of natural gas reached a record $11-12 per MMBtu, and has become increasingly volatile. Because generation fueled by natural gas is typically the "marginal" or last unit dispatched in order to meet demand, it sets the market price. Thus, the natural gas price increase has significantly impacted the prices of wholesale and retail electricity, and the increased price volatility has made it challenging for Texans to plan their energy purchases.
- CARBON REGULATION—Even though Texas has sought to create an environment for energy companies characterized by legal and regulatory certainty, the prospect of federal legislation to regulate the emissions of carbon dioxide (CO_2) and other greenhouse gases has created the single greatest uncertainty for companies seeking to build generation facilities in Texas.

  This uncertainty is preventing the addition of low-cost generation that ultimately holds the greatest potential for reducing energy costs in the state. Coal is one of the least expensive sources of power, and Texas has abundant lignite resources. Texas' energy future, perhaps even Texas' ability to compete globally, is threatened by carbon legislation, even though carbon has never been recognized by Texas or the federal government as a pollutant.
- OIL PRICES—Oil prices are also at record levels, reaching $145 per barrel in July 2008. While oil is not used to generate electricity in Texas to any significant extent, gas prices have historically been tied to oil. High oil prices also increase the economic pressure on customers and heighten motivation to use electricity for meeting transportation energy needs with plug-in hybrid vehicles.
- COST OF BUILDING NEW GENERATION—Significant technological advances are positively impacting the cost and efficiency of wind turbines, combustion turbines, solar panels, and other generation sources. However, the rising cost of building materials (such as steel, concrete, and copper) have increased the expense of building new, capital-intensive electricity generation facilities, such as coal and nuclear plants. This has made alternative energy technologies more economically viable.

- **Transmission**—Transmission and distribution lines transport electricity from generation facilities to end-use customers. Texas policy makers understand the need for transmission expansion, in order to accommodate demand growth, to maximize the efficiency and reliability of the electric grid, and to serve the state's vast wind resources. Although concerns have been expressed about the cost of new transmission, there is recognition that this infrastructure will offer access to additional clean generation resources.
- **Retail Technology**—Technological advances have been developed to empower consumers to become more efficient users of electricity. These include advanced metering systems, higher efficiency appliances and equipment, and systems for automatic responses to market signals. These devices may become even more important if transportation even modestly switches from oil to electricity. These technologies do, however, have up-front costs.
- **Retail Pricing and Policies**—Retail competition has brought new competitors, products, and services to the market and promises to bring forward technology that will give residential customers the real-time ability to monitor their electricity usage with the goal of reducing consumption or moving it off-peak. However, rising natural gas and energy prices have led some to conclude that restructuring has failed to deliver its promised benefits to customers. As a result, proposals to re-regulate the industry are introduced every legislative session. Such proposals cause legal and regulatory uncertainty, making it more difficult for energy companies to gain access to capital markets and, ultimately, to deploy the new technologies and products that could enable electricity customers to save money.

While the impact of these trends is not unique to Texas, the unique nature of Texas' electricity markets may require Texas policy makers to evaluate these impacts closely and implement new policies and actions that will further improve Texas' electricity markets and economic competitiveness.

There are no easy answers to the energy challenges of the next several decades and there is no single "silver bullet" to solve the problems of growing consumption fueled by the success of globalization and constrained global energy supplies. Rather, the question is how to most effectively and efficiently provide the diverse mix of energy resources needed for Texas' growing economy.

Many other states are addressing these challenges by adopting centralized resource planning mechanisms and governmental dictates for specific generation technologies. Such attempts inhibit market-based solutions and competitive pressures that are more likely to provide long-term efficiencies and innovation. In contrast, because the competitive marketplace in Texas is already providing a diverse mix of generation resources, this plan seeks to identify and remove regulatory, legal, informational, and economic barriers that thwart efficient market responses to the energy needs of the state.

This report is organized into seven sections. The remainder of Section 1 discusses the current energy landscape in Texas and provides the background for the discussion in the next four sections concerning Texas' energy future. Section 2 focuses on the generation sector, identifies current challenges to the wholesale electricity market, discusses the impact that carbon regulation may have on Texas' ability to meet its future energy needs cost-effectively, and provides energy generation policy recommendations. Section 3 addresses the transmission and distribution sector, and provides recommendations for ensuring the continued development of its critical infrastructure. Section 4 identifies the potential for energy efficiency, demand-response programs, advanced metering deployment, and smart grid technologies, which can enable customers to have more control over their energy consumption and usage patterns, and revolutionize portions of the retail, wholesale, and transmission and distribution sectors. Section 5 discusses the future of the retail electricity market in the state, and provides recommendations to help ensure that all Texans are informed about how they help Texas' energy future. Section 6 discusses workforce needs in the energy sector and Section 7 addresses governance issues.

1.1 Structure of the Texas Electricity Markets

Texas' electricity markets are structured in a manner unique among states. Figure 1 shows Texas' four regional power grids.

- The Electric Reliability Council of Texas (ERCOT) is the regional power grid for the majority of Texas, representing 85 percent of the electricity demand in the state, and covering 75 percent of the geographic area of Texas. ERCOT includes the Dallas-Ft. Worth Metroplex, Houston, Austin, San Antonio, Corpus Christi, and South Texas, including the Rio Grande Valley.
- The majority of the Texas Panhandle, including Amarillo and Lubbock, and northeast Texas are located within the Southwest Power Pool (SPP), a regional electric grid that also includes Oklahoma, Kansas, and portions of Arkansas, Louisiana, Missouri, and New Mexico.
- Southeast Texas, including the Beaumont and Port Arthur areas, is located in the Southeastern Reliability Council (SERC), which covers most of the southeastern United States, except for Florida.
- El Paso is located in the Western Systems Coordinating Council (WSCC), a power grid that covers the United States and parts of Canada west of the Rocky Mountains.

Figure 1: Texas' Regional Power Grids

In 1995, the Texas Legislature introduced competition into the state's wholesale markets. Generation developers not affiliated with electric utilities were permitted to construct and operate new generation facilities and were provided access to the transmission lines of electricity utilities in the state to permit them to deliver their power to wholesale customers.

Senate Bill 7, enacted in 1999, continued the transition toward competitive energy markets by establishing a framework, shown in Figure 2 on the next page, to allow retail competition in the electricity market. Governing boards of municipally owned utilities and electric cooperatives were granted the authority to elect whether and when to open their service areas to customer choice.[1] Retail competition in the non-ERCOT regions (SPP, SERC, and WSCC) was subsequently delayed by either legislative or PUC action due to concerns about the viability of the wholesale markets in these areas, a necessary precondition to a fair and level playing field for competition. The investor-owned utilities in these areas (Southwestern Public Service Company (SPS), a division of Xcel Energy; Southwestern Electric Power Company (SWEPCO), a division of AEP Texas; Entergy Texas; and El Paso Electric Company) remain bundled, vertically integrated utilities subject to full regulation of rates and services by the PUC. New generation facilities require a Certificate of Convenience and Necessity (CCN) from the PUC prior to the inclusion of the costs of the facility in rates.

1 To date, only Nueces Electric Cooperative has elected to enter retail competition.

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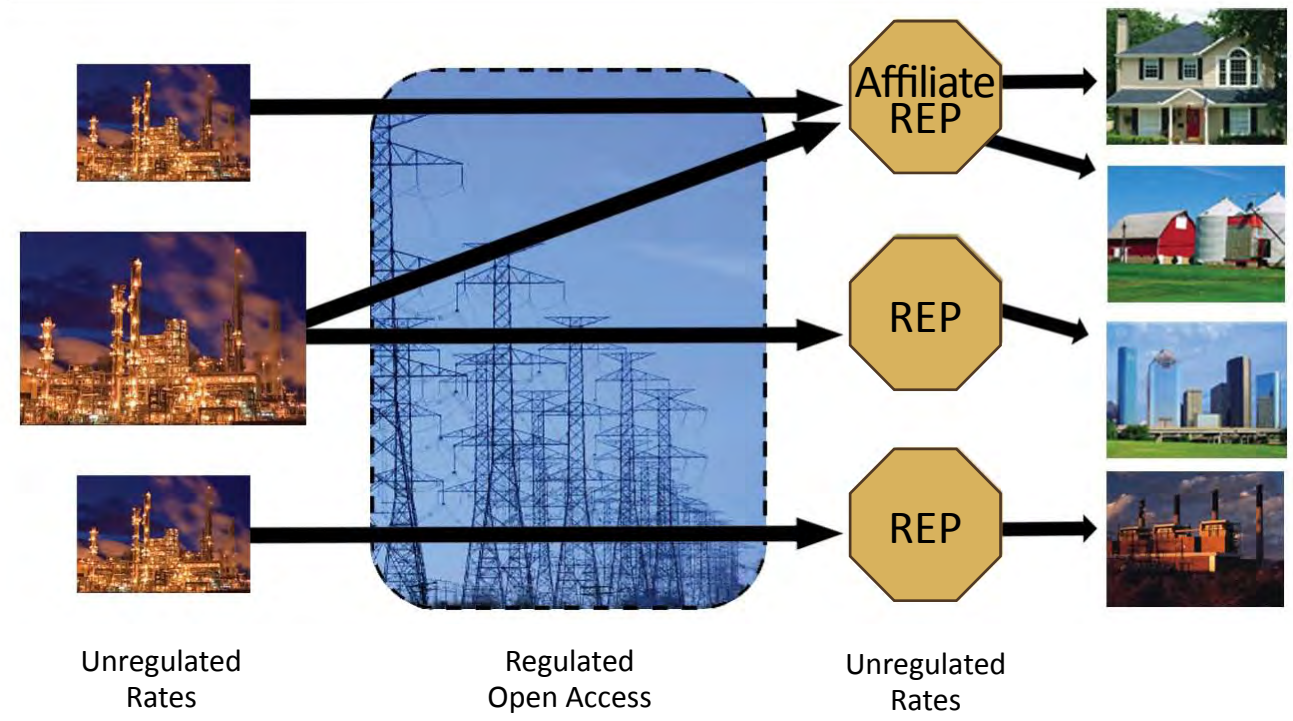
Figure 2: Senate Bill 7 Market Structure



Within the ERCOT region, retail competition for customers of investor-owned utilities was implemented on January 1, 2002. The market structure for this region provided that the formerly integrated utilities were required to separate their business functions into three distinct companies: a power generation company (PGC), a transmission and distribution utility (TDU), and a retail electric provider (REP). The power generation and retail electric sectors are, at this point, generally unregulated, with prices and investment decisions determined by the forces of competition. The transmission and distribution sector remains fully regulated by the PUC, with rates set on a cost-of-service basis and open access guaranteed to all buyers and sellers of electricity.

Equal and non-discriminatory access to the transmission grid is vital to the success of both wholesale and retail competition. Within the majority of the state, the ERCOT independent system operator is responsible for the day-to-day management and operation of the transmission grid to ensure that all buyers and sellers have equal access to the grid and that reliability is maintained. Because the ERCOT power region is entirely within the state of Texas, the production and sale of electricity is not subject to regulation by the Federal Energy Regulatory Commission (FERC). While FERC does have jurisdiction over reliability standards and enforcement, the existence of a single economic regulator (the PUC) places Texas in a unique position. Texas has been able to develop a cohesive market structure to foster wholesale and retail competition, and, at least within the ERCOT region, does not face the hurdles of multi-state licensing and permitting that can often significantly delay new generation and transmission investment in other parts of the country.

ERCOT has weak interconnections with neighboring grids. ERCOT has transmission capability of approx 800 megawatts to SPP in the North and East portions of Texas through bi-directional DC ties, and a 300 megawatts tie to Mexico's utility Comisión Federal de Electricidad (CFE). Most U.S. marketplaces have import/export capability of 20 to 25 percent of their peak demand but ERCOT has less than 7 percent capability. As such, developments external to ERCOT affect ERCOT power prices in a very limited manner.

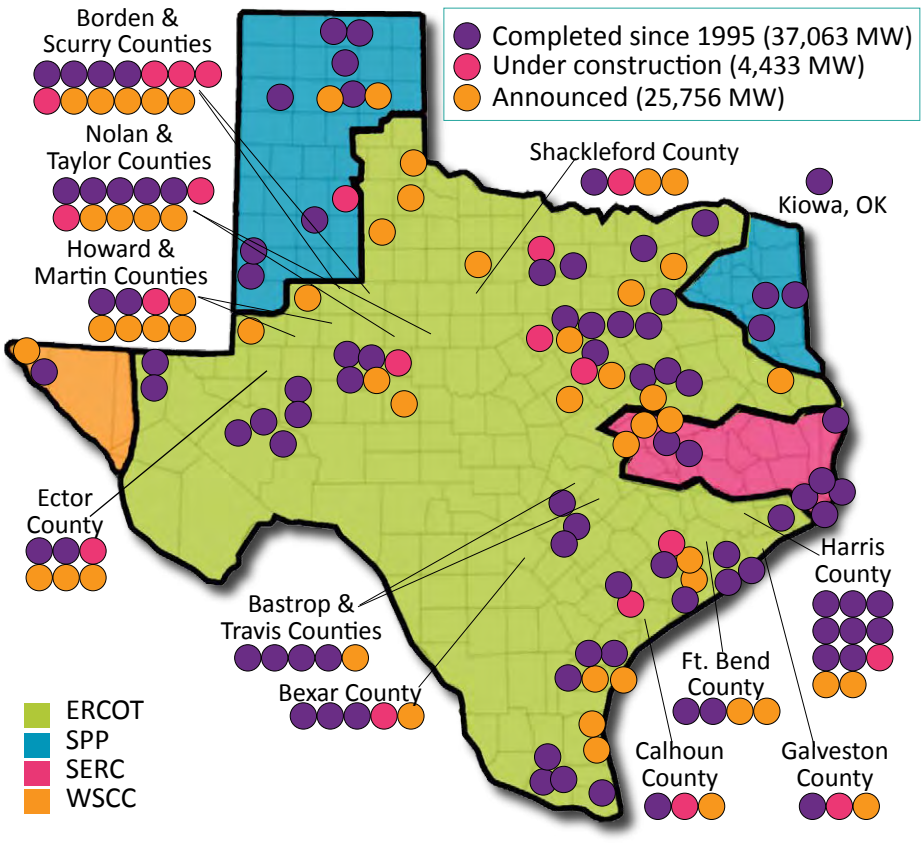
As a means of facilitating greater interregional transfers, three new facilities utilizing "switching" technology are located on the border of ERCOT and SPP/Entergy. These projects do not supply a direct interconnection between the markets; however, the units are all capable of switching output from one region to the other. In total, these three units account for an additional 2.9 GW of transfer capability into and out of ERCOT.

In the ERCOT region, all transmission costs are spread among all customers within the region. Under this form of rate making, all costs of fully integrating new generation to the grid beyond the interconnection point are borne by electric customers. This policy has made Texas an attractive place to develop new generation as developers do not face uncertain costs in addition to their own capital expenditures. The electric utility that builds transmission is required to obtain PUC approval by obtaining a CCN. The utility is required to provide open access service to eligible transmission customers, is allowed regulated rights of return, and is granted the permission to use eminent domain to obtain easements for transmission facilities.

1.2 Wholesale Electricity Markets in ERCOT

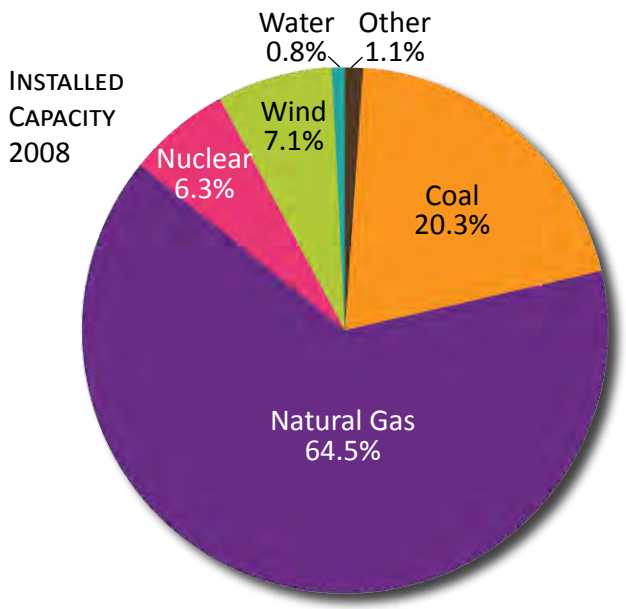
Many experts and financial analysts view the competitive structure in Texas as a successful example of wholesale and retail competitive electric markets. The ERCOT market has experienced unprecedented investment in the generation sector since restructure, all at the risk and expense of the generation developers. To the extent the owners of generation make decisions that ultimately turn out to be poor economic choices or operate their units in an inefficient manner, the owners bear the risk of foregone profit or an inadequate return on their investment. In contrast, in regulated markets, ratepayers ultimately bear the risk of constructing and operating units and inefficiencies in the operations of a utility's generation fleet or costly investment mistakes result in higher rates for customers.

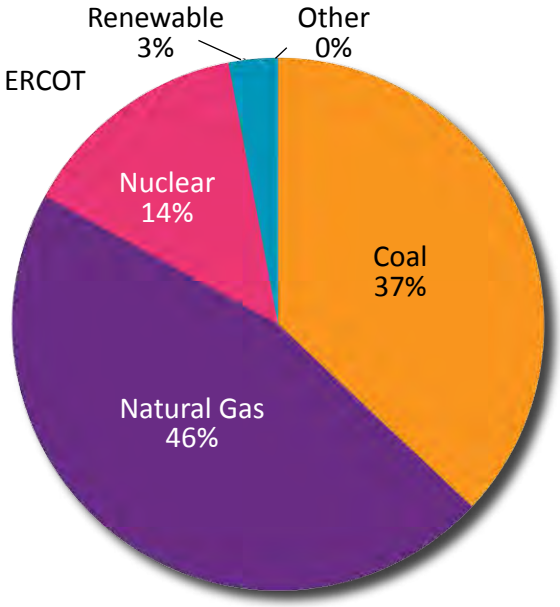
Figure 3: New Generation Plants Since 1995



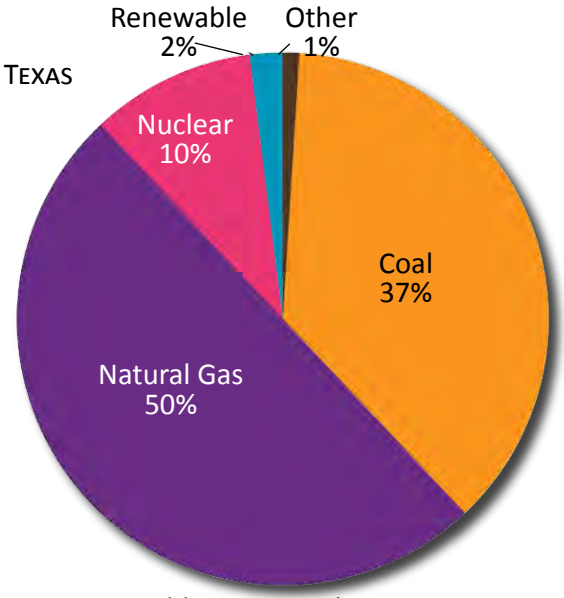
Since 1995, over 37,000 megawatts of new generation has been built and is currently operating in Texas, as shown in Figure 3. The vast majority of this generation, over 32,000 megawatts, has been natural gas – predominately efficient combined cycle gas turbines.[2] These units are advanced, high efficiency power plants that use less fuel than the older, former utility owned gas generation on the grid, and have led to the mothballing or retirement of these older units.

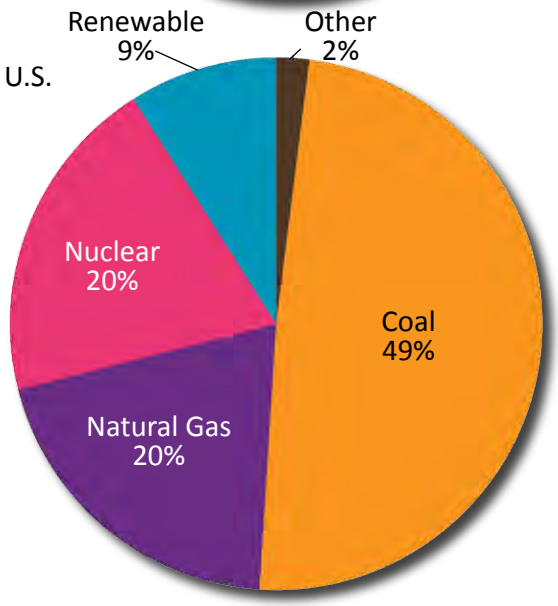
2 The PUC. "New Generating Plants in Texas Since 1995." Map. PUC. 7 July 2008 <http://www.puc.state.tx.us/electric/maps/gentable.pdf>.





Above: Figure 4: ERCOT Installed Generation Capacity Mix





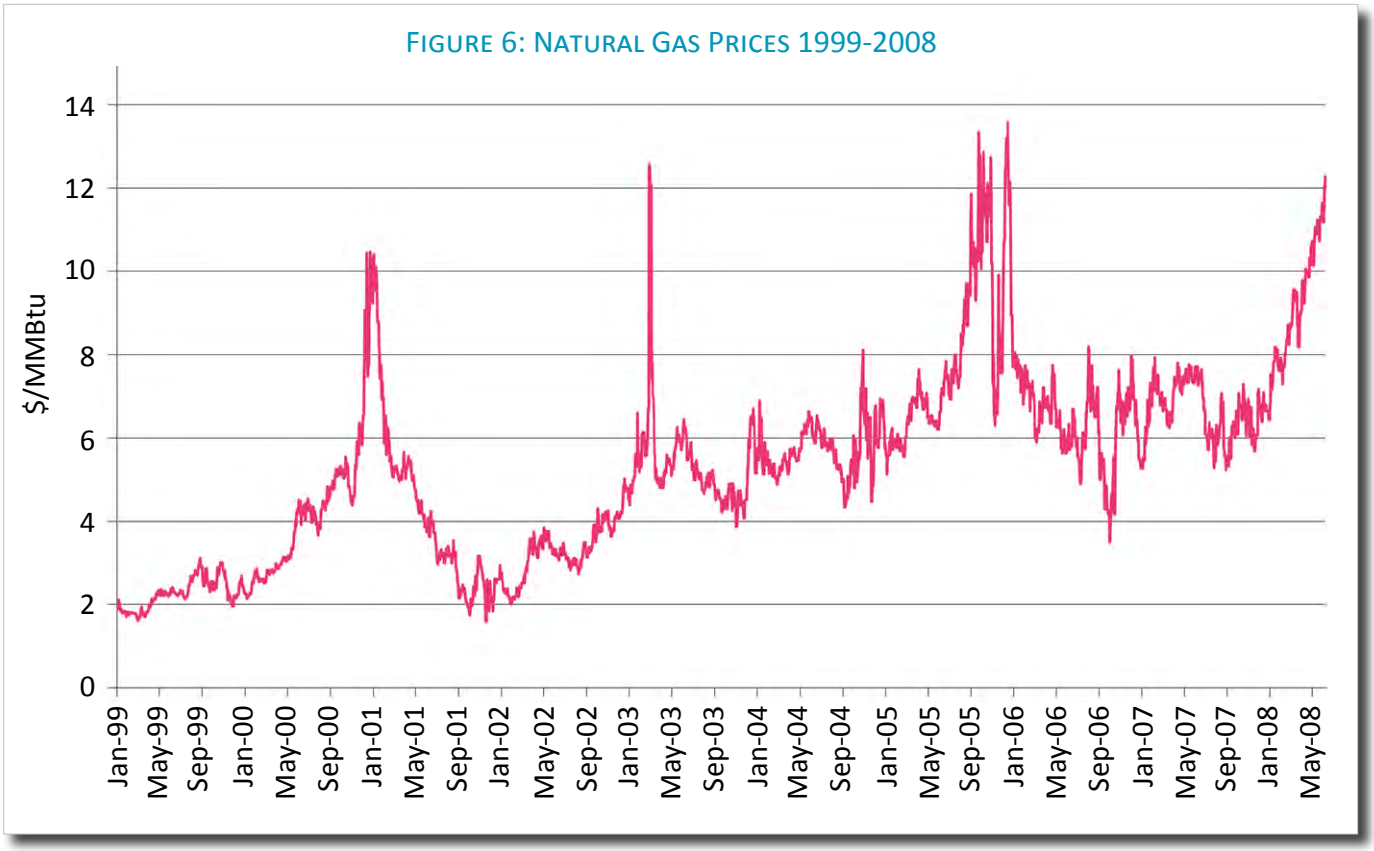
Right: Figure 5: Texas vs. U.S. Electricity Mix (GWh)

This influx of new natural gas capacity has led to a fuel mix in Texas that, when measured both on the basis of installed generation capacity and energy produced from that capacity, illustrates an extreme reliance on natural gas. Today, ERCOT's installed capacity, as shown in Figure 4, is 64.5 percent natural gas. Natural gas provides 46 percent of the energy consumed in the ERCOT region (50 percent statewide), as shown in Figure 5. In contrast, natural gas accounts for about 20 percent of the energy consumed in the U.S.

In any competitive commodity market, the market price is generally set by the last, or "marginal" unit of supply needed to satisfy demand, and electricity is no different. In ERCOT, natural gas-fired generation is the marginal source of electricity generation in virtually all hours of the year, which means both wholesale and retail electricity prices are directly correlated to natural gas prices. Even at the times when demand is at the lowest (approximately 25,000 megawatts), natural gas generation is still needed to meet demand.

Since the retail market opened in 2002, natural gas prices have increased significantly, and prices have been extremely volatile, rising from around $2 to $3 per MMBtu when the market opened in 2002 to above $12 per MMBtu in June 2008. Average prices for 2008 are expected to be higher than those in 2005, which reflected the reduced supply resulting from Hurricanes Katrina and Rita.

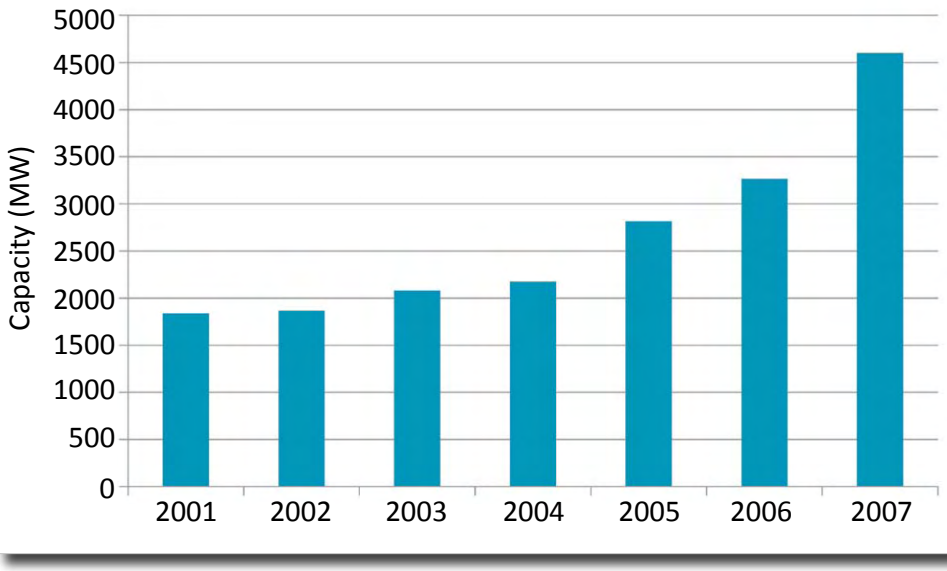
Figure 6: Natural Gas Prices 1999-2008



The significant increase and heightened volatility of natural gas prices since 2002 is a major challenge to the electricity marketplace in ERCOT. It is not expected that natural gas prices will return to 2002 levels. (see Figure 6) Rather, with the need to access more expensive supplies of gas in the future and increasing LNG imports from abroad, prices are expected to remain high. Additionally, generators are expected to build more natural gas capacity in coming years to fill expected capacity shortfalls. By the middle of the next decade, new nuclear and coal plants have the potential of lowering electricity prices, but uncertainty about pending carbon legislation may prevent the addition of an adequate amount of coal to dramatically impact prices.

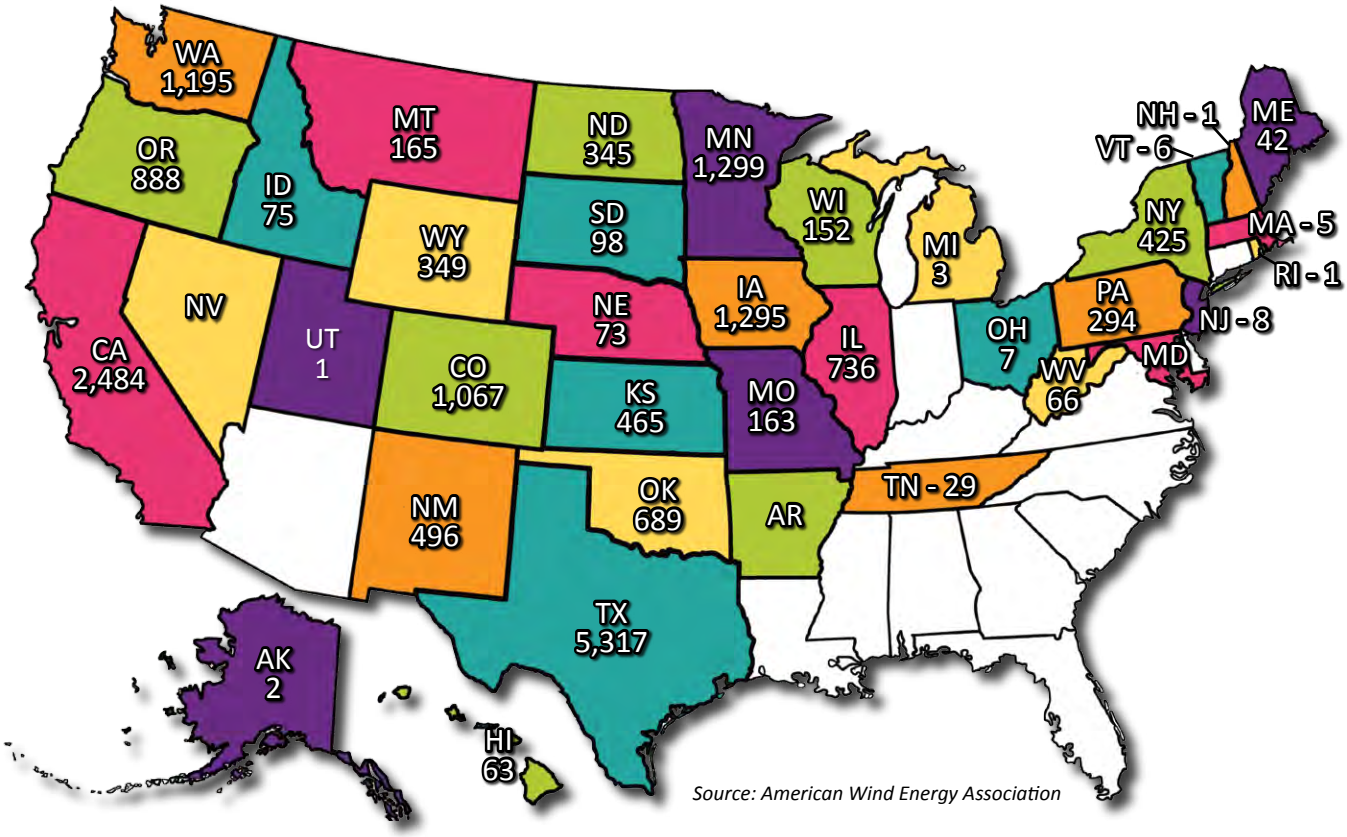
In recent years, a substantial amount of wind energy has been installed, primarily in West Texas. This increase is shown in Figure 7. Work remains to integrate large amounts of wind. ERCOT must have the tools and reserves to adequately handle the intermittency of wind generation. When wind is produced, it generally displaces natural gas-fired generation, and sometimes even coal, resulting in lower natural gas consumption, and at times, lowering energy prices.

Figure 7: Growth of Renewable Energy Capacity in Texas



As of the first quarter of 2008, Texas had installed 5,317 megawatts of wind capacity, more than any other state. A state-by-state comparison is shown below in Figure 8. In 2007 alone, Texas added 1,600 megawatts of new wind capacity. By May 2008, the total installed wind capacity in Texas exceeded 5,000 megawatts, nearly surpassing the legislative mandate set in 2005, and ERCOT currently projects that as much as 10,000 megawatts may be operating by the spring of 2009. An additional 45,000 megawatts are in various stages of the interconnection review process.[3] This surge has been driven by high natural gas prices, excellent wind resources, relatively few siting issues due to low population density in West Texas, a viable wholesale market in which to sell the energy, and the state's commitment to build the transmission necessary to export wind energy to where it is most needed. With 136,000 megawatts of potential capacity, Texas has the second largest resource potential in the country.[4]

Figure 8: Wind Capacity as of March 2008



Texas has also added generation from biomass to its fuel mix. Current Texas law provides that new biomass and landfill gas electrical generation is eligible for renewable energy credits under Texas' renewable energy portfolio standard, leading to 20 megawatts of new biomass and 67 megawatts of new landfill gas capacity having been installed since 1999. Signed by Governor Perry in 2007, House Bill 1090 provided for a grant program to provide subsidies of up to $20 per ton for farmers, loggers, and others who divert suitable biomass waste to generation facilities that use biomass to generate electricity. Additionally, two companies are currently developing larger scale biomass power plants in East Texas. However, the capital costs of building biomass plants are comparable to new coal fired power plants and limited suitable fuel will likely constrain biomass energy to a relatively small portion of the overall energy mix.

3 Kahn, Bob. "Planning for Texas' Energy Future." Senate Business and Commerce and Senate Natural Resources Committees Hearing. Senate Finance Committee, Texas State Capitol E1.036, Austin, TX. 15 Apr 2008. 7 July 2008 <http://www.ercot.com> Path: News; Reports and Presentations>

4 "U.S. Wind Energy Projects - Texas." American Wind Energy Association. 31 Mar 2008. 7 July 2008 <http://www.awea.org/projects/projects.aspx?s=Texas>.

1.3 Role of ERCOT and Transmission Planning in Market Facilitation

ERCOT, the independent system operator in Texas, is overseen by the PUC, and manages the flow of electric power to approximately 20 million Texas customers in order to keep the electric grid reliable. The electric grid in the ERCOT area of the state connects 38,000 miles of transmission lines and more than 500 generation units. ERCOT also serves as the independent entity that ensures seamless customer switching and manages financial settlement for the competitive wholesale market.

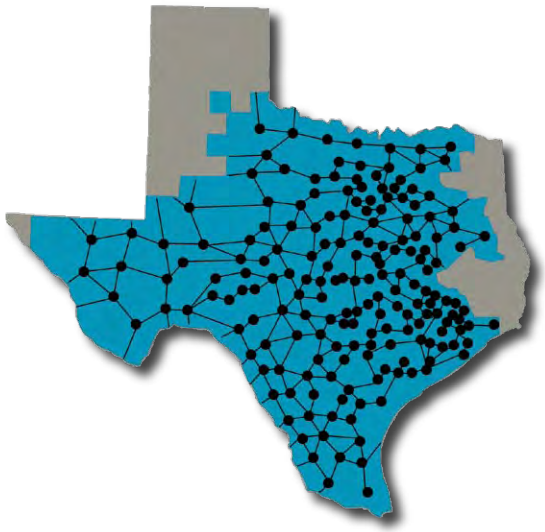
Electricity is unique among commodities in that it cannot currently be cost-effectively stored for later use. That means the supply and demand of electricity must match in real-time within relatively small tolerances. ERCOT ensures that supply and demand are matched in real-time, and operates markets to procure needed energy and reserves to ensure that reliability is maintained even if unexpected demand occurs or large power plants trip offline. In addition, ERCOT also manages congestion on the grid. Congestion occurs when insufficient transmission capacity exists to allow the lowest cost provider of electricity to delivery power to customers. When the transmission grid becomes congested, ERCOT maintains the reliability of the grid by instructing power plants to change their output levels in order to route power around the congestion.

Under current market rules, ERCOT manages this congestion in two ways. For the main congested transmission lines, the market is segmented into "zones", as shown to the right in Figure 9, and market participants who schedule between these zones bear the costs of relieving any congestion that emerges. ERCOT operates markets where generators bid to increase or decrease their output based on the needs of the system. Within these zones, ERCOT employs command and control mechanisms to order generators to increase or decrease their output, with the costs of resolving this "local" congestion being shared among all market participants.

While this model has allowed ERCOT to maintain reliability on the grid, several major shortcomings of this approach have become clear. In many cases, the price signals for generators to respond to and operate in ways that prevent congestion from occurring simply do not exist, in large part because the costs of local congestion are spread among all market participants, irrespective of whether their actions contribute to the congestion. Likewise, there are insufficient signals to inform ERCOT as to the most effective way to resolve congestion. As a result, ERCOT is in the midst of transitioning to a nodal marketplace, as shown in Figure 10, which is expected to deliver significant benefits to the grid and marketplace by ensuring the lowest cost dispatch of generation units, while cost-effectively managing congestion.

Figure 9: Zonal Market Design

Figure 10: Nodal Market Design



Ultimately, congestion is often best addressed through adding new transmission infrastructure to the grid. ERCOT conducts an ongoing transmission planning process to identify the grid's needed upgrades. ERCOT annually reports their findings to the PUC, which ultimately approves the new transmission lines and their routes. Since 2005 alone, over 2,500 circuit miles of new transmission has been added to the ERCOT power region's transmission grid, far outpacing new investment anywhere else in the country. For transmission projects in the ERCOT power region, the PUC is the only regulatory body involved in the permitting of the lines, and the PUC has enacted policies and procedures to expedite the approval of transmission lines deemed critical to the grid by ERCOT.

1.4 Retail Electricity Markets in ERCOT

The competitive retail electric market in ERCOT is widely viewed as one of the most successful electricity markets in the world. While the impact of high and volatile natural gas prices on electricity prices continues to create challenges for customers and REPs, significant benefits have been achieved for Texas customers and the economy, since the opening of the marketplace.

One manifestation of Texas' success since the opening of the retail market in 2002 is the proliferation of consumer offerings. Due to the attractiveness of Texas as a place to do business, all types of customers (industrial, commercial, and residential) may choose from a large number of REPs seeking to provide their energy needs. In order to manage their risk and cost of electricity, customers have a wide array of products from which to choose, including fixed-price term contracts for as long as five years or products that more closely track the real-time or daily energy market. Larger customers have options to more efficiently use self-generation and demand-response tools to re-sell their electricity back to the market at times of high demand and energy prices. Both large and small customers have options to purchase electricity in a manner that meaningfully impacts their environmental concerns and sensibilities through the purchase of renewable energy products.

Figure 11 shows the number of non-affiliated REPs and product offerings in each TDU territory for residential customers in early May 2008. The AEP Texas Central Company territory, for example, had 30 providers offering customers almost 100 different product choices. These choices include fixed- and variable-rate offers, short- and long-term contracts, and renewable energy options, with prices ranging from 11.9 to 18.5 cents per kWh. In order to gain and retain customers, competitive pressures compel non-affiliate REPs to offer innovative service packages, some of which include energy efficiency products, demand-side management (DSM) options, and customer education programs.

Figure 11: Residential Retail Electricity Options

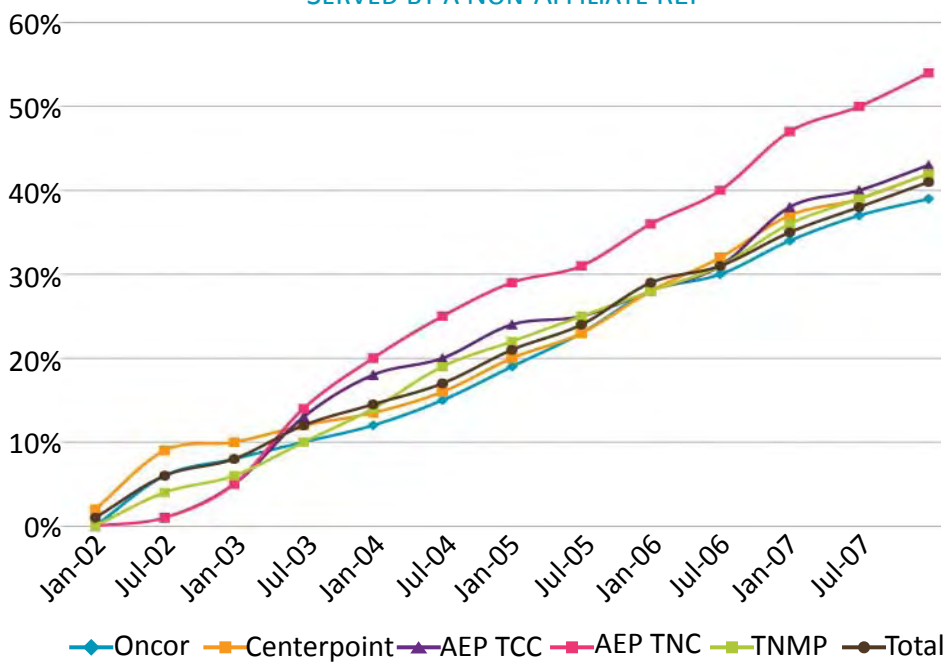
TDU Area	# of Non-Affiliated REPs	# of Product Offerings	Lowest Price *(cents per kWh)*
AEP – TCC	30	99	11.9
AEP – TNC	29	95	11.1
Centerpoint	29	98	12.5
ONCOR	29	98	11.3
TNMP	27	90	11.5

Source: http://www.powertochoose.org (May 8, 2008)

Prior to restructuring, a fraction of such offerings were provided to customers by the integrated monopoly providers. Further, in other states where restructuring has taken place, the number of retail providers and products has dwindled to a fraction of what is available in Texas, because policy makers restricted prices of the incumbent providers to a level that results in below-market pricing.

Shopping for electricity has clearly proven popular with customers, with over 40 percent of residential customers (50 percent of residential load) and almost 70 percent of commercial and industrial customers, having switched their service to non-affiliated REPs. Figure 12 shows the share of residential customers that have switched to non-affiliated REP service in each TDU territory, and its gradual but continual upward trend. Commercial and industrial customers have embraced change more quickly than residential customers. This is not surprising, given that the cost of power is often a major expense for such customers.

FIGURE 12: PERCENTAGE OF RESIDENTIAL CUSTOMERS SERVED BY A NON-AFFILIATE REP



Source: PUC Report Card on Retail Competition (Dec. 2007)

Approximately 80 percent of residential customers have made observable choices in the competitive market. This percentage includes those customers that have switched their service to a non-affiliated REP, those that have remained with their affiliated REP but changed their pricing plan, and those that have opted for service from an affiliated REP after moving to a new area in Texas. Clearly, residential customers are aware of electric choice and are exercising their option to choose.

Thus, several key hallmarks of competition—product choice, price options and switching—and the control that having such products, prices, and choices provides to the consumer, are all clearly evident in Texas.

No discussion of retail competition is complete without a discussion of whether prices are lower under competition than they would have been under continued regulation. In 2006, in response to a request from the Legislature, the PUC performed an analysis of the rates that would have been charged had regulation been in effect, the rates charged by the affiliated REPs, and the prices offered by the competitive market through 2005. The PUC concluded that even customers who had remained with the affiliated REPs paid lower prices than they would have under continued regulation. Further, customers also had competitive options that resulted in an estimated savings of $800 to $1440 between January 2002 and December 2005.[5]

Unquestionably, had natural gas prices remained low, retail electricity prices in Texas would be among the lowest in the nation. In fact, as late as April 2008, the average of all competitive offers in the each service area, including higher priced renewable energy and longer-term fixed rate options, was comparable to the last rates charged under regulation in 2001, even though natural gas prices have increased almost 300 percent since 2001.

5 The PUC. "Electricity Pricing on Competitive Retail Markets in Texas" PUC. 3 Feb 2006. 7 July 2008 <http://interchange.puc.state.tx.us/WebApp/interchange/Documents/32198_5_502558.PDF>

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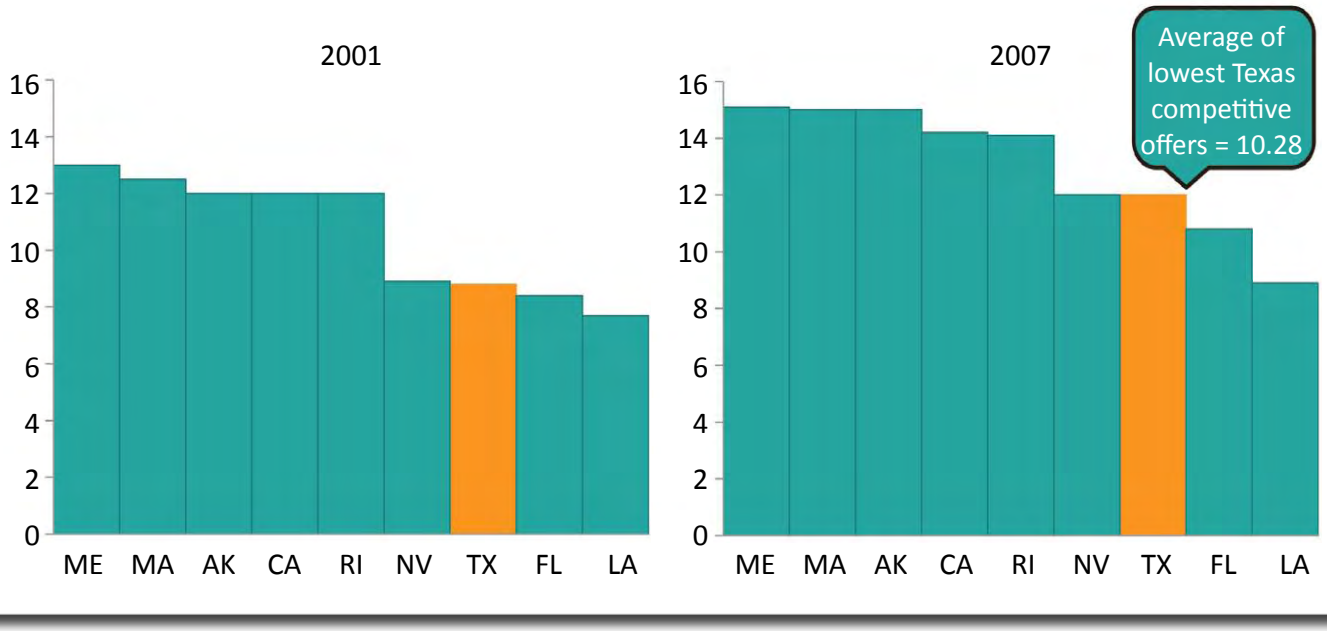
Figure 13: Average Residential Electricity Rates for States Highly Dependent on Natural Gas



Even with Texas' relative dependence on natural gas for power generation, Texas's competitive market has kept Texas' price for power among the lowest of the states that are highly dependent on gas for generation, as shown in Figure 13.

Moreover, there is strong evidence that the price of power has been kept down, in spite of higher gas prices, because of Texas' competitive market. This is likely because competitive suppliers have hedged the volatile price of natural gas, and passed on such benefits to customers in order to distinguish their offers from others. This richness of offerings provides customers with access to creativity and diversity in their energy purchasing decisions, which would not be the case in a traditionally regulated framework.

Continued increase in natural gas prices (to as high as $11 to $12 per MMBtu in June 2008) has caused short-term and variable rate prices to increase. Significant disturbances in the wholesale market during May and early June 2008 have also created challenges for REPs and customers, especially those who chose to rely heavily on the real-time or short-term energy markets for supply. While recent changes to market rules by the PUC and ERCOT combined with the transition to a nodal market design in 2009 address some of these concerns, the impact of high natural gas prices may continue for some time.

Even with this continued rise in natural gas prices, Texas's competitive retail market is continuing to provide options for customers that mitigate these severe price increases. While natural gas prices have risen almost 300 percent since market opening (as of June 3, 2008), competitive offerings include prices that are less than a 40 percent increase from the regulated rates that existed at the end of 2001, even though Texas' heavy reliance on natural gas sets the price of all fuel used to generate electricity. See Figure 14 on the next page.

Of course, not all REPs can provide the lowest prices and not all customers sign-up with the REP who has the lowest price, but offers available in the marketplace demonstrate what the competitive market was designed to do—to distinguish those who make smart business decisions from those who do not. Customers and REPs who chose to secure longer-term supplies or effectively hedged their risk will have well positioned themselves for this challenging environment.

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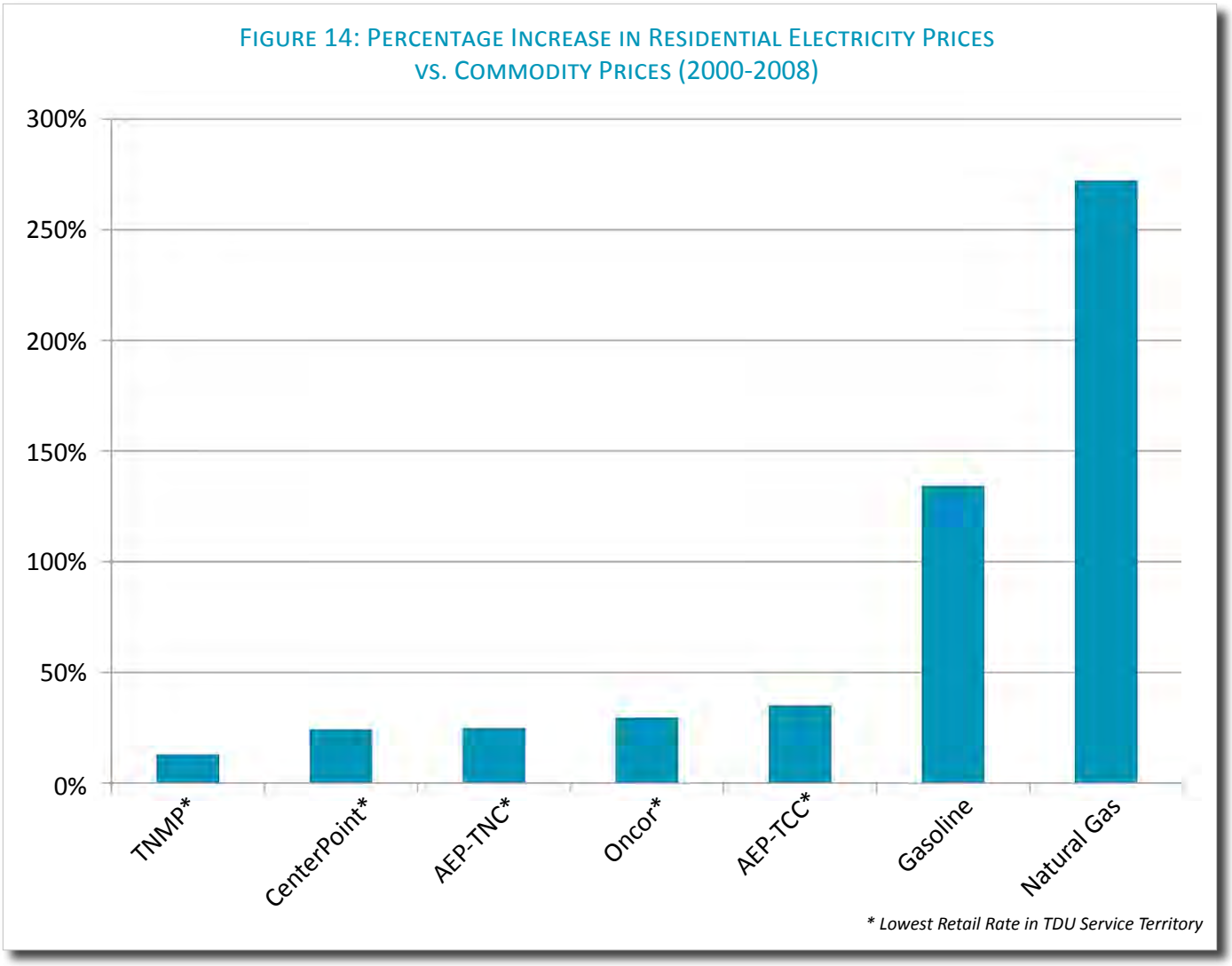
Figure 14: Percentage Increase in Residential Electricity Prices vs. Commodity Prices (2000-2008)



The other main benefit stemming from retail competition has been a tangible shift of risk away from customer to REPs, power generation companies, and the shareholders of these companies. While customers in regulated markets enjoy the benefit of paying the average costs of all fuel used (including coal and nuclear fuel) instead of all energy being priced at the cost of the marginal fuel (i.e. natural gas), these customers must bear the full risk of paying for the capital costs of the new generation investment needed to meet demand. As will be discussed in greater detail in the next section, the incremental costs of new coal, nuclear, renewable energy, or even natural gas generation nationwide are likely to be far in excess of the costs of the existing generation fleet included in current regulated rates. In regulated markets, ratepayers will be required to bear the full cost of these investments, whereas in competitive markets such as ERCOT, the risks of recovering this investment and a reasonable profit fall entirely on the generation companies.

As such, all electricity customers are likely to see substantial increases in their electricity costs in the coming years, whether those cost drivers are increased natural gas prices or incremental capacity additions. The competitive retail market in ERCOT, however, will continue to allow customers and REPs to manage the changing cost factors and more quickly and efficiently respond to these market dynamics.

1.5 Texas' Future Energy Needs

Since 1995, the competitive market in Texas has met the needs of the growing Texas economy primarily through market-based responses. As discussed earlier in this section, over 32,000 megawatts of new, efficient natural gas-fired generation was installed in response to market forces. Additionally, market forces have made Texas the nation's leader in installed wind capacity.

In the areas of Texas outside the ERCOT power region, excess supply by the electric utilities has been declining in recent years. As such, some utilities have had to purchase additional capacity from the wholesale market to be able to continue to serve their customers reliably, and several utilities have requested approval by the PUC to construct new generation facilities to meet their demand growth.

Texas will continue to face a sizable need for new generation resources in the next two decades. Two main factors drive the need for new capacity: the expected growth in electricity demand in the region and the expected need to replace a significant portion of the existing generation fleet due to age.

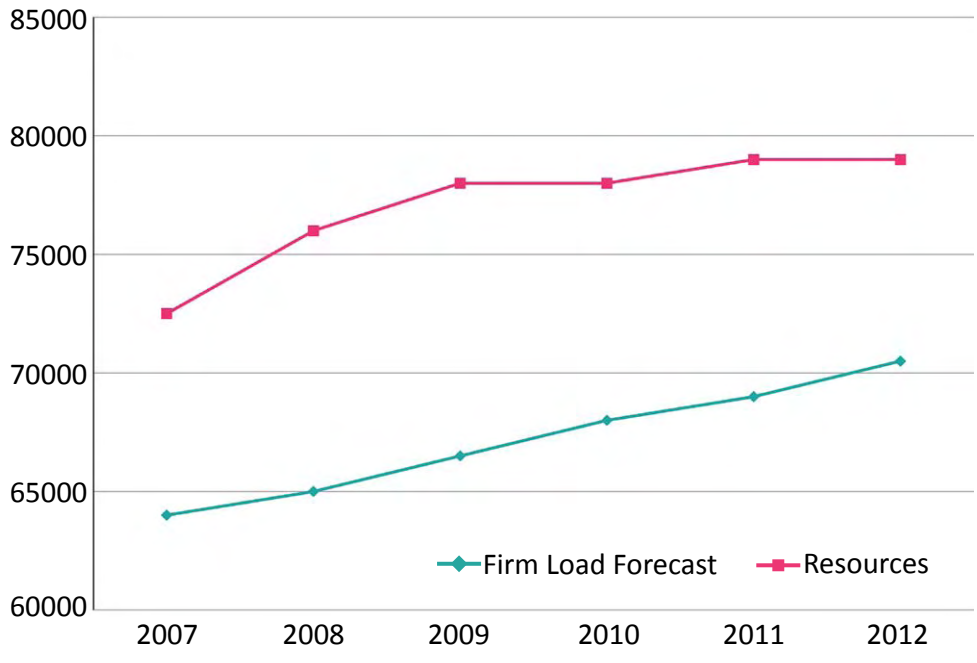
Within its power region, ERCOT forecasts the peak demand will grow at approximately 2 percent per year between now and 2025, requiring a nearly 50 percent increase in installed generation capacity by that date, and a need for between 1,500 and 2,000 megawatts each year just to meet this growth and maintain adequate reserve margins. The year-by-year forecasts are shown in Figure 15.

Figure 15: ERCOT Long-Term Peak Demand Forecast (MW)

Year	Peak Demand Forecast
2007	63,794
2008	64,927
2009	66,247
2010	67,641
2011	68,964
2012	70,052
2013	71,454
2014	72,672
2015	73,908
2016	75,000
2017	76,420
2018	77,591
2019	81,622
2020	82,871
2021	84,363
2022	85,681
2023	87,015
2024	88,180
2025	89,883

The market continues to add additional generation resources in order to meet these needs. In the short term, ERCOT projects that adequate new generation will be added to the grid in order to maintain the minimum 12.5 percent reserve margin needed to ensure reliability during peak periods through 2013, as shown in Figure 16. Of the nearly 6,000 megawatts of additional non-wind capacity expected to come online by 2013, almost 4,000 megawatts, or over two-thirds, is new coal generation, with the remainder being additional natural gas-combined cycle and peaking units. Almost 4,000 megawatts of additional wind capacity is also expected to be online in this period.

Figure 16: ERCOT Peak Demand and Supply Forecasts



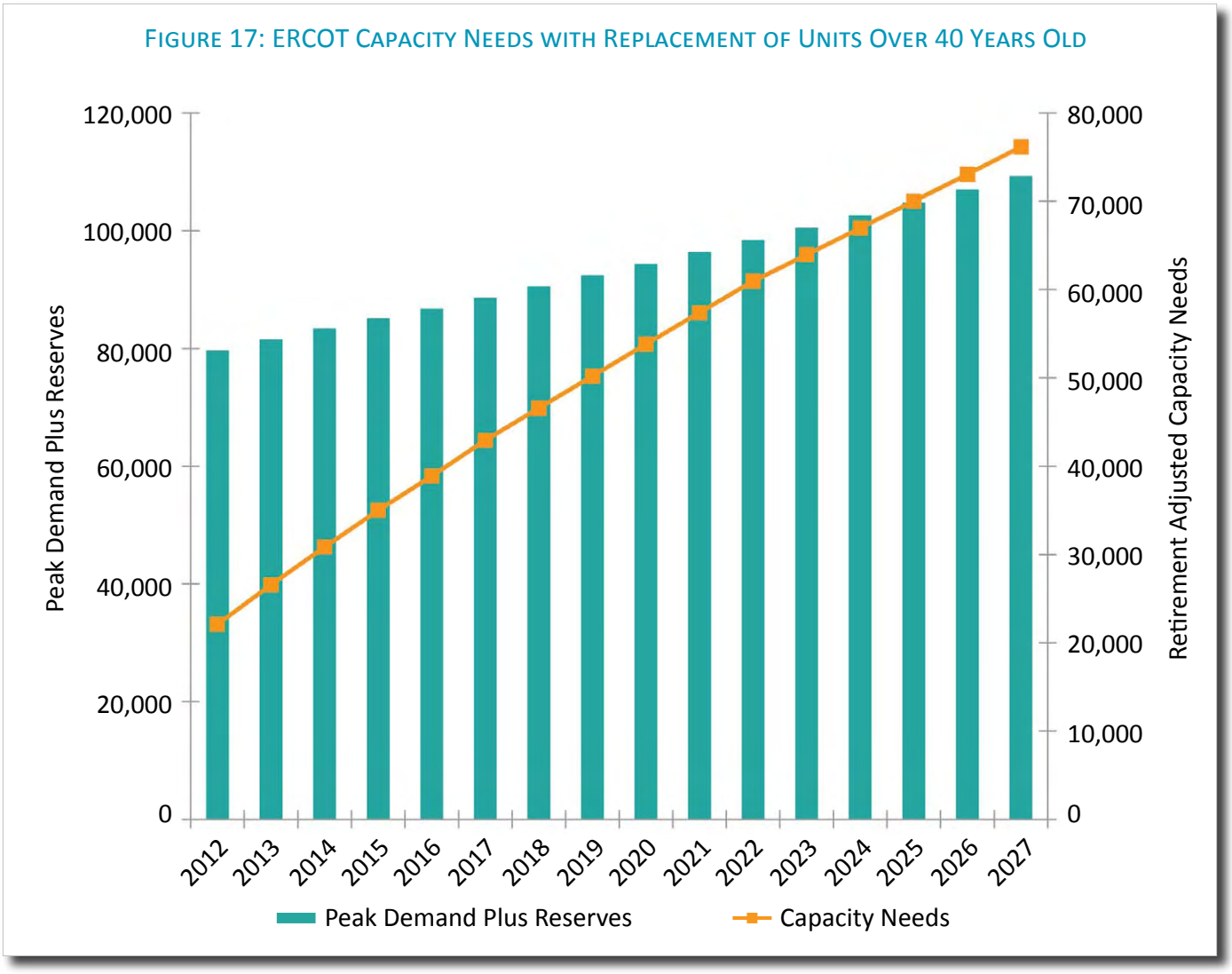
Beyond 2013, it appears that the market will continue to provide adequate resources, as there are additional units in the final phase of the interconnection process, but currently awaiting an air permit or final interconnection agreement. These additional resources range from 3,091 megawatts in 2009 to 19,068 megawatts in 2013.

This additional capacity will be needed because the generation fleet in Texas is aging, as shown in Figure 17. Approximately 10,000 megawatts of generation within ERCOT is currently over 40 years old, with many of the older units being located in major metropolitan areas. Over 40,000 megawatts of new capacity would be needed by 2017 and 75,000 megawatts by 2027 to meet the forecasted load growth of the state and to replace capacity over 40 years old.[6] Even if older units stay online until they are 50 years old, 20,000 megawatts of additional new capacity will be needed by 2017 and almost 64,000 megawatts will be needed by 2027.

1.6 Summary

This section has provided an overview of Texas' current energy landscape. This discussion has shown the benefits of the competitive wholesale and retail markets and the significant challenges that have emerged in the last several years. The next section will discuss the impact of these challenges on the wholesale electricity market, and provide the first set of recommendations for enhancing the ability of Texas' energy markets to adapt in this difficult environment.

Figure 17: ERCOT Capacity Needs with Replacement of Units Over 40 Years Old



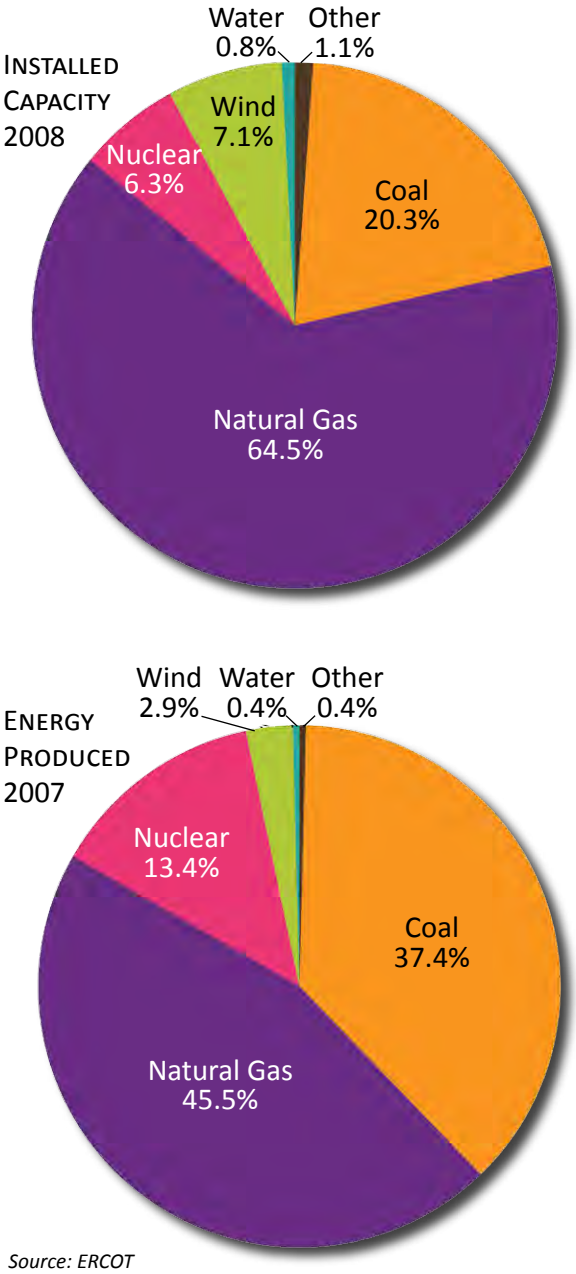
6 ERCOT. "Long-Term Peak Demand and Energy Forecast." ERCOT. May 2007. 7 July 2008 <http://www.ercot.com> Path: News; Reports and Presentations. ERCOT. "Report on Capacity, Demand, and Reserves." ERCOT. May 2007. 7 July 2008 <http://www.ercot.com> Path: News; Reports and Presentations.

2.1 Overview of Investment Trends

As discussed in the first section of this report, since the wholesale market was restructured in 1995, significant new investment in generation facilities has occurred, as new competitors entered Texas seeking to compete in the electricity market. (shown in Figure 18) Of the 37,000 megawatts of new generation capacity installed since 1995, the vast majority has been natural gas-fired generation. When initially constructed, this capacity provided a large amount of low-cost, environmentally friendly power to Texas, as the price of natural gas was less than $3 per MMBtu, and the production cost of these units was less than $30 per megawatts-hour. At the time, efficient combined-cycle natural gas-fired generation was the most cost-effective option available.

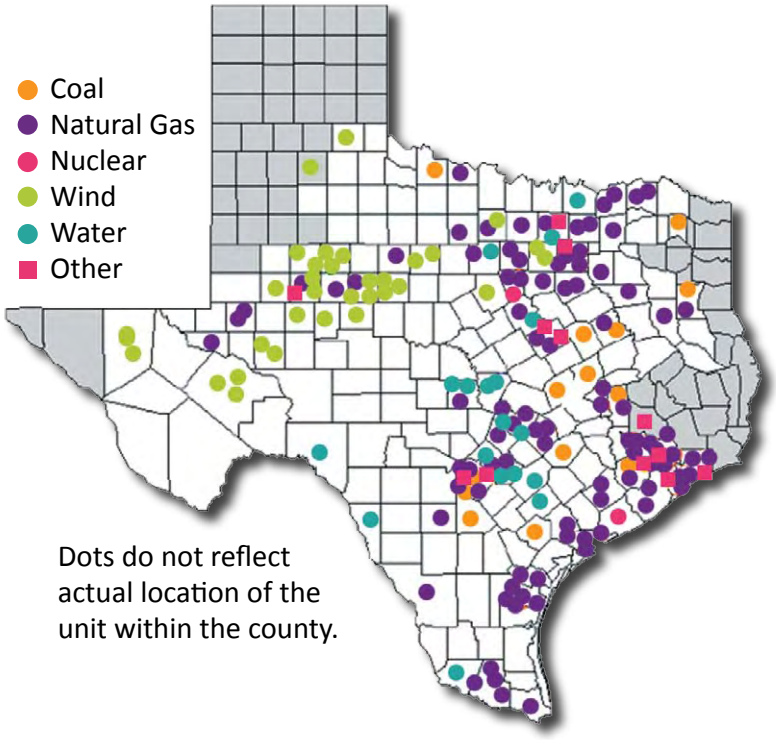
This large addition of generation, while providing a reliable electric grid for Texas, has increased the ERCOT region's reliance on natural gas. Today, installed capacity in ERCOT is 64.5 percent natural gas, (shown in Figure 19) and natural gas generation provides 45.5 percent of all energy consumed in the ERCOT region. Furthermore, natural gas generation is the marginal source of electricity production in virtually every hour, which means that market prices in both the wholesale and retail market are directly correlated with and impacted by increases in natural gas prices.

Figure 19: ERCOT Capcacity and Energy Mix by Fuel Type



Source: ERCOT

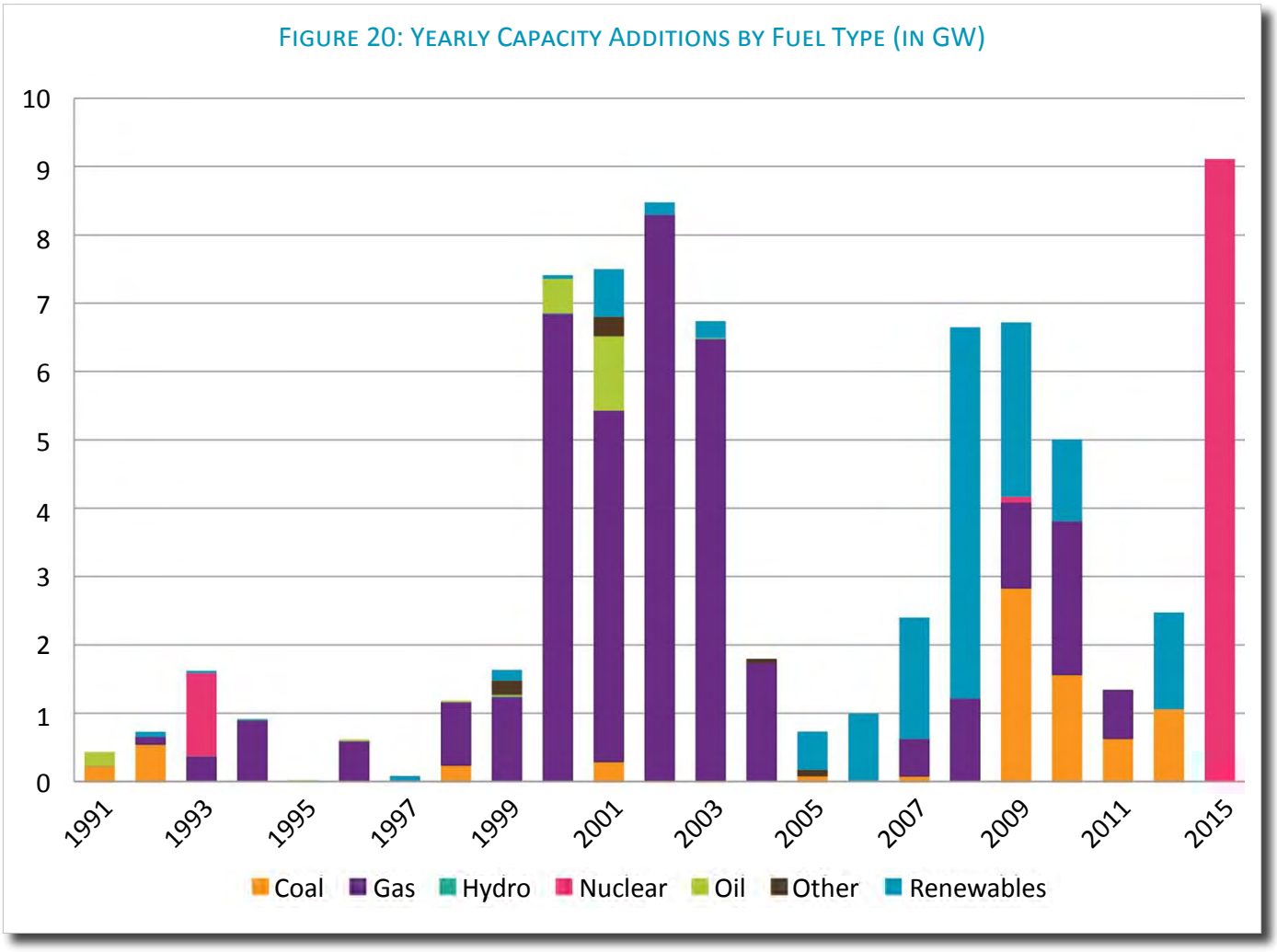
Figure 18: Location of ERCOT Generation Plants by Fuel Type



The addition of new natural gas generation has slowed, as natural gas prices have increased by almost 300 percent since the retail market opened. Ultimately, these high natural gas prices should send a market signal for generation companies to build non-natural gas facilities that are lower cost. Indeed, motivated by a combination of Texas' renewable portfolio standard, federal subsidies, and higher market prices resulting from the increases in the cost of natural gas, thousands of megawatts of wind generation have been installed in West Texas. While transmission expansion has lagged the installation of wind farms, wind energy has displaced natural gas generation, and this spring, has lead to significantly lower market prices in the western part of the ERCOT grid.

Additionally, generation companies in Texas are responding to these market signals by attempting to build additional coal and nuclear generation units. Figure 20 below shows the annual actual and projected capacity additions by fuel type. Approximately 6,000 megawatts of new coal capacity is expected to come online by 2015. While a large and beneficial addition to the ERCOT generation mix, even this amount of coal capacity will be insufficient to meet the energy needs of Texas, as an additional 3,000 megawatts of natural gas generation will be needed to meet the short term needs of Texas citizens. In the longer term, a sizable amount of new nuclear capacity is planned, 9,000 megawatts have been proposed; however, due to the lengthy permitting and construction process, it is unlikely to be online prior to 2015. Such investments illustrate the effectiveness of Texas' competitive marketplace to incent a diverse mix of generation resources.

FIGURE 20: YEARLY CAPACITY ADDITIONS BY FUEL TYPE (IN GW)



2.2 Current Challenges

2.2.1 Impact of Natural Gas Prices on Energy Prices and Investment Needed to Move Natural Gas Off the Margin

With such a large amount of natural gas generation meeting the electricity needs of Texas customers, the impact of high and volatile natural gas prices has significantly increased the cost of electricity since the market opened and made it more difficult for customers to manage and plan for their electricity usage.

The price volatility of natural gas has begun to lead Texas away from natural gas as a generation source and drive investment in other directions, though some amount of additional natural gas generation is likely to be needed in the short term.

Although companies are investing in other forms of generation such as coal, nuclear and wind, virtually all generation forms have their challenges, and Texas should proactively seek to remove potential barriers to these forms of generation. For example:

- Coal—The capital costs of building generation plants has increased greatly over the last two to three years due to significant increases in the costs of underlying materials, such as steel, concrete, copper, and other materials. Since coal generation is more capital intensive than natural gas, increases in materials cost have had a greater effect on the overall cost of generating electricity from coal than natural gas plants. Coal plants also face uncertainties relating to environmental regulation, including carbon regulation. While coal plants can potentially be outfitted with technology to capture and sequester CO_2, such technology is unproven in utility application and adds significant costs to building and operating coal power plants.
- Natural Gas—Texas has relied heavily upon natural gas in its fuel mix. Natural gas is relatively clean. Unlike baseload generation, such as coal and nuclear, gas-fired plants can be ramped up or down in order to meet fluctuating demand. Natural gas plants cost less to build than coal and nuclear plants, although the capital cost of natural gas-fired plants has increased due to the underlying costs of materials. As noted earlier, natural gas prices in the past few years have increased greatly and have been volatile, resulting in higher prices for electricity.
- Nuclear—No new nuclear units have been built in the U.S. in decades. Nuclear emits no carbon, so the uncertainty created by potential future federal carbon legislation, along with low fuel costs, makes it an attractive option. Significant incentives for new nuclear generation were also recently adopted by the federal government. However, those positive attributes must be balanced against a lengthy and costly permitting process, capital costs higher than coal plants and uncertainty regarding federal government decisions surrounding waste disposal.
- Wind—Wind energy benefits from recent improvements in technology, high federal subsidies, zero carbon emissions, and no fuel costs. However, wind energy is produced intermittently, and wind farms generally produce power during off-peak hours when demand is lowest. Substantial penetration of wind energy into the electric grid is likely to create additional costs to ensure that adequate natural gas, storage, demand-response, or other technologies are online and available to respond to inherent large fluctuations in wind energy production. The most robust wind sites are also usually in remote geographic locations, necessitating significant transmission investment to be able to efficiently move the wind energy to the parts of the grid with the highest demand.

- Solar—Solar energy benefits from improved economics, the on-peak nature of solar energy production, federal subsidies, zero carbon emissions, and no fuel costs. However, the capital investment costs of solar central station generation and photo-voltaic panels are extremely high and generation is intermittent.
- Biomass—Biomass, including wood and landfill gas, is an attractive renewable generation option in Texas because it uses waste from the agricultural and forestry sectors in the State. As discussed earlier, Texas law provides incentives for new biomass and landfill gas electrical generation. As a result of the incentives, biomass generation facilities have been built in Texas. Because the capital costs of building biomass plants are relatively high and because suitable fuel sources are limited, it is likely that biomass energy will remain a relatively small though important portion of the overall energy mix.
- Demand-Side Management–If implemented correctly, cost-effective DSM programs can be an inexpensive alternative to the cost of building new generation, and provide customers with opportunities to reduce their energy costs. As the cost of generation continues to increase, DSM becomes a more attractive way to manage demand.

Ultimately, a significant amount of non-gas generation will need to be brought online in order to move natural gas off the margin as the price-setting source of generation. ICF International (ICF) conducted an analysis of a variety of scenarios of new non-gas generation additions to the market by 2023, and compared power prices in each scenario to the base case, their results are shown below in Figure 21.

Figure 21: Analysis of New Generation Additions

Scenario	Description	Generation Mix (% of energy used)
Base		34% Gas, 48% Coal, 9% Nuclear, 9% Renewables
Scenario 1	Base + 24,000 MW of additional wind generation	32% Gas, 46% Coal, 9% Nuclear, 13% Renewables
Scenario 2	Base + 35,000 MW of additional wind generation	30% Gas, 39% Coal, 9% Nuclear, 22% Renewables
Scenario 3	Base + 6,000 MW of additional nuclear generation	31% Gas, 42% Coal, 19% Nuclear, 8% Renewables
Scenario 4	Base + 20,000 MW of additional coal generation	26% Gas, 57% Coal, 9% Nuclear, 8% Renewables
Scenario 5	Base + 28,000 MW of additional coal generation	17% Gas, 66% Coal, 9% Nuclear, 8% Renewables
Scenario 6	Base + 35,000 MW of additional coal generation	14% Gas, 70% Coal, 8% Nuclear, 8% Renewables

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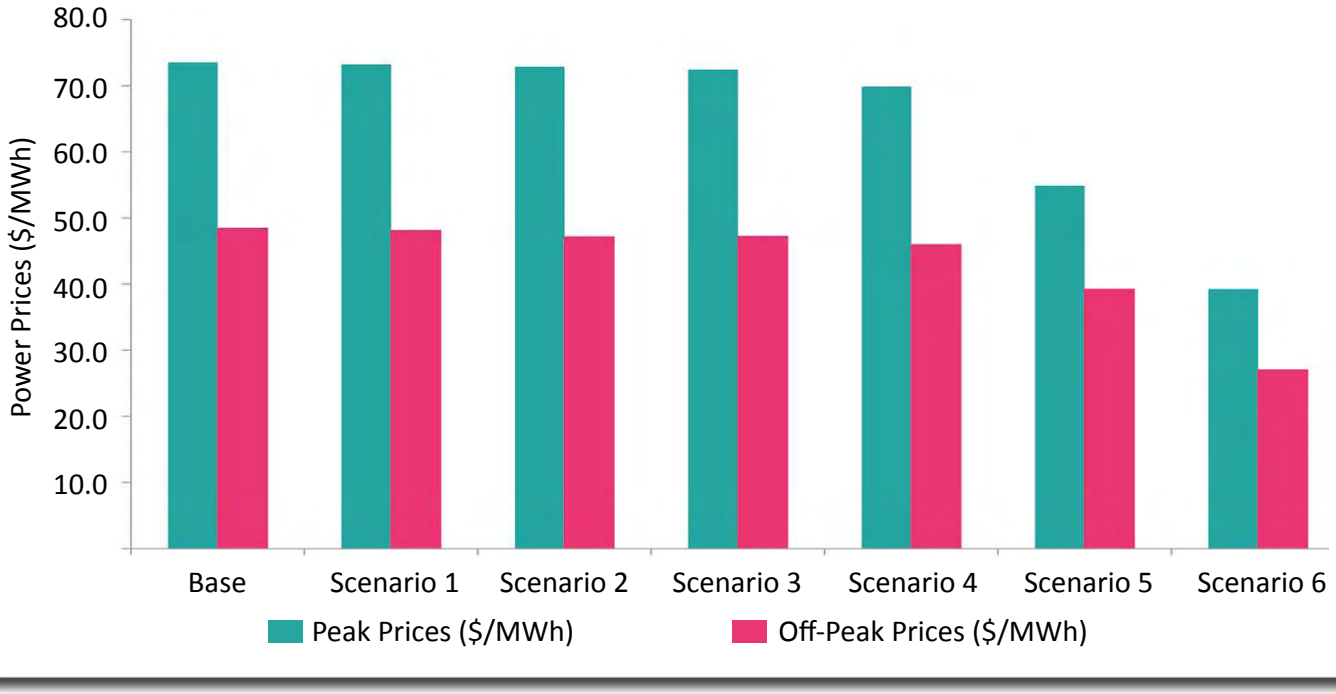
Figure 22: Impact of Generation Additions on Power Prices



As shown in Figure 22, ICF concluded that the wind and nuclear capacity scenarios (1-3) would not appreciably change the power prices, implying that gas would continue to be the marginal fuel during most of the hours. While much larger amounts of new nuclear generation would more appreciably impact prices, only a limited amount of nuclear generation is likely to be able to commence operation by 2023 due to the lengthy federal permitting process and construction time. Wind energy, due to its intermittent nature, does not produce enough energy to impact prices significantly.

ICF found that the introduction of significant amounts of coal capacity (exceeding 25,000 megawatts) was needed to lower power prices, because only the introduction of that level of coal capacity was sufficient to move natural gas generation off the margin in a large number of hours. What that means is this: there is a direct correlation between the price of natural gas and the price of electricity in Texas because natural gas sets the price of power. Only by introducing large amounts of non-gas baseload generation into the fuel mix would Texas be able to move natural gas off the margin and remove it from its price setting position. Because of the uncertainty created by potential federal carbon legislation, generation companies have been reluctant to construct new coal facilities, thereby eliminating the least costly form of baseload generation. As noted above, while nuclear energy could eventually provide sufficient capacity to remove natural gas-fired generation from the margin, only a limited amount of new nuclear generation is likely to come on line by 2023, given the lengthy federal permitting and construction timelines associated with this generation.

2.2.2 Costs of New Construction

ICF and the PUC estimated the production and total costs of the generation technologies that form the bulk of the fuel used for energy now to determine if there are economic barriers due to high capital costs for the addition of a large amount of nuclear and coal fired generation.[7] Figure 23 shows these estimates at two ranges of natural gas prices ($9 and $13.50 per MMBtu for natural gas) and coal prices ($1.80 per MMBtu and $2.70 per MMBtu) for the major baseload generation technologies and wind energy.

The cost estimates in Figure 23 include ICF's current estimates of the capital costs for the various technologies, which are significantly higher than several years ago due to rapid increases in the cost of steel, concrete, copper, and other materials. As a result of these cost increases, all generation technologies have become significantly more expensive to construct than just a few years ago. This analysis does not assume any federal or state subsidies for any technology. Existing subsidies can significantly offset some of the costs of these technologies, but are not included in this analysis because over the long term, the continued existence of the subsidies cannot be reliably predicted.

As illustrated by Figure 23, pulverized coal is the lowest-cost resource over the life of the plant at current fuel prices, suggesting that absent any barriers, a substantial amount of new coal generation would be expected. However, as discussed in the next section, the threat of a federal CO_2 emissions tax has created a significant market barrier to this cost-effective generation, as such regulation will add substantial and uncertain costs on to coal-fired electricity production. Additionally, Texas has a valuable resource in its lignite deposits, which competes favorably with Powder River Basin coal on a tonnage basis to meet Texas' coal demand. Texas' lignite resource, its coal capacity, and its ability to respond rapidly to market conditions are all threatened by potential federal carbon legislation, resulting in adverse implications for the Texas coal industry, generation companies, and Texas electric customers, who should have the ability to benefit from an electric supply that is made more diverse and cost-effective with coal in the generation portfolio.

FIGURE 23: FUEL AND LEVELIZED COSTS OF VARIOUS GENERATION TECHNOLOGIES ($ PER MWH)

GENERATION TYPE	FUEL COSTS	AVERAGE COST OF GENERATION
Natural Gas-Combined Cycle ($9 per MMBtu)	$64	$93
Natural Gas-Combined Cycle ($13.50 per MMBtu)	$91	$120
Natural Gas-Combined Cycle w/CO2 Sequestration ($9 per MMBtu)	$70	$117
Natural Gas-Combined Cycle w/CO2 Sequestration ($13.50 per MMBtu)	$105	$146
Pulverized Coal ($1.80 per MMBtu)	$16	$92
Pulverized Coal ($2.70 per MMBtu)	$24	$101
Pulverized Coal w/CO2 Sequestration ($1.80 per MMBtu)	$24	$138
Pulverized Coal w/CO2 Sequestration ($2.70 per MMBtu)	$35	$150
IGCC Coal ($1.80 per MMBtu)	$16	$128
IGCC Coal ($2.70 per MMBtu)	$23	$136
IGCC Coal w/CO2 Sequestration ($1.80 per MMBtu)	$19	$154
IGCC Coal w/CO2 Sequestration ($2.70 per MMBtu)	$29	$163
Nuclear	$5	$117
Wind (Intermittant resource)	$0	$112

7 Solar energy is not shown because the costs of the generation are still substantially higher than any of the other resources. Biomass and geothermal are not shown because of the relatively limited applications of those technologies.

2.2.3 Uncertainty Created by Potential CO_2 Regulation

Federal regulation of CO_2 emissions has the potential to impose tremendous costs on Texas and restrict the ability of the competitive market to provide the types of generation units that would lower the cost of energy.

Texas companies produce 30 percent of the natural gas consumed in the U.S. and 19 percent of total U.S. oil production. Additionally, virtually all electricity consumed within Texas is produced within the state as opposed to being imported from other regions. Because Texas produces so much of its own energy and exports some forms of energy to the rest of the nation, Texas will be adversely affected by carbon legislation in a disproportionate manner, much more than states that produce little energy, or ones that import energy from other states, such as California. Areas that have an abundance of hydroelectricity, like the Pacific Northwest, will be significantly less impacted than Texas. Figure 24 below shows carbon emissions by state in 2005. Texas emitted just over 660 million tons of carbon in 2005, 11 percent (almost 6 billion tons) of total U.S. emissions.

FIGURE 24: CO_2 EMISSIONS FROM FOSSIL FUEL COMBUSTION BY STATE, 2005
(MILLIONS OF METRIC TONS)

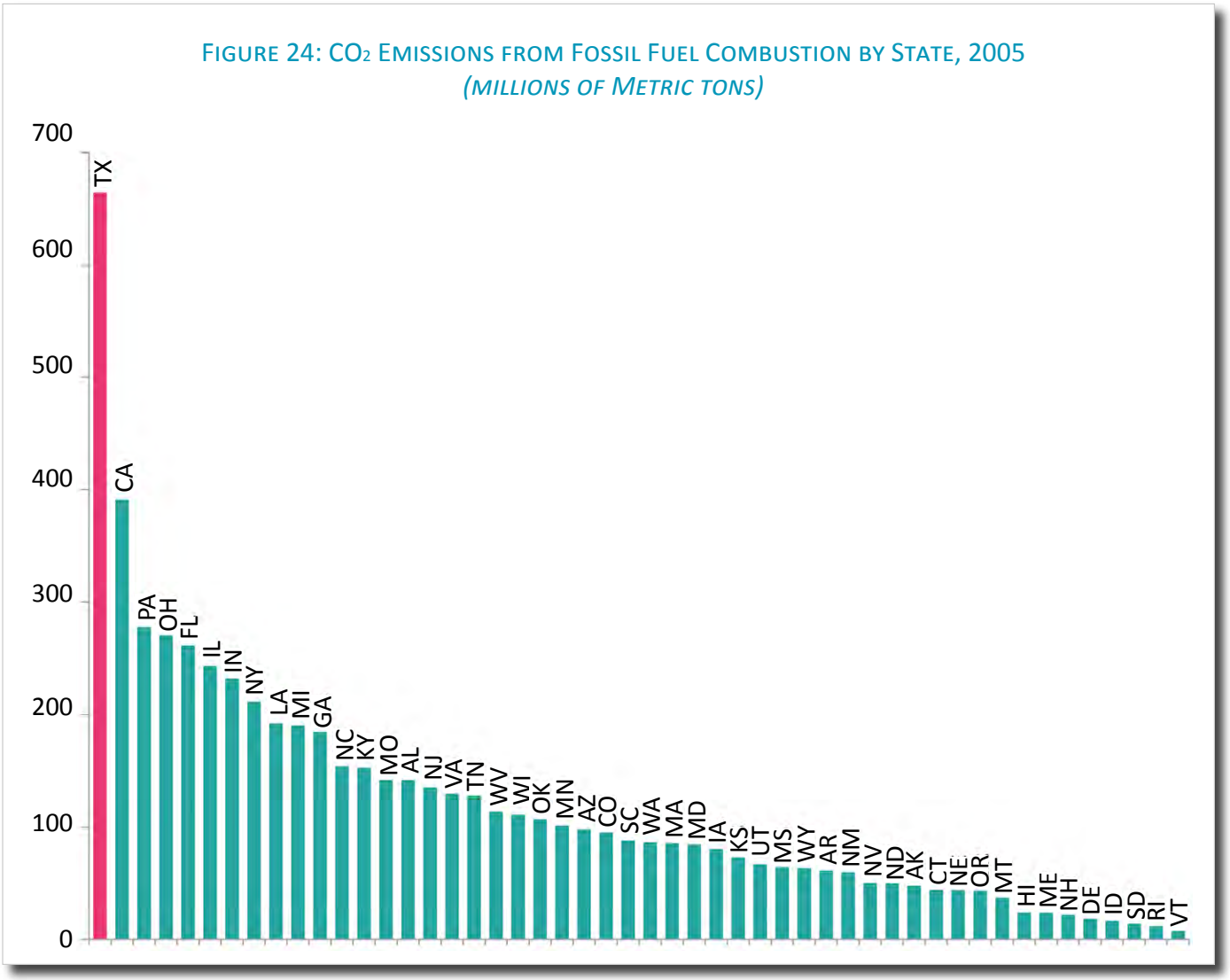


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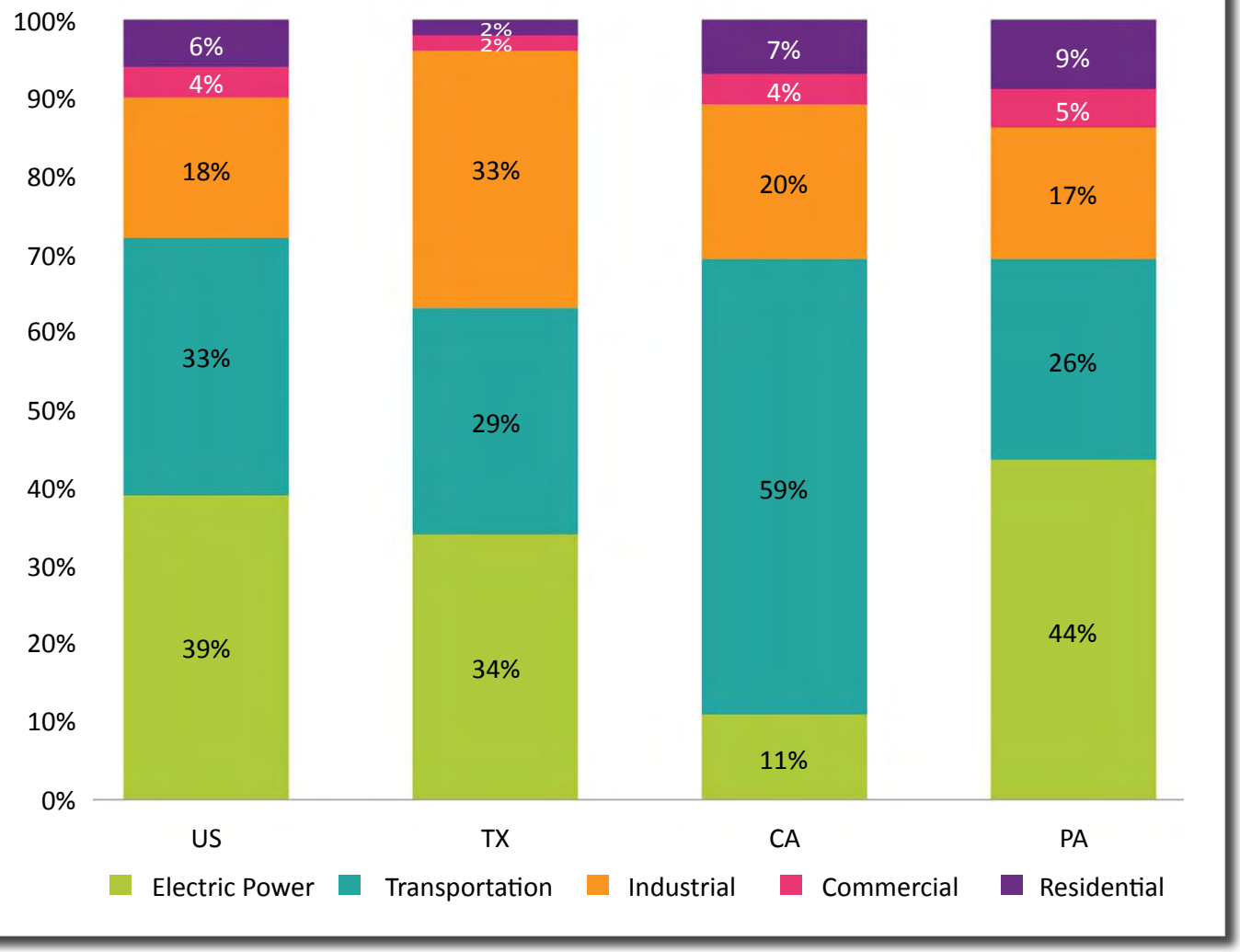
FIGURE 25: SHARE OF CO_2 EMISSIONS BY SECTOR, 2005



These large carbon emission numbers must be put into context. As stated earlier, Texas is the largest producer of natural gas consumed in the U.S., and produces 19 percent of the total oil consumed in the form of gasoline, jet fuel, and feedstock for other industrial processes. Figure 25 above compares the relatively larger industrial share of Texas' carbon emissions to that of other parts of the country.

Additionally, Texas' carbon emissions reflect: (1) the large amount of megawatts of electricity generated in Texas; (2) the state population and the relatively high rate of electricity demand growth due to Texas' growing economy; (3) Texas' climate, which requires large amounts of air conditioning and cooling; (4) the electricity fuel mix, which heavily relies on natural gas and coal; (5) the heavy industrial output of the state, which provides for the product needs of the nation; and (6) a large transportation sector that encompasses trucking, railroads, barges, airplanes, tankers, and automobiles.

Even without federal regulation, Texas has proactively addressed means to lessen the state's electricity generation facilities environmental impact and industrial output. Since 1999, annual NOx emissions have fallen 22 percent from non-electricity generating units and by more than 57 percent from electricity generating units. Similarly, SO_2 emissions have fallen by about 15 percent from non-electricity generation facilities and more than 22 percent from electricity generating units during the same period. These comparisons are displayed in Figures 26 and 27 respectively.

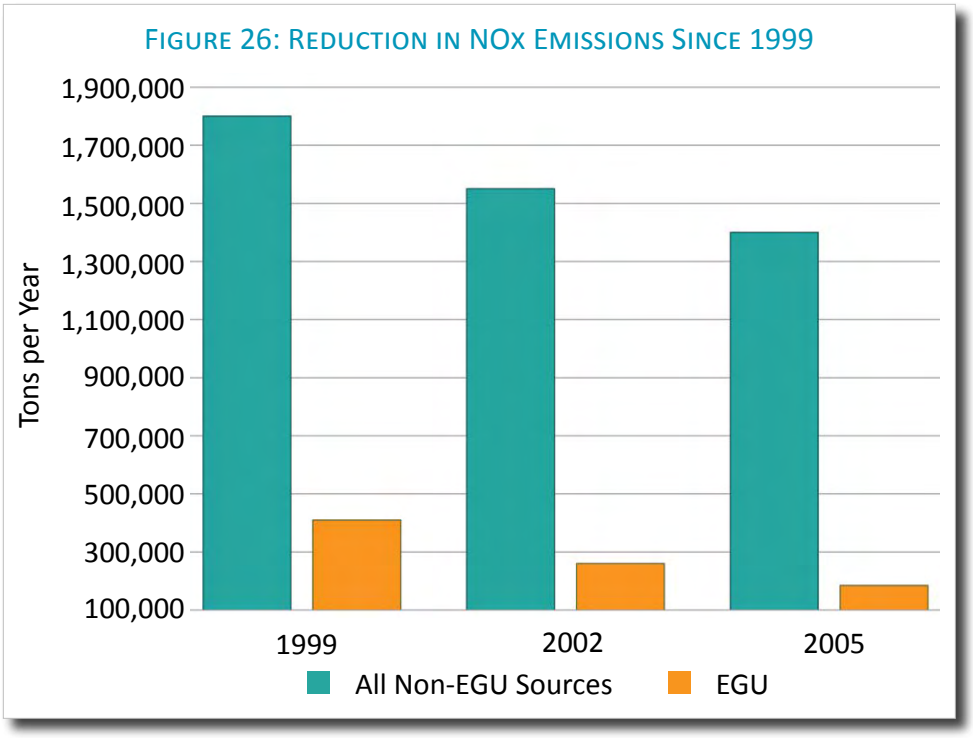


FIGURE 26: REDUCTION IN NOX EMISSIONS SINCE 1999

These emissions reductions have come from a combination of proactive policies adopted by Texas, as well as the effects of Texas' well-functioning competitive market, which has caused the retirement or mothballing of a sizable number of older, less efficient, and higher-polluting facilities.

Driven by high natural gas prices, excellent wind resources, relatively few siting issues due to the low population density in West Texas, a viable wholesale market in which to sell the energy, and the state's commitment to build the transmission necessary to export wind energy to where it is most needed, Texas has led the nation in the development and installation of thousands of megawatts of new wind generation.

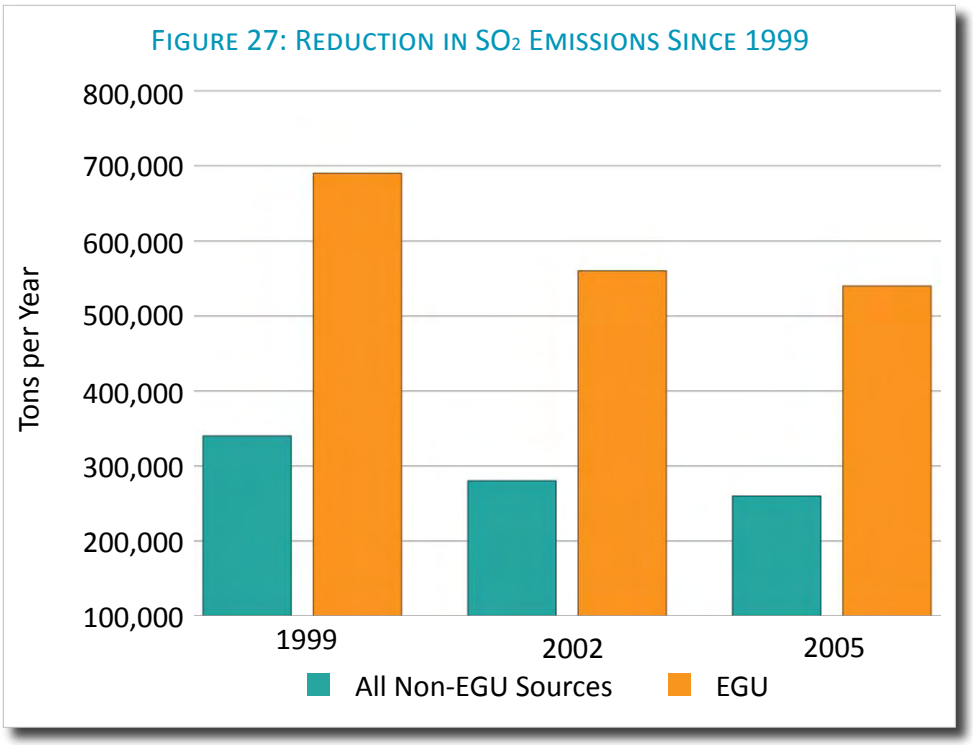


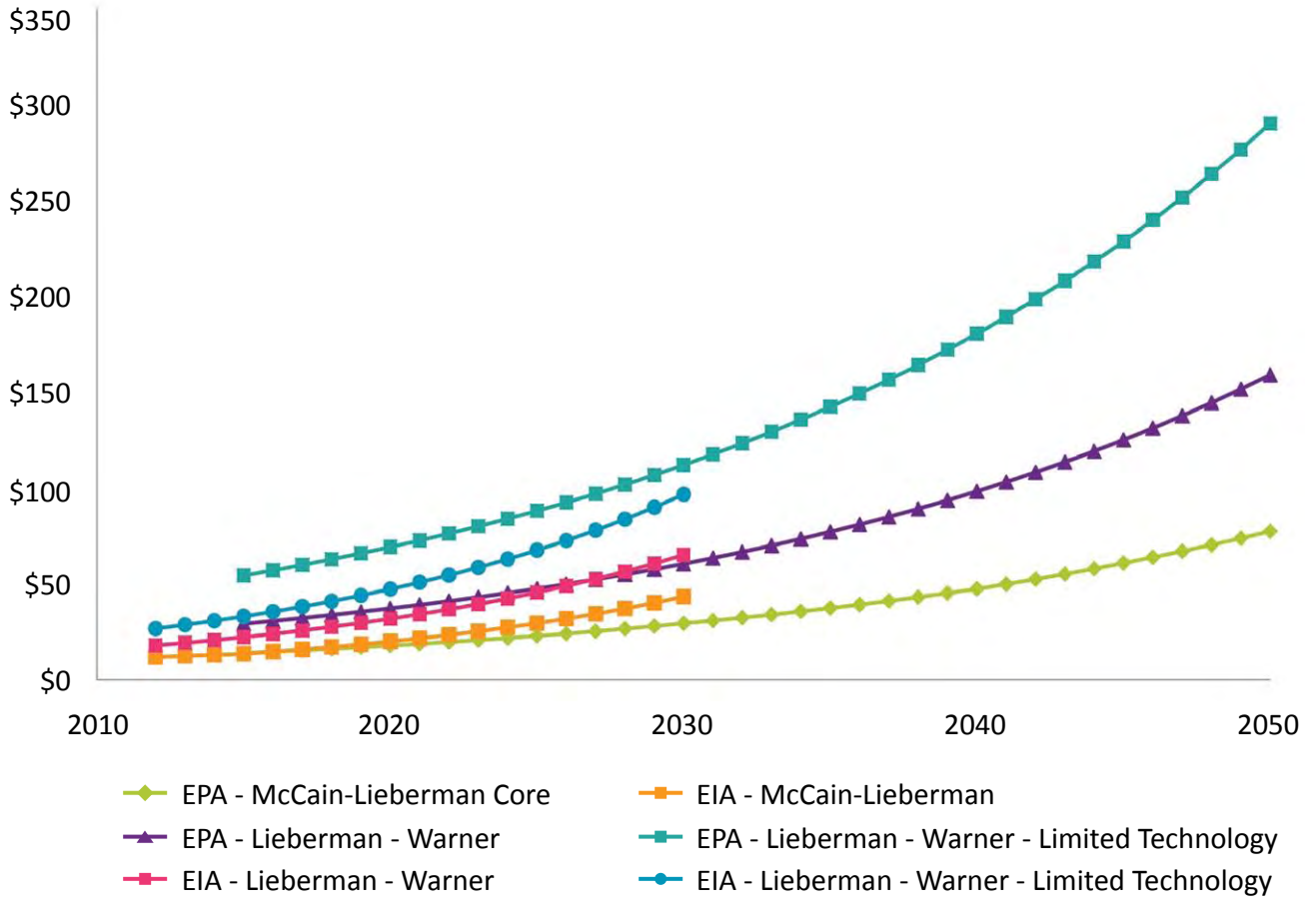
FIGURE 27: REDUCTION IN SO_2 EMISSIONS SINCE 1999

Texas has also been a leader in the use of CO_2 in enhanced oil recovery (EOR) operations and has one of the largest CO_2 storage potentials of any state. EOR is the injection of CO_2 into oil wells as a means to increase the recovery of additional oil at existing wells. EOR operations have been underway in the Permian Basin of west Texas since 1972, during which time, over 55 million tons of CO_2 have been injected.[8]

Texas' future generation mix is impacted by the threat of carbon regulation, causing market reluctance to add the quantity of coal generation that could meaningfully lower market prices. Should the federal government enact draconian and costly carbon regulations, certain types of generation will effectively be barred from construction, unless costly carbon capture and sequestration technologies are added to the plants.

Figure 28 presents the CO_2 emission allowance price forecasts for the McCain-Lieberman and Lieberman-Warner bills, as evaluated by Energy Information Administration (EIA) and the Environmental Protection Agency (EPA). The price projections are driven by several key assumptions, including the availability of new technologies (especially new nuclear plants and carbon capture technologies), the extent of electric demand growth, the availability of offsets, and natural gas prices.[9]

FIGURE 28: PROJECTED CO_2 PRICES FROM RECENT EIA AND EPA ANALYSES
2005 DOLLARS/TON CO_2



8 Han, W., B. McPherson, and F. P. Wang. "CO_2 Sequestration in the Permian Basin SACROC Northern Platform, Site of 35 Years of CO_2 Injection." American Geophysical Union, Fall Meeting 2006. Abstract #H21A-1356. Dec 2006. 7 July 2008 <http://adsabs.harvard.edu/abs/2006AGUFM.H21A1356H>.

9 The CO_2 allowance price impacts described above are not necessarily reflective of ICF's own internal CO_2 forecast. ICF's CO_2 price forecasts are generally lower than those shown in Figure 28.

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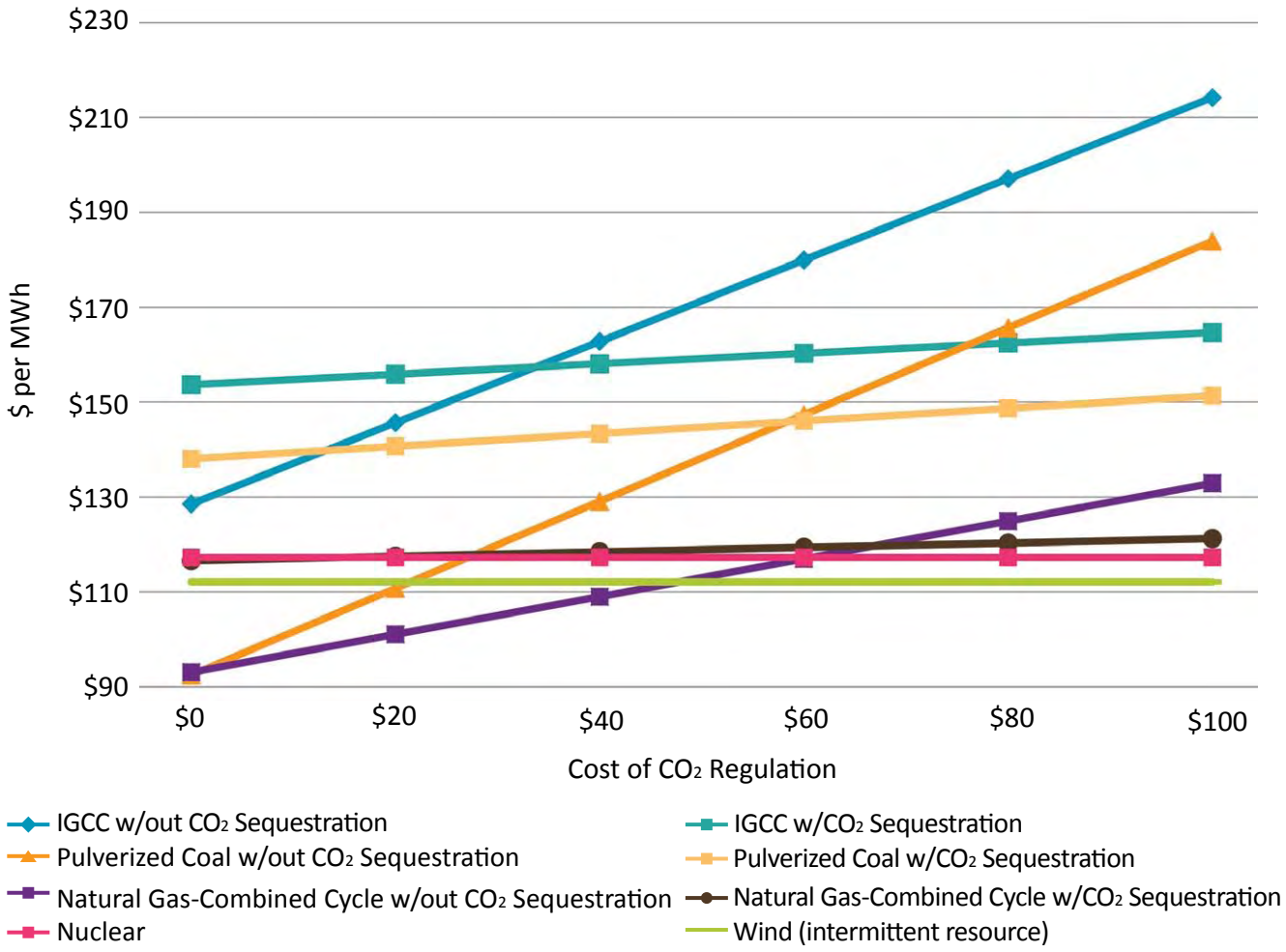
Figure 29: Impact of Carbon Regulation on Levelelized Cost of New Generation: $9 per MMBtu Scenario



The cost of CO_2 emission regulation, whether such regulation is accomplished directly through a carbon tax or indirectly through a cap-and-trade allowance scheme, will play a significant role in the development and adoption of generation technologies. ICF and the PUC analyzed the potential impact on the cost estimates shown in Figure 23 for a range of carbon cost scenarios. Figure 29 above shows the results assuming natural gas prices return to a $9 per MMBtu range. Again, this analysis does not include any presumed level of state or federal subsidies for specific generation technologies, nor does it presume that certain technologies will be preferentially allocated CO_2 allowances or otherwise exempted from the regulation. Wind power is shown for reference, but is not directly comparable to the other technologies because of its intermittent nature.

At $9/MMBtu natural gas prices, coal, and natural gas-combined cycle generation technologies are the most competitive. At approximately $30 per ton of CO_2, coal becomes more expensive than nuclear power. Natural gas-combined cycle plants are the least expensive option until carbon prices reach $60 per ton of CO_2 when nuclear becomes more competitive. All carbon sequestration technologies remain more expensive than combined cycle and nuclear at carbon levels even as high as $100 per ton.

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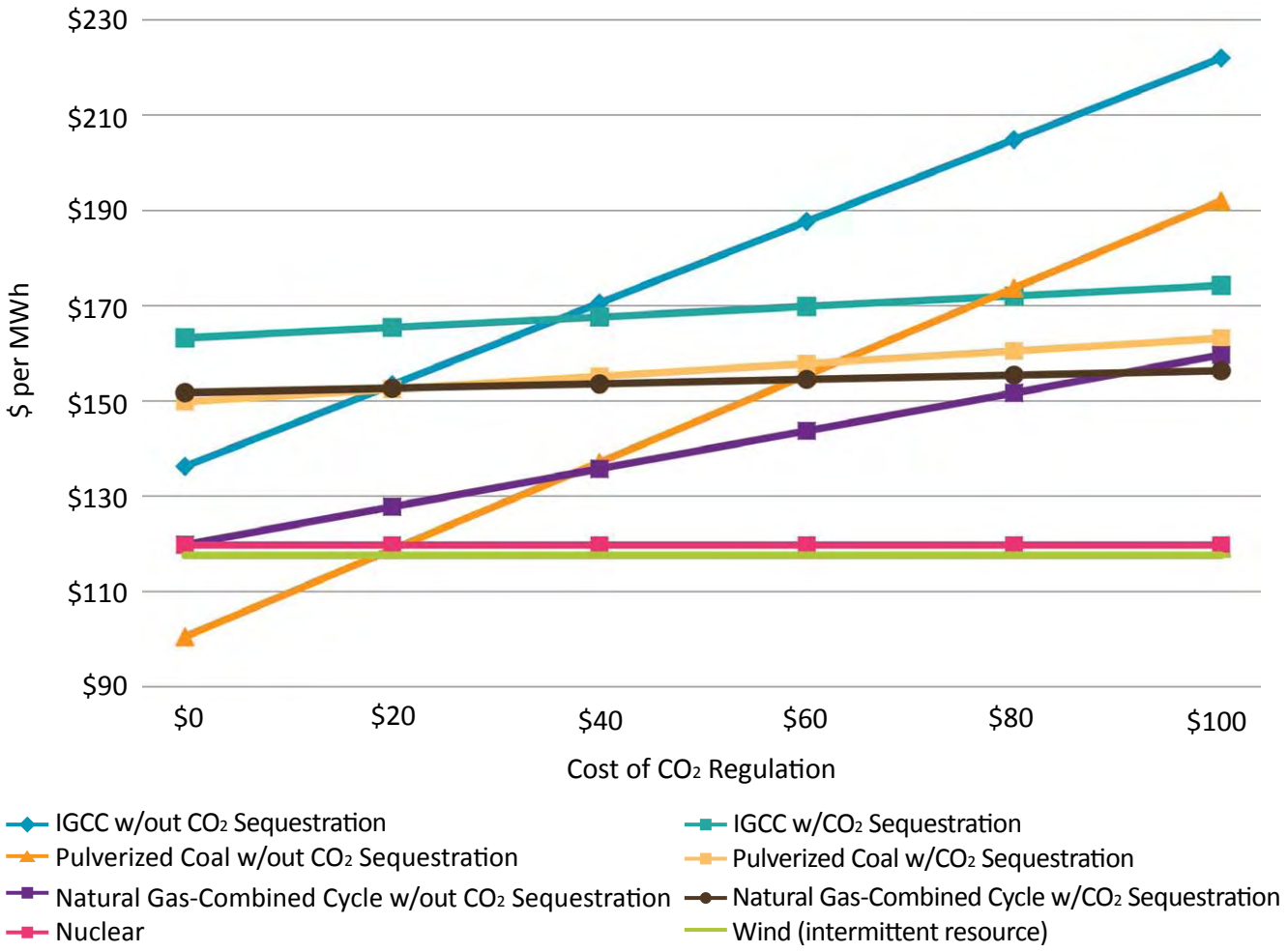
Figure 30: Impact of Carbon Regulation on Levelelized Cost of New Generation: $13.50 per MMBtu Scenario



While it is perhaps counter-intuitive that natural gas generation remains a low-cost option even at this relatively high natural gas price, the significant increase in capital costs for coal and nuclear plants has erased some of the fuel cost benefits of these resources. Because natural gas generation produces roughly half the CO_2 emissions of coal generation, the increased cost of carbon regulation has a smaller impact on natural gas generation. This analysis does explain current generation development trends in Texas: with carbon costs in the low-to-mid range ($20 to $40 per ton), all of the main generation technologies (natural gas, nuclear, pulverized coal, and wind) all converge at roughly the same total cost. Thus, one would expect that the market would develop a mix of resources, as it is doing.

Figure 30 shows the same analysis, but assumes a 50 percent increase in the price of natural gas (to $13.50 per MMBtu) and coal (to $2.70 per MMBtu).

At natural gas prices of $13.50 per MMBtu, if there is no carbon regulation, natural gas becomes a less attractive resource as pulverized coal is significantly cheaper than natural gas and nuclear power is cost competitive with natural gas. As carbon costs increase to $20 per ton, nuclear becomes the least expensive option. Under very high costs for CO_2 emissions, natural gas-combined cycle plants and nuclear generation remain the two least expensive non-wind options.

Figures 29 and 30, along with Figure 22, clearly illustrate that the threat of carbon regulation is making it exceedingly difficult for the competitive electric market in Texas to develop the low-cost resources necessary to lower the end use customers' cost of electricity. Although Texas' competitive market is likely to prove to be much more adept at responding quickly to these rapidly changing and uncertain market conditions, there is no doubt that this uncertainty comes at a cost to Texas consumers. Regulated markets are likely to move more slowly, thus inserting lag and the unavoidable cost associated with that lag. Additionally, in regulated markets, once regulators approve a new generation facility, the risks that an investment will later prove to be an unwise choice due to changing market conditions or technological advances will generally be borne by ratepayers.

However, Texas must ensure that barriers to constructing new generation are as low as possible to facilitate a quick market response to this challenging environment. The remainder of this section will discuss targeted proposals to lower these barriers and facilitate the most efficient market response to Texas' energy needs.

2.3 Recommended Actions

2.3.1 Cost-Effectively Slow the Rate of Demand Growth

As seen in Figures 23, 29, and 30, all capacity additions are likely to be significantly more expensive than just a few years ago, due to rising fuel and capital costs. The threat of carbon legislation and uncertainty about its potential cost creates a wide range of possible outcome for the marketplace to evaluate when making new generation investment decisions. Carbon regulation is likely to create additional upward pressure on electricity prices, even beyond the actual costs of CO_2 emissions, as virtually every input to building power plants is likely to become more expensive. Finally, draconian and costly CO_2 regulation will likely cause additional demand for natural gas, given its relatively low CO_2 emissions, which will increase the price of natural gas, causing an increase in the market price for electricity in Texas.

Because of these factors, Texas is likely to benefit from additional energy efficiency and DSM that slow the rate of demand growth and shift energy usage to off-peak hours where existing capacity sits idle. This issue is addressed in greater detail in Section 4 of this report, as are specific recommendations.

Even with reduced demand growth, Texas will still need additional generation to meet the demand growth and to replace old generation units, some of which may be forced into early retirement by carbon regulation.

2.3.2 Allow the Market to Continue to Provide the Most Cost-Effective Mix of Resources

While many will suggest that the answer to these energy challenges is to dictate or mandate investments in certain generation technologies, such measures are likely to only further increase costs to consumers or have unintended consequences. Increasing energy prices will, as a normal function of markets, create incentives for customers, generators, and REPs to find the lowest cost resources to meet demand, including creating incentives for investments in alternate energy resources that today may not be economic. Additionally, markets will respond to bring technological advancements much faster than regulators or legislative bodies can.

As an example, Texas currently mandates, through a Renewable Portfolio Standard (RPS), that 5,880 megawatts of renewable energy be provided by 2015 and sets a target of 10,000 megawatts by 2025. Of these amounts, 500 megawatts is set aside to be supplied from non-wind sources. Texas is expected to exceed the initial mandate before the end of this year, if it has not already done so, and will unquestionably exceed the 10,000 megawatts goal within a few years, far in advance of the goals set by the legislature. Some have suggested that, because the market is drawing so much investment in wind generation, the mandate is unnecessary and should be removed, while others suggest increasing the RPS. Increasing the mandate is unnecessary in light of the significant investment currently taking place. Removing the mandate adds an equal level of uncertainty to a market that is functioning well.

To meet the energy challenges of the state, Texas should allow the marketplace to drive investment in all forms of generation resources and no new technology-specific mandates should be implemented. A mandate requiring one technology may serve as a disincentive to other equally beneficial technologies, and is likely to raise costs to customers and businesses in the state. Most importantly, the Texas competitive wholesale model is working to bring diverse new generation investment to the state and any new policies should do no harm through creating unnecessary regulatory and legislative intervention.

Texas currently has a requirement that a certain percentage of new generation installed in the state after 1999 be natural gas-fired generation. Such a requirement is an inappropriate preference to a particular generation technology, especially given the increase in natural gas prices that has occurred since the passage of this provision.

- ✓ RECOMMENDATION 1: Recognizing that the combination of incentives and competitive market forces in place in Texas resulted in more rapid investment in wind energy than in any other state, Texas should promote the competitive marketplace by neither increasing nor removing the mandates for renewable energy.
- ✓ RECOMMENDATION 2: The Legislature should repeal the presumption in PURA in favor of gas-fired plants in order to ensure that a diverse mix of resources is developed in Texas.
- ✓ RECOMMENDATION 3: Texas should not institute any new power plant permitting processes, as this would insert costly delay, erect barriers to entry, and eliminate the ability for Texas' competitive marketplace to respond quickly to changing market signals. Legal and regulatory certainty is critical for the competitive marketplace to function. Numerous states have lengthy and costly permitting processes for wind, and gas- and coal-fired generation; Texas has avoided this by permitting only emission and water aspects of generation plants.

2.3.3 Remove Barriers to Adding New Nuclear Generation

As noted throughout this Energy Plan, the Texas wholesale market should continue to incent private investment in a diverse generation portfolio. Nuclear power plays an important role in providing necessary diversity and is unaffected by the uncertainty surrounding federal carbon legislation. Although jurisdiction over nuclear issues largely resides with the federal government, Texas can assist in the development of new nuclear facilities by ensuring that any permitting done by Texas is done in a timely manner.

- ✓ RECOMMENDATION 4: To encourage the development of nuclear power in Texas, the TCEQ should expedite necessary water and wastewater permits associated with new nuclear power plants. While all design and site permits reside with the Nuclear Regulatory Commission, ensuring that these state permits do not delay development is critical.

For decades now, the federal government has failed to provide potential nuclear generation investors with certainty regarding nuclear waste disposal. Texas A&M University has more expertise in the area of nuclear generation than any other university in the United States. Texas should not continue to wait for the federal government to fulfill its obligation in this area, but should instead take advantage of the state's expertise to research opportunities regarding the entire nuclear fuel cycle.

- ✓ RECOMMENDATION 5: The state should establish a partnership between institutions of higher education and industry to research opportunities regarding the entire nuclear fuel cycle, including recycling spent fuel. France obtains 75 to 80 percent of its electric power from nuclear generation facilities, but in the United States, continued uncertainty about nuclear waste disposal remains an ongoing uncertainty for nuclear plant developers, and exploring possibilities to recycle spent nuclear fuel may help resolve this issue.

2.3.4 Address Barriers to Growth in the Wind Industry, While Reliably Integrating Wind into the Grid

Texas has experienced unprecedented growth in the wind generation sector in recent years. The amount of wind generation in Texas exceeds that of any other state by a wide margin, and emphasizes Texas' leading role in meeting the challenge of changing market conditions. Further, there are increasingly positive externalities in terms of wind technology development and manufacturing (e.g., wind turbine design and manufacturing) as Texas continues to be the leader in renewable technology adoption. Finally, wind generation can decrease natural gas consumption by displacing generation from natural gas units at times when wind energy is produced.

Recent operational issues with wind have illustrated the need to ensure that adequate operating reserves are available to offset the sudden drop-off of wind generation, and that wind generation is appropriately incorporated into ERCOT's grid operations. In February of 2008, ERCOT had to implement emergency procedures to account for a rapid decline in available operating reserves. While other generation outages and issues contributed significantly to the event, a large and sudden decline in wind energy production was a contributing factor. This event illustrated the need for ERCOT to use new state-of-the-art forecasting tools to better estimate the amount and rate of fluctuation of wind energy production, to proactively identify operational issues that are likely to arise from the continued expansion of wind power on the grid, and to explore means of providing better incentives or requirements for wind generation operators to schedule their power more accurately.

Because of the extensive wind activity in the western part of the grid and the current limited transmission out of the area, power prices in the western ERCOT power grid region have been lower than the rest of the ERCOT region this spring. At times this spring, power prices in the western part of the grid have been negative. As the installed wind capacity has continued to grow over the past year, ahead of the needed transmission expansions, the frequency of these negative price periods has increased, as shown in Figure 31.

FIGURE 31: EFFECTS OF WIND CAPACITY ADDITIONS ON WEST ZONE POWER PRICES

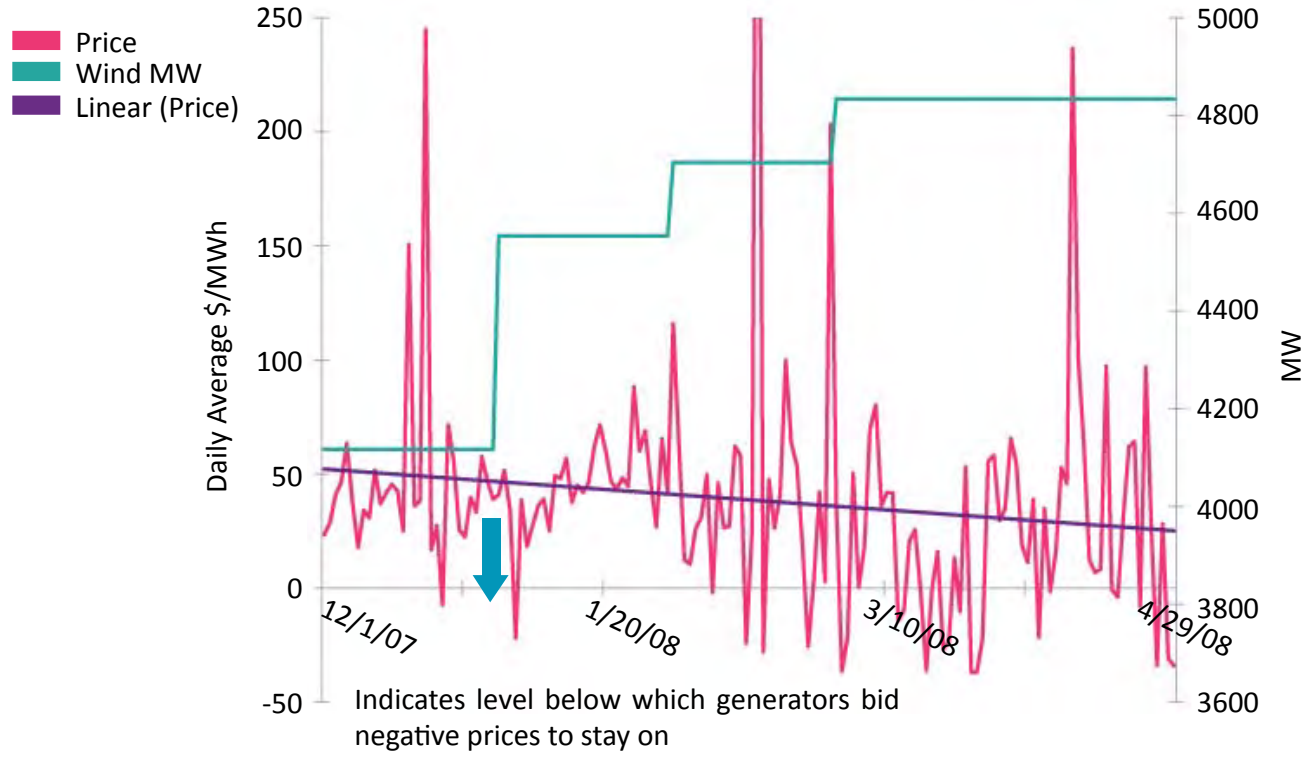


Figure 32: Weighted Average Price of Balancing Energy by ERCOT Zone

HUB	Mar 2008	Feb 2008	Jan 2008	Dec 2007
South	$57.97	$64.73	$58.46	$49.29
North	$67.72	$58.83	$67.91	$48.29
Houston	$66.33	$64.29	$57.61	$53.05
West	($11.11)	$46.21	$35.64	$60.04
ERCOT HUB	$55.79	$60.94	$59.39	$50.70

ERCOT recently calculated that the weighted average prices of balancing energy was negative for the month of March 2008. Those results are shown in Figure 32 above.

While the provision of wind energy to the market has the potential to create a tremendous benefit for customers, it has also made it difficult for other types of generation in this area (primarily coal and natural gas generation) to be economically viable. As a result, prices for certain types of operating reserves have been much higher this spring than in past years.

Ultimately, to maintain developer confidence in the markets, the solution is to increase transmission capacity out of West Texas to the rest of the grid in order to move this wind power to the major demand centers in the state as rapidly as possible. These transmission issues and the associated recommendations are discussed in the next section.

Given the inability of many baseload units (especially nuclear) to decrease production at times of high wind production and the need to keep some fossil fuel units online to provide operating reserves to the system, even with substantial transmission additions, there is a limit to the amount of wind energy that the ERCOT grid can accommodate during low demand periods in the spring and fall. As a result, ERCOT may be required to limit the amount of wind energy generation during these periods and operating reserves may become very expensive because the downward pressure that wind generation may put on prices makes it difficult for controllable generation to stay economically online.

Energy storage technologies have the potential to address these issues. Such technologies store excess wind energy in a form that can be released at a later time when demand is higher. Texas has a number of mature oil fields that could be used for compressed-air energy storage (air is pumped in during off-peak periods when power prices are low and extracted for extra power generation during peak periods when power prices are high), and market participants are exploring other options for compressed air storage or large-scale batteries. These technologies also have the potential to provide greater use of new transmission facilities built in West Texas. These technologies, however, are not yet commercially viable. Several initiatives should be explored to help mature these technologies.

- ✓ Recommendation 6: The state should establish an innovation prize or prizes, funded with private-public revenue, for the commercialization of large-scale energy storage.
- ✓ Recommendation 7: The PUC and ERCOT should study whether an additional operating reserve service to help manage the intermittency of wind energy or other alternative energy sources would be a cost-effective solution to more reliably integrating these energy resources to the grid. Such a service could be provided by quick-start natural gas units, demand-response by customers, or storage solutions.

In addition to reliably integrating wind generation in West Texas, the state should continue to encourage the development of wind energy resources both onshore and offshore along the Texas Gulf Coast. Onshore and offshore Gulf Coast wind energy resources are expected to be more synchronized with the daily demand patterns, so wind is more likely to be available when it is needed the most to meet demand. The onshore and offshore Gulf Coast wind resources typically have fewer incremental transmission requirements; however, the two current coastal wind energy projects have encountered siting controversies due to migratory bird patterns and other coastal ecosystem concerns.

2.3.5 Provide Incentives of Defined Duration and Cost to Solar Technologies to Assist in Making These Technologies Cost-Effective

Texas has a solar intensity base that is among the best in the country. This resource creates the potential for deployment of both utility-scale solar thermal plants and commercial/residential scale rooftop photovoltaic panels. Texas also has substantial older coal- or oil-fired generation capacity that could be refurbished with solar concentrating technology to produce a hybrid plant that runs on solar-heated steam in the daytime and on coal-fired steam at night. Such technologies, however, do not appear to currently be economically viable. Public announcements by FPL Energy and Acconia Solar for projects in other states suggest the capital costs of concentrated solar plants are as high or higher than new nuclear plants, while producing much less energy. However, Texas should continue to monitor the maturation of these technologies to determine if they will become a viable economic option for Texas' power needs. Expansion of the transmission grid in West Texas to accommodate wind power may also provide opportunities to co-locate solar generation technologies in the region as well.

In April 2008, Governor Perry announced Texas would invest $1 million through the Texas Enterprise Fund (TEF) in Heliovolt Corporation of Austin for the construction of a 125,000 square foot manufacturing facility and development space to test and produce the company's thin film solar power cells. This investment will create nearly 160 jobs and $62 million in capital investment. Such strategic investments will continue to position Texas as a leader in new energy technologies.

In addition to strategic investments through the TEF, Texas should adopt two strategic initiatives to continue to help spur new investment in solar technology in Texas.

- ✓ RECOMMENDATION 8: To encourage development of new solar energy, the Texas Department of Housing and Community Affairs should amend their Low Income Housing Tax Credit Application QAP to offer additional points to applicants who install alternative energy sources including solar panels, solar water heaters, or other solar products in their developments.
- ✓ RECOMMENDATION 9: The state should provide a sales tax exemption for the purchase and installation of solar generation systems.

2.3.6 Bring a Texas Perspective to the Debate Over Carbon Legislation to Illustrate the Potentially Devastating Effects CO_2 Regulation Will Have on the Texas and National Economy

Although Texas has never recognized carbon as a pollutant and legislation introduced to do so at the state level has never received serious consideration by the Texas Legislature, momentum toward significant and costly regulation appears to be building at the federal level. The current Lieberman-Warner proposal, S.2191, passed the Environment and Public Works Committee in the U.S. Senate but failed to garner the necessary votes on the Senate floor.

Even though it appears unlikely legislation will pass this year, it is expected that multiple proposals will be introduced that may have a severe impact on Texas' economy. Figure 33 on the next page shows key components of the leading proposals.

Figure 33: Recent Federal Carbon Regulation Proposals

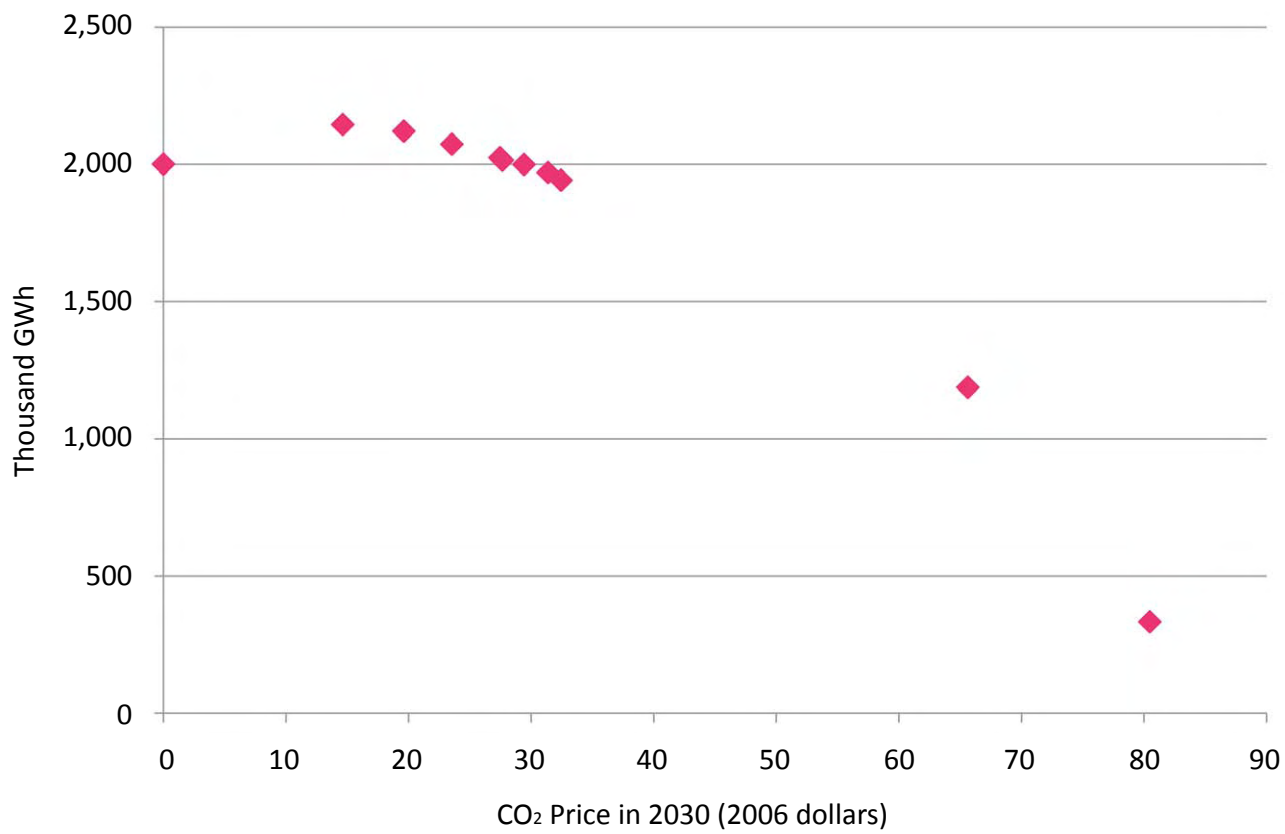
	S. 1766: The Low Carbon Economy Act of 2007 (Bingaman/ Specter)	S. 2191: America's Climate Security Act of 2007 (Lieberman/ Warner)	S. 280: The Climate Stewardship & Innovation Act of 2007 (McCain/ Lieberman)	S.485: Global Warming Reduction Act of 2007 (Kerry/Snowe)	H.R. 1590: The Safe Climate Act of 2007 (Waxman)
Introduced	July 2007	Oct 2007	Jan 2007	Feb 2007	Mar 2007
Start Year	2012	2012	2012	2010	2010
Coverage	All 6 GHGs	All 6 GHGs	All 6 GHGs	All 6 GHGs	All 6 GHGs
Targets	Capped sectors: 60% below 2000 levels by 2050	Capped sectors: 70% below 2005 levels by 2050	Capped sectors: 60% below 1990 levels by 2050	Whole economy: 65% below 2000 levels by 2050	Whole economy: 80% below 1990 level by 2050
Sectors	Fossil fuel, high GWP gases, some NO_x	Electricity, transportation, industry	Commercial, industrial, electric power, and transportation	Greatest emitting sectors/sources; those with most cost-effective reduction opportunities	All sectors (largest/easiest to control emitters)
Structure	Generally, upstream Cap & Trade, industrial and electric emitters at point of emissions	Cap & Trade	Cap & Trade	Cap and trade; other standards or requirements TBD	Cap & Trade
Allocation	Initially 49% freely allocated to regulated entities; 75% auction by 2030	20% to generators, decreasing to 0% by 2035; 10% to LSEs; 20% to industry, rising auction (starting at 24%)	TBD by administrator (mix of free allocations and auction)	TBD by President (mix of free allocation and auction)	TBD by President (mix of free allocation and auction)
Flexibility	Domestic offsets, possible international offset program (up to 15%) $12/ metric ton safety valve, rising at 5% + inflation	15% of cap may be met with foreign credits and 15% with offsets; 15% may be borrowed from the Carbon Market Efficiency Board	Offsets up to 30%, banking, borrowing, early reduction credits	Offsets; international credits possible; banking	Banking, early reduction "rewarded", forest and agricultural sequestration "encouraged"

The costs of these proposals will depend on the precise nature, extent, and method of capping or taxing carbon emissions and the extent to which domestic and international offsets are permitted. However, because Texas has a larger share of industrial-related emissions than the rest of the country and because Texas is home to many of the world's largest refining and petrochemical companies, Texas is likely to be disproportionately impacted by this regulation. A multi-sector proposal, like some of those shown earlier, that covers emissions from the electric, transportation and industrial sectors, would make up to 96 percent of Texas' emissions subject to a cap.

However, as a major producer of oil and natural gas that is combusted outside of the state, Texas industry may be responsible for an even greater share of reductions than its emissions would indicate. Several proposals, including Lieberman-Warner, set the point of compliance for natural gas and petroleum upstream of the point

TOC

Figure 34: Projected Impact of CO_2 Prices on Coal Generation in 2030



of combustion. In other words, Texas companies may be required to pay for CO_2 allowances to cover the carbon content of fuels produced in Texas but used elsewhere.

As shown in Figure 28, the cost of the Lieberman-Warner bill is estimated to result in costs of over $50 per ton of CO_2 emitted. The power sector is projected by many, including the EPA and the EIA, to be responsible for the largest share of emission reductions. ICF has estimated that the ability to economically dispatch existing coal plants is not affected by carbon regulation until the cost exceeds $30 per ton, even though the regulation will significantly increase the costs of these units and siphon revenues that would otherwise be used to build additional capacity in Texas. That is, carbon regulation will extract an enormous amount of money from Texas business and consumers and send it to a large new bureaucracy in the federal government to dramatically expand federal spending, without accomplishing any of the stated goals of reducing CO_2 emissions from power plants.

In ICF's projections, at CO_2 prices above $30/ton, coal-fired generation from existing units will begin to fall rapidly from the levels that would occur without carbon regulation, as shown in Figure 34 above. At $80/ton CO_2, generation from coal-fired power plants may fall by over 75 percent. This generation will have to be replaced by other sources, and given the limited ability to add large amounts of nuclear capacity, because of lengthy federal permitting requirements and inactivity on resolving waste disposal issues, it is most likely that substantial additions of natural gas-fired generation will be needed to maintain reliability in the state as well as other regions of the country. This will create additional significant demand for natural gas, raising both natural gas and electricity prices for Texans.

Because natural gas will continue to be the marginal source of generation in Texas under these scenarios, electricity prices will increase not only due to the likely higher natural gas prices caused by this regulation, but also because natural gas generation emits CO_2, although less than half that of coal. Texas natural gas generators will be required to purchase carbon allowances or pay a tax on their emissions, raising electricity prices.

- ✓ RECOMMENDATION 10: State policy makers should bring a Texas perspective to federal carbon policy debates. Texas needs to participate actively in the carbon discussion and educate Washington decision makers on the economic value of Texas' energy production to the nation.
- ✓ RECOMMENDATION 11: Americans will bear significant costs, and Texans will bear a disproportionate share of those costs, should the federal government decide to impose costly carbon regulation. Retail customers should be further educated on electric competition, efficiency, and the costs and benefits of fuel mix choices. The state should form a private-public partnership among industrial and large commercial energy customers, petroleum and generation companies, chambers of commerce, the PUC, the TCEQ, and the RRC to educate the public on the cost of carbon regulation to Texans. This partnership should inform its work by conducting a study highlighting the cost of carbon regulation versus environmental benefits to Texans.

2.3.7 Incent the Development of Clean Coal Technology and the Use of Texas lignite

Emerging technologies such as Carbon Capture and Storage (CCS) could help, but the costs are potentially large and uncertain. Investing in research, development, or demonstration CCS projects could be beneficial for Texas as it may help sustain the demand for Texas lignite and also help in enhanced oil recovery. R&D demonstrations, legal action to resolve issues related to liability concerning the release of sequestered CO_2, and/or providing funding to aid private industry efforts to implement large-scale CCS on power plants may be helpful.

- ✓ RECOMMENDATION 12: In order to incent the development of clean coal technology, the state should create a state innovation prize, funded with private-public revenue, for the large-scale deployment of a mine mouth clean coal generating facility that uses Texas lignite as its primary fuel and captures nearly all carbon emission for storage underground or use in enhanced oil recovery or other market driven beneficial use.
- ✓ RECOMMENDATION 13: The state should provide a five-year sales tax exemption for the equipment used to capture and store carbon dioxide from facilities that use Texas lignite as a fuel source.

2.3.8 Develop Texas Natural Gas Assets and Aggressively Explore Partnerships to Gain Access to Undervalued Resources

The almost 300 percent increase in the cost of natural gas since 2002 indicates a demand for natural gas far outpacing supply. The ICF analysis shows a continued heavy reliance on natural gas, which is only likely to increase if federal carbon legislation is enacted. In addition to diversifying the fuel mix from which electricity is generated, Texas should also make efforts to increase the supply of natural gas.

- ✓ RECOMMENDATION 14: Texas should identify and resolve barriers to accelerating development of in-state natural gas assets, including Barnett and other shale assets. Issues related to the proximity of the Barnett shale to major metropolitan areas and transport of gas from the region to markets must be considered. Texas should also explore and develop partnerships with other jurisdictions to gain access to potentially undervalued resources. As part of this exploration and development, Texas should address the federal ban on accessing all onshore and offshore resources.

Finally, Texas should ensure that its tax policies encourage the deployment of additional energy resources to the state. Therefore, Texas should undertake further research to ascertain the impact state and federal taxes have on bringing energy investment to the state.

Section Three: Transmission and Distribution Policy

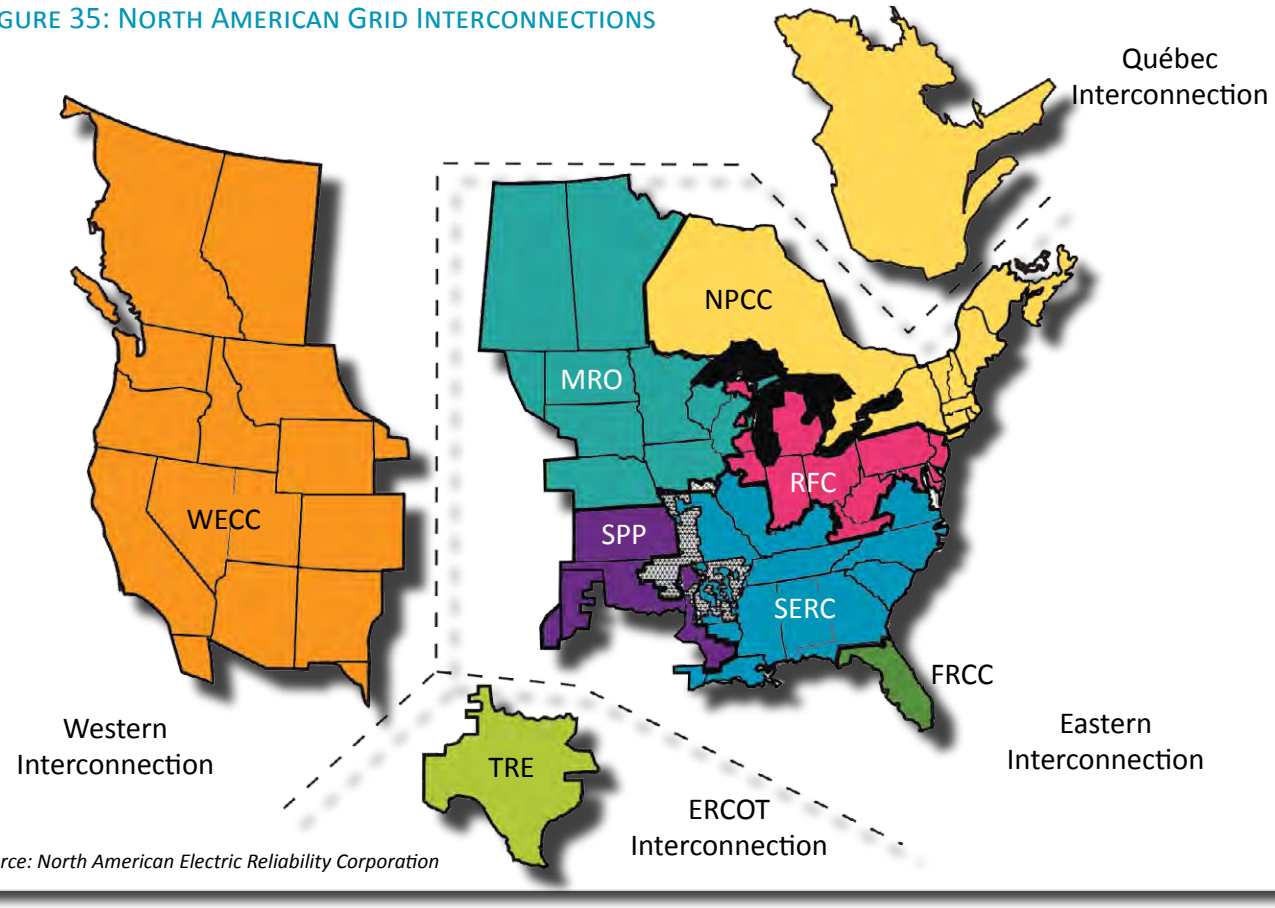
3.1 Overview of Investment Trends

Texas' transmission system is divided into ERCOT and non-ERCOT regions, shown in Figure 35. The ERCOT transmission system is one of three interconnected grids that service the continental US and is comprised of 38,000 miles of transmission lines, 22 percent or 8,515 miles of which, are high-voltage 345 kV lines.[10] Electricity is transported over a high-voltage system over a multi-path power network that allows for alternative energy flow paths. For the non-ERCOT regions of Texas, the SPP performs transmission planning for parts of Northeast Texas and the Texas Panhandle, the Entergy Gulf States Utilities (within SERC) for parts of East Texas and the El Paso Electric Company (within WSCC) for parts of West Texas.

In Texas, TDUs[11] provide transmission and distribution service and are subject to extensive rate regulation by the PUC. ERCOT conducts a transmission planning process and has overseen the addition of 5,200 circuit miles of transmission since 1999. These transmission additions have facilitated the interconnection of tens of thousands of new megawatts of generation facilities to the grid, and have alleviated bottlenecks that limit the ability to move power efficiently around the state. Even with this investment, there are still times when the transmission system is constrained, and prices diverge through the region.

In order to support demand growth, reduce congestion, and accommodate unprecedented levels of wind generation, ERCOT has identified $3 billion of transmission improvement needed over the next five years. The improvements include enhancing the North-Houston transfer capability and bolstering transfer capability from West Texas to accommodate the large wind capacity addition.

Figure 35: North American Grid Interconnections



Source: North American Electric Reliability Corporation

10 NERC. "2007 Long-Term Reliability Assessment: 2007-2016." Oct 2007: 107. 7 July 2008 <http://www.nerc.com/files/LTRA2007.pdf>.

11 In Texas, some of the largest TDUs are Oncor, Centerpoint Energy, and AEP.

Figure 36: RTO Transmission Investment

RTO	Cost of Projects ($M)	Peak Demand 2007 (MW)[6]	Number of years in Plan	$/MW-yr
New England[3]	4,385	27,460	10	15,969
ERCOT[5]	2,800	62,500	6	7,467
PJM[2]	9,319	139,428	10	6,684
SPP[1]	2,200	35,900	10	6,128
Midwest ISO[4]	2,200	109,099	5	4,033

1 *SPP Transmission Expansion Plan for 2008-2017*
2 *PJM RTEP Cost Summary based on project completion date 2007-2017*
3 *New England ISO Regional System Plan Transmission Project Listing - October 2007 Update for 2007-2012; excludes $978 million in 2007 in-service projects*
4 *Midwest ISO Transmission Expansion Plan 2007*
5 *NERC 2007 Long-Term Reliability Assessment; Does not include CREZ related transmission.*
6 *SPP (market footprint) and ERCOT from FERC Market Oversight summaries; Midwest ISO from 2007 Transmission Expansion Plan; PJM from press release May 5, 2008.*

ERCOT has the second highest amount of planned transmission investment among Regional Transmission Organizations per megawatts year (see Figure 36). Although over the last two years distribution investments have picked up considerably, distribution expenditure increases averaged only 2.5 percent over the same period.

3.2 Current Challenges

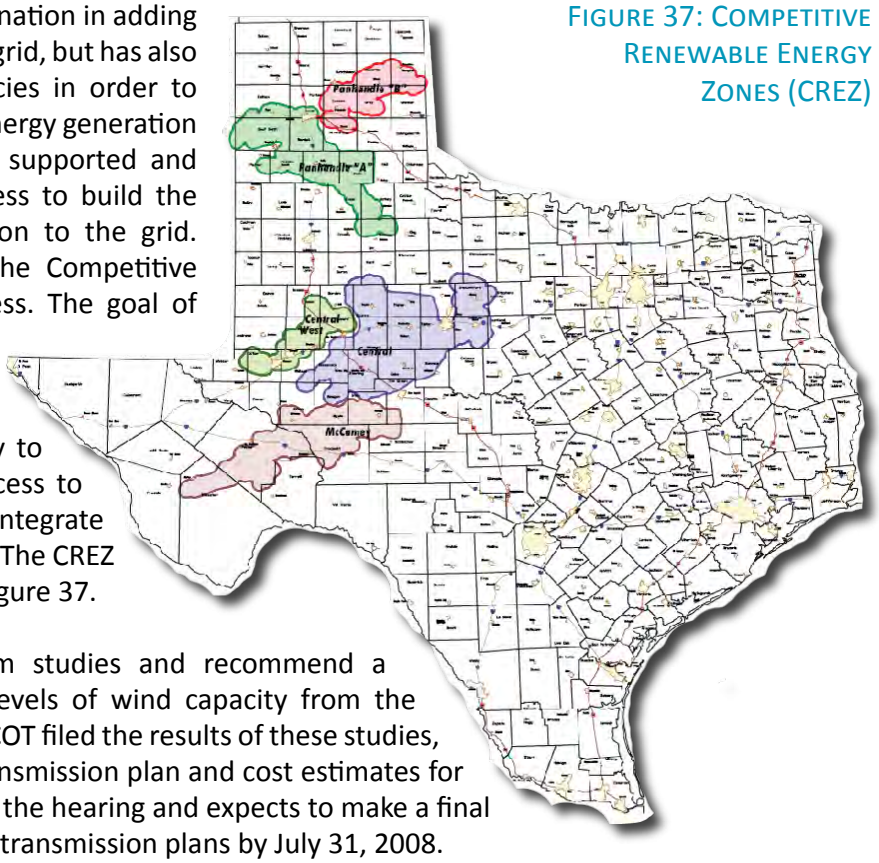
3.2.1 Expanding the Transmission Grid to Areas with Large-Scale Wind Energy Potential

As discussed in the previous section, far more wind capacity has been installed in West Texas than can be presently exported to the major population centers in the central and eastern portions of the state. As a result, power prices in the Western portion of the grid have frequently been negative this spring, as wind generation owners have bid prices down in an attempt to keep their plants on line. Wind generation, has on occasion, also been curtailed because of transmission congestion, and on these occasions, energy that could have displaced natural gas generation was lost.

Substantial transmission expansion to relieve the existing congestion and proactively address the expected addition of significant additional wind capacity is critical to efficiently use Texas' wind resources, while still providing for a reliable electricity grid and ensuring that adequate fossil-fuel, controllable generation is online to provide reserves to the system.

Fortunately, Texas has not only led the nation in adding new transmission infrastructure to the grid, but has also adopted innovative transmission policies in order to specifically integrate new renewable energy generation to the grid. In 2005, Governor Perry supported and signed legislation establishing a process to build the transmission necessary to get wind on to the grid. A key feature of this legislation is the Competitive Renewable Energy Zone (CREZ) process. The goal of the CREZ process is to facilitate wind development through the proactive identification of areas of the state where future wind generation is likely to locate, and proactively begin the process to build new transmission capacity to integrate these areas to the broader ERCOT grid. The CREZ designations by the PUC are show in Figure 37.

Figure 37: Competitive Renewable Energy Zones (CREZ)



The PUC directed ERCOT to perform studies and recommend a transmission plan for four different levels of wind capacity from the designated zones. On April 2, 2008, ERCOT filed the results of these studies, shown in Figure 38, and provided a transmission plan and cost estimates for each scenario. The PUC has completed the hearing and expects to make a final decision on the CREZ designations and transmission plans by July 31, 2008.

Additionally, the PUC is exploring selecting the transmission providers for the CREZ lines based on a competitive bidding process. While this is a departure from the standard practice of defaulting transmission builds to the incumbent transmission service provider in the area that the lines are to be built, this modification increases the transparency and ease with which new transmission providers can enter Texas and compete to build these lines. The PUC is in the process of revising its current rules to accommodate this change and outlining criteria for the qualification and selection of transmission providers.

3.2.2 Encouraging Investment in Technological Advancements in Transmission and Distribution Technologies

While Texas has adopted many innovative policies and encouraged investment in transmission, the fact that transmission and distribution remains a regulated function creates the possibility that technological advancements or investments will not occur as rapidly as they occur in competitive markets. This is partially because in traditional ratemaking, incentives for utilities to invest in these technologies may not exist, as companies are generally focused on minimizing costs between rate proceedings due to the lag that can occur in reflecting new investments in rates. New technologies may also permit more efficient use of the transmission grid, but may not be aggressively pursued by utilities if uncertainty about cost recovery exists.

Figure 38: Wind Capacity Scenarios

	Scenario 1 (MM)	Scenario 2 (MW)	Scenario 3 (MW)	Scenario 4 (MW)
CREZ Wind Capacity	5,150	11,553	17,956	17,516
Base Case Wind	6,903	6,903	6,903	6,903
Total Wind	12,053	18,456	24,859	24,419

3.3 Recommended Actions

3.3.1 Expeditiously Complete the CREZ Proceeding and Other Transmission Projects for Wind Generation

✓ Recommendation 15: In order to proactively address the addition of significant wind capacity, the PUC should expeditiously conclude the CREZ proceeding, select a transmission plan, and issue needed CCNs for CREZ transmission lines. The current transmission development schedule may not allow for construction to commence before the third or fourth quarter of 2009. The PUC should rapidly complete the remaining tasks so transmission construction can begin in earnest.

✓ Recommendation 16: The state should encourage onshore and offshore wind generation along the Texas Gulf Coast. While the development of these resources should be balanced with concerns related to migratory birds and other ecological conditions, coastal wind resources appear to have much smaller incremental transmission need due to their proximity to the existing transmission grid, and are expected to have energy production that more closely aligns with peak demand.

3.3.2 Examine Methods to Ensure Current Transmission is Efficiently Used

Many areas of the country use a method called "dynamic line rating" to efficiently use existing transmission capacity. Transmission lines generally accommodate more power in cooler weather or windy conditions (because air movement across the transmission lines tends to cool them). Centerpoint Energy and Oncor Electric Delivery currently dynamically rate their transmission lines based on ambient temperature, and American Electric Power has a number of transmission lines that are dynamically rated in a manner that can account for wind speed effects. For the rest of the transmission owners, ERCOT currently uses a static method of determining the amount of power that can flow across transmission lines. Broader use of dynamic line ratings may allow ERCOT to reliably accommodate additional wind energy over existing and new transmission lines in West Texas.

✓ Recommendation 17: The PUC should require ERCOT and the transmission utilities to study dynamic line ratings in West Texas to show available transmission capacity more accurately and allow for more efficient use of transmission facilities.

3.3.3 Consider Alternative Transmission Models and Additional Interconnections to Other Grids

To benefit from scale and regional diversity of fuel mix, Texas should evaluate enhancing transfer capability with the Eastern and Western Interconnections through additional back-to-back DC facilities and DC transmission lines, provided that such interconnections do not threaten Texas' unique jurisdictional status.

Such investments may be attractive as pure merchant investments, as the DC technology is controllable and can take advantage of divergences in market prices between the various grids. In Texas, several companies have expressed interest in constructing transmission using a non-traditional regulatory approach. These include facilities that are privately funded, are not rolled into the rate base, and designed for exclusive use for interconnecting to the utility's transmission system. The challenge from a constitutional and policy standpoint is whether the builder of such facilities would have access to property through eminent domain.

✓ RECOMMENDATION 18: The PUC should identify and resolve any legal or regulatory issues that prevent the development of merchant transmission investments that could provide additional privately funded transmission.

3.3.4 Study the Use of High-Capacity Conductors

Many other regions replace existing transmission lines with high-capacity conductors. This reduces the time for increasing transmission capacity and often can be executed without taking lines out of service and disrupting the marketplace.

✓ RECOMMENDATION 19: The Governor should request that the PUC, institutions of higher education, ERCOT, and relevant industry evaluate new conductors and propose sites where these technologies could provide value.

3.3.5 Consider Streamlined Forms of Regulation for Transmission and Distribution Utilities

Texas has adopted an innovative transmission cost recovery and rate-setting process whereby TDUs can annually reflect newly completed transmission lines in their rates without the need for a fully litigated and costly rate case. This streamlined recovery process significantly reduces the lag in reflecting new investments in rates, and has made Texas an attractive place for new infrastructure investment. Additionally, the legislature has provided for surcharges to recover expenses related to advanced metering, nuclear decommissioning costs, and energy efficiency expenditures outside of a full rate case. When full rate cases are conducted, they can be as expensive and time-consuming as rate cases for fully bundled and regulated utilities, even though transmission and distribution expenses only comprise 20 to 30 percent of the retail customer's total bill.

Texas should explore whether alternative forms of regulation, such as performance-based ratemaking, rate of return bands, or formulaic rate adjustments could provide a more efficient regulatory construct for the regulated transmission and distribution companies. These forms of regulation could provide for lower cost, an incentive/penalty structure for service quality, or energy efficiency goals, and a means to encourage new investment in infrastructure and smart-grid technologies to modernize the distribution network and ultimately lower costs for consumers, while still providing appropriate regulatory oversight by the PUC and periodic full rate cases.

✓ RECOMMENDATION 20: The Governor should direct the PUC to study whether alternate forms of rate regulation for transmission and distribution utilities would be appropriate to meet these goals and identify whether any statutory impediments exist to implementing such regulation.

3.3.6 Establish Research and Development Partnerships to Develop Advanced Transmission and Distribution Technologies.

There is an increasing amount of innovation in technological solutions to help grid operators and TDUs rapidly sense, diagnose, and mitigate issues that may otherwise cause customer power outages or reliability issues. Many of these technologies have recently become feasible due to advances in information technology. Texas should establish private-public partnerships to develop, promote, and research these technologies for deployment on the Texas power grid.

✓ RECOMMENDATION 21: The state should partner with higher education institutions and corporations to develop and promote advanced transmission and distribution technologies and incent investment in the research and development of such technologies.

In addition to reducing barriers to generation investment and ensuring adequate transmission infrastructure exists to ensure the efficient movement of power around the power grid, Texas should explore ways to cost-effectively reduce the rate of demand growth in the state. As illustrated in Section 3, given dramatically increased fuel and capital costs, all future incremental sources of generation are likely to be relatively expensive. Proactive measures that can reduce the need for additional generation resources in the state, especially during peak usage periods, can provide substantial benefits to Texans.

4.1 Overview and Potential Benefits of Efficiency and Demand-Side Management

Texas has implemented demand-side management (DSM) programs for many years. DSM programs are broadly defined as a set of actions that can be taken to influence the level and timing of the consumption of electricity. DSM programs are generally categorized into two types of programs; energy efficiency programs and demand-response programs. Both types can be implemented for all classes of electricity customers.

Energy efficiency programs are designed to increase efficiency by maintaining the same level of production or comfort, but using less energy. For example, a program that allows or encourages commercial customers to retrofit their buildings with more efficient lighting systems would be referred to as an "energy efficiency" program. Other programs that would fit into this category include the promotion of new home construction that use less energy than homes built using standard construction practices or implementing standards that appliances must use a lower amount of electricity. In general, energy efficiency programs provide a reduction in the overall quantity of electricity consumed over the year, but may not necessarily reduce the electricity demanded at the hour of system peak. Many customers routinely engage in energy efficiency actions through purchasing more efficient appliances, installing compact fluorescent light bulbs, or adjusting the temperature of their house in response to higher energy prices or environmental sensibilities.

In contrast, a demand-response program is designed to encourage customers to reduce usage during peak times or to shift that usage to other times. For example, a program that provides a payment to customers who permit their electricity provider to cycle off their air conditioners for brief periods using a remote switch, usually during times of peak demand, would be classified as a demand-response program. Other examples of customer demand-response in Texas include pricing structures that provide for real-time energy prices, which also encourages customers to reduce consumption during peak times or interrupt their consumption when wholesale market prices are generally higher and when the system may be running short of capacity. In general, demand-response programs provide a reduction in the electricity demanded at the time of system peak and may or may not reduce total annual electricity usage.

4.2 Current Energy Efficiency and DSM Projects

In 2007, Governor Perry signed House Bill 3693 (HB 3693), comprehensive energy efficiency legislation that is intended to significantly increase the specified energy efficiency goals over the next two years.

Regulated utilities (TDUs in ERCOT, and the integrated utilities outside of ERCOT) are required by law to offer DSM programs sufficient to offset 15 percent of the growth in demand by December 31, 2008 and 20 percent of the growth in demand by December 31, 2009. The PUC is required to submit a study by January 2009 to, among other things:

- Consider the technical, economic, and achievable potential and natural occurrence of energy efficiency in Texas;
- Determine the amount of energy savings achievable through utility programs;
- Recommend whether utility funding of energy efficiency should continue or is best provided by the competitive marketplace;
- Recommend whether utilities should fund educational programs regarding energy efficiency;
- Quantify the cost and benefits of meeting energy efficiency goals; and
- Assess whether the following additional goals are achievable: 30 percent reduction in growth in demand by December 31, 2010 and a 50 percent reduction in growth in demand by December 31, 2015.

In 2008, the TDUs[12] are implementing DSM programs with a total annual budget of approximately $96 million, as summarized on the next page in Figure 39.

According to calculations performed by ICF, these programs provide demand reduction at a cost of approximately of $506/kW of demand avoided. In contrast, the approximate capital costs of the incremental generation resources analyzed in Section 2 were:

- Pulverized Coal ($3,000/kW)
- IGCC Coal ($4,000/kW)
- Combined Cycle Gas Turbines ($1,200/kW)
- Peaking Gas Turbines ($600/kW)
- Nuclear ($5,000/kW)

Certain DSM programs may also have additional benefits, including power plants emission reductions and land and water use reductions as new plant construction is deferred. Additionally, more efficient use of existing generation, transmission, and distribution facilities may be achieved as peaks in demand are “leveled” over the course of the day and year. This saves on operation and maintenance of electric system components. Finally, energy efficiency leads to increased local economic development activity as the expenditures made on incentives, marketing, training, and other activities flow to local businesses.

Not all DSM programs provide benefits. The benefits of each type of program must be carefully weighed against any program drawbacks, such as short-term increases in rates, program costs, uncertainty surrounding success of the programs, and difficulty in forecasting the participation and costs in the programs.

12 This includes: Oncor, Centerpoint, Entergy, Texas New Mexico Power, AEP Texas North, AEP Texas Central, SWEPCO, and El Paso Electric.

FIGURE 39: SUMMARY OF TDU DSM PROGRAM BUDGETS FOR 2008

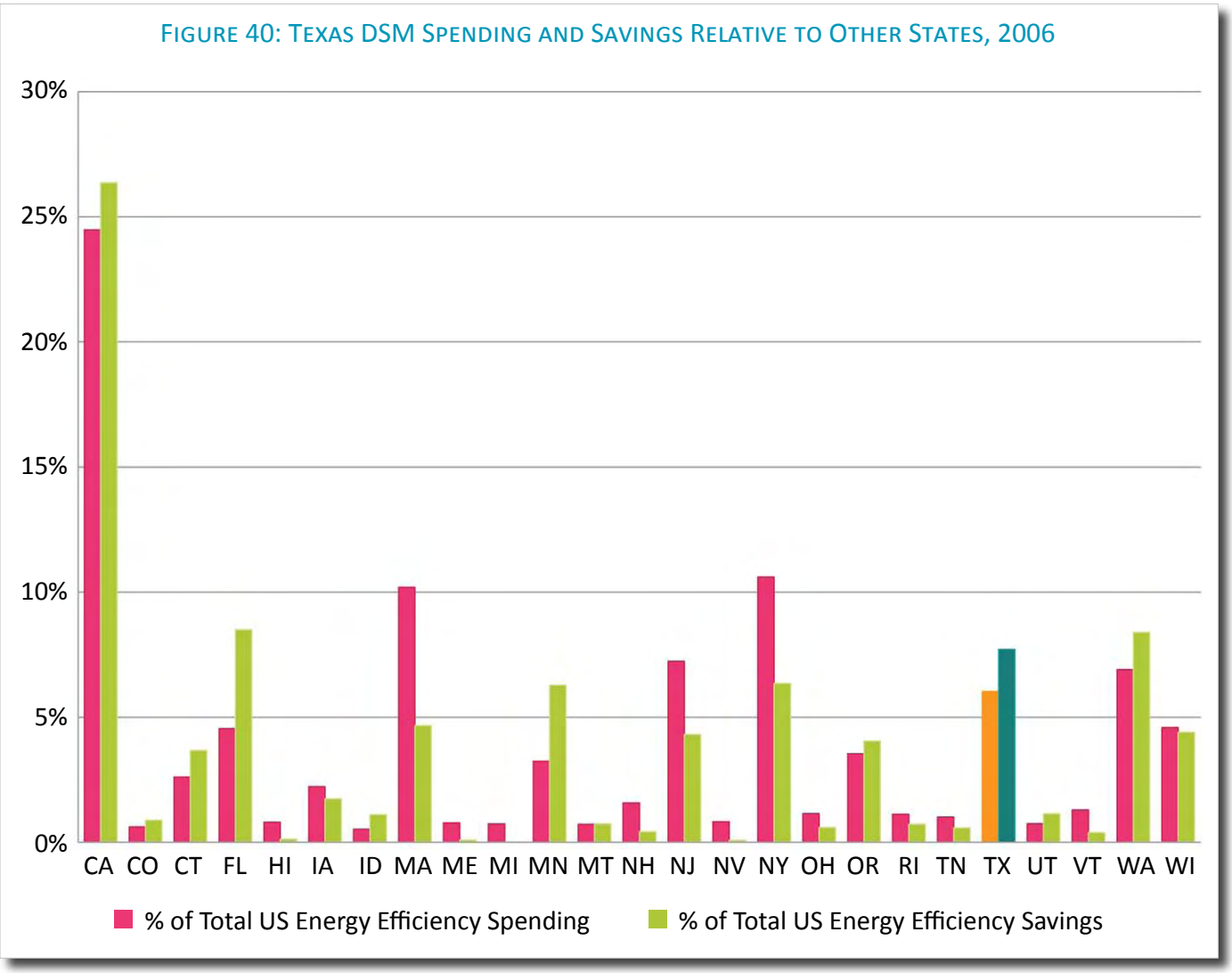
Program Type	Customer Class			Total 2008 Budget	% of Total
	Residential	Hard to Reach/Low-Income	Commercial		
Air Conditioning Equipment and Installation Practices	$12,042,897	$1,840,042	$20,506,916	$34,389,855	36
Weatherization (Primarily)		30,980,900		30,980,900	32
Compact Fluorescent Lamps	8,928,297			8,928,297	9
Efficiency by School Districts			7,008,442	7,008,442	7
ENERGY STAR New Homes	3,748,199			3,748,199	4
Load Management	686,269		2,903,593	3,589,862	4
Low-Income Weatherization	1,739,428		535,514	2,274,942	2
Efficiency by City Authorities (Multiple Measures)			1,549,403	1,549,403	2
Retrocommissioning	1,110,452			1,110,452	1
Efficiency by School Districts			1,055,854	1,055,854	1
Standard Offer (Multiple Qualifying Measures)			634,230	634,230	1
Water and Space Heating		487,324		487,324	1
TOTAL	$28,255,542	$33,308,266	$34,193,952	$95,757,760	
% OF Total	30	35	36		

The provision of expanded energy efficiency/DSM programs will likely result in short-term increases in TDU rates, due to program costs and the cost recovery mechanism provided for in HB 3693. Furthermore, even though all customers will pay for the incentive programs through higher TDU rates and will indirectly benefit from the reduced growth in demand, only some customers will receive the direct program benefits through more efficient air conditioners, light bulbs, insulation, weatherization, and appliances.

When combined with concerns about equity between customers, between customer classes, and different perspectives on the future costs of carbon, the determination of the "appropriate" level of DSM can be a complex and policy-driven exercise. Numerous energy efficiency DSM studies have been completed which suggest that load growth can be eliminated or dramatically reduced with cost-effective DSM. While that goal is laudable, many others have expressed concern that such load reductions may not be practical, desirable, or provide adequate levels of reliability, especially in states with significant population growth and economic development, like Texas.

Despite these potential drawbacks, it is clear that DSM programs have an important role to play in Texas' mix of resources. DSM programs become more attractive as wholesale generation rates increase and environmental regulations make it more difficult to build generation facilities.

Figure 40: Texas DSM Spending and Savings Relative to Other States, 2006



In 2006, prior to the enactment of HB 3693, Texas ranked approximately 22nd among the states for energy efficiency on a per capita basis, and the American Council for an Energy Efficient Economy (ACEEE) ranked Texas' policies towards DSM as the 11th most favorable in the nation. Texas ranked sixth in the overall level of DSM spending by the states in 2006[13] and fourth in terms of overall energy savings as a result of energy efficiency and DSM programs. Figure 40 illustrates that although Texas spends less money than many other states on these programs, the money used in Texas is more effective. Texas accounts for a greater proportion of the actual energy efficiency savings as it does the cost.

Additionally, since 2002, large commercial and industrial customers have been able to participate in markets for reserve generation capacity conducted by ERCOT by bidding their load into these markets. In essence, these customers compete with generators to provide reserves by offering to cut their consumption with very short notice, and in doing so, free up generation that would be otherwise be providing these reserves to generate energy for customer consumption. In 2007, the PUC also established a new Emergency Interruptible Load Service (EILS) program that will provide for additional demand-response that ERCOT can utilize prior to implementing rotating outages in emergency situations. The costs of these programs are not included in Figure 40, even though they provide a substantial amount of demand-response (approximately 1,500 megawatts combined).

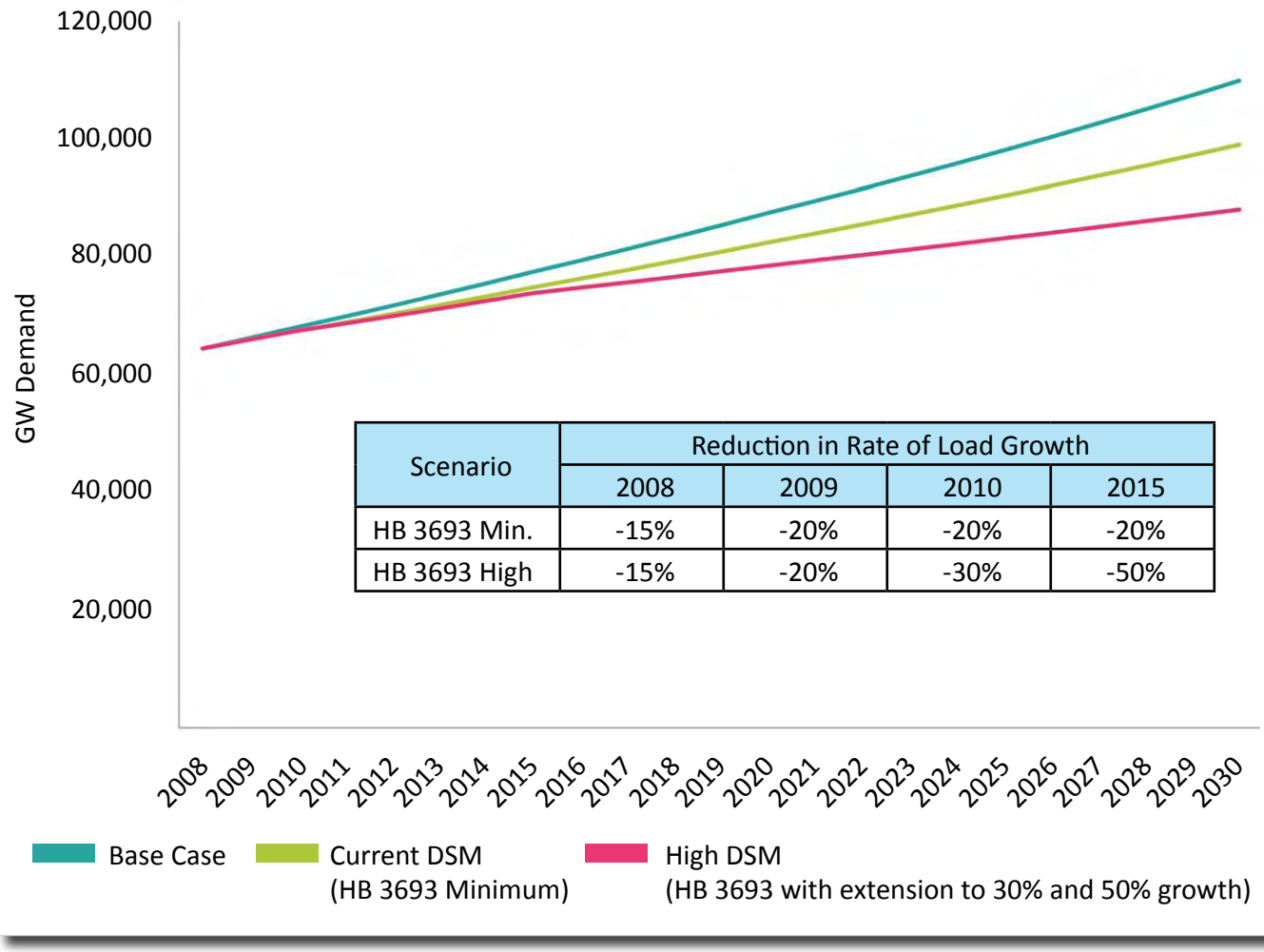
13 Eldridge, Maggie, et al. "The State Energy Efficiency Scorecard for 2006." ACEEE. Report #E075 June 2007. 7 July 2008 <http://www.aceee.org/pubs/e075.pdf>.

REPs such as TXU Energy, Direct Energy, and Reliant Energy have also begun to introduce energy efficiency services as an element of their competitive offerings, and retail customers are increasingly responding to higher energy prices by adopting a wide range of conservation and energy efficiency activities outside of specific utility or REP programs. Municipal and cooperative utilities also provide DSM programs to varying degrees, including some very aggressive programs (e.g., Austin Energy).

4.3 Future Potential

Figure 41 is an analysis conducted by ICF regarding the impact on the system peak demand of the level of DSM required by current law and the impact if the goal was increased to a 30 percent reduction in growth in demand by December 31, 2010 and a 50 percent reduction in growth in demand by December 31, 2015. ICF's study results suggest that the increased energy efficiency requirements of HB 3693, currently under study by the PUC, could result in the deferral or elimination of 21,899 megawatts of new generation needed to meet expected demand through 2030. Even the levels required under currently law have the potential to defer approximately 10,000 megawatts of new generation and the associated emissions.

Figure 41: Impact on System Peak Demand of Various DSM Scenarios



Scenario	Reduction in Rate of Load Growth			
	2008	2009	2010	2015
HB 3693 Min.	-15%	-20%	-20%	-20%
HB 3693 High	-15%	-20%	-30%	-50%

4.4 Current Challenges

4.4.1 Deployment of Advanced Metering

Residential consumers account for approximately 45 percent of the energy demand in ERCOT. Yet, residential consumers currently receive very little information about their consumption behavior and how changes in their usage patterns and use of DSM technologies can reduce energy use. Residential electricity meters currently track the total number of kWh consumed between the two dates on which the meter is read. These meters cannot track when these kWh were used (at night or during the day) or what the customer contributed to the overall system peak demand. In contrast, industrial and large commercial customers have more advanced (and expensive) electricity meters that record the customers' usage every fifteen minutes. As a result, these customers have competitive pricing options that permit them to pay for their electric usage based on "time of use" (or "heat rate" of generating units on line) because the time periods of their energy use is identifiable.

A key component of HB 3693 is the encouragement of rapid deployment of an Advanced Metering Infrastructure (AMI) for energy efficiency and demand-response. AMI provides real-time consumption data which offers residential consumers new technologies and services to manage their energy consumption. If deployed ubiquitously as part of a "smart grid," both consumers and the TDU will benefit from reliability increases as consumers reduce their peak demand usage.

Providing advanced meters to retail customers may benefit the TDUs by allowing them to provide remotely-read meters, remotely connect and disconnect customers, and the ability to interface with in-home devices, such as a special thermostat that adjusts temperature settings in response to different prices throughout the day. Several vendors are working with Texas TDUs to further explore the development of in-home networks that would allow automation of appliances to take advantages of lower energy prices at certain portions of the day.

Although AMI can be expensive, the investment can be offset by the combination of operational benefits it provides (e.g., reduced costs associated with meter reading, connections, theft detection, and distribution system optimization, etc.) and DSM program benefits (e.g., increased participation in time-of-use rate, benchmarking, and demand-response programs.) The PUC has developed rules to guide the implementation of AMI and the recovery of the associated costs, and both Centerpoint Energy and Oncor have filed AMI deployment plans with the PUC.

Foremost, this is a dramatic change for consumers, and they will need to be educated about the features and benefits of AMI. In addition, cooperation is needed among TDUs, REPs and other parties who may each like to develop services that leverage the AMI, as well as rules to govern the access to the AMI and the use of data gathered by the AMI. Issues among each of these entities will have to be resolved before Texas customers will be able to realize the full value of AMI.

Finally, ERCOT must develop the ability to settle power prices on 15-minute interval data for all customers. For customers to receive the full benefits of reducing their consumption during peak periods, the customer and their REP must be accurately billed on the basis of when the energy consumption actually occurred. This may require a significant capital investment by ERCOT and close coordination and sequencing with ERCOT's upcoming transition to a nodal market, nonetheless, it is a critical step for ubiquitous deployment of AMI.

Appropriate metering investment is also critical for ensuring that distributed generation, such as solar panels on residential and commercial structures, receives accurate compensation for excess power sent to the grid. Advanced meters can separately track when a customer with solar generation is a net consumer from the grid and when the customer is generating excess energy that is sent onto the grid for use by other customers. Because customers with solar panels have the potential to be net consumers at off-peak hours when prices are generally lower, and net producers during peak demand times, Texas has a unique opportunity to provide market incentives for deployment of solar generation by ensuring that excess power is accurately measured at the time it is produced, and that customer receives the real-time wholesale market price for the excess energy.

4.4.2 Customer Education

While most observers would agree that the potential for DSM is significant, there are wide-ranging opinions on the amount that is feasible, given customer willingness to invest in the more efficient technologies or behaviors. While a TDU may be willing to invest in a technology that pays back (i.e., the savings exceed the costs) over a seven to 10-year period, 60 percent of commercial and industrial customers require their energy efficiency investments to pay back in two years or less. For residential customers, the upfront costs of more efficient appliances and homes can be a substantial barrier, even though the more efficient options ultimately cost less over time. While the incentive payments currently provided for, by the existing statutory programs, can help encourage many customers to take these more efficient actions, not all customers will be convinced of benefits.

4.4.3 TDU Financial Impacts

Current DSM cost recovery mechanisms for the TDUs can serve as a disincentive for the companies to invest in efficiency measures, as rates for some customer classes are designed to recover the costs of providing transmission and distribution service on a per kWh or per kW basis. That is, even though the costs of providing TDU service is generally fixed, increased energy efficiency measures will reduce customer consumption, resulting in lower revenue. Absent some alternative way to recover this lost fixed cost contribution, the utility's implementation of DSM programs may reduce its earnings until such time that rates can be adjusted to account for the lower consumption.

The PUC has recently made significant revisions to its cost recovery rules that improved the internal financial incentives of a TDU to aggressively pursue DSM. These include permitting the TDU to recover incremental DSM program costs required to meet increasing goals through an annual cost recovery rider instead of filing for a typically expensive and time-consuming rate case. In addition, TDUs are now eligible to retain a share of the net benefits of the DSM programs they successfully implement pursuant to certain performance criteria. However, these incentives are subject to a cap of 20 percent of the utility's program costs.

Since these mechanisms are new, it is not yet clear if they will have the effect of significantly removing the pre-existing disincentives for TDUs to pursue DSM.

4.4.4 Incorporation of Other Parties and Technologies in DSM Programs

It was anticipated that the introduction of retail competition would spur the development of new technologies used for the delivery of energy efficiency services. While low-income action agencies, federal weatherization programs, REPs, energy service companies, and other organizations have been involved in the delivery of DSM programs, the TDUs remain the primary sponsors of large-scale DSM programs. Numerous REPs are now implementing energy efficiency programs as a way to attract and retain retail customers. Part of the study currently being conducted by the PUC is to evaluate means by which the competitive market can play a greater role in delivering these services.

4.5 Recommended Actions

4.5.1 Require Ubiquitous Installation of Advanced Meters by All TDUs and Enable Usage of the Meters by REPs.

Under the current statute, the PUC cannot require a TDU to deploy advanced meters to all customers. Ultimately, the greatest benefits will be achieved by ubiquitous deployment, as a complete advanced meter roll-out will permit the automation of meter reading, reconnection requests, and other market facilitating activities performed by the TDUs, and will provide offsetting operation costs to the upfront costs for the meters. Broad-based deployment of advanced meters with other smart grid technologies will also permit TDUs to better monitor their system and respond to power outages.

In addition to the actual meter deployment, appropriate settlement of the consumption data generated by the meters is critical for customers to enjoy the benefits of real-time pricing offers, and to receive the value of excess power sent to the grid by customers who install solar panels or other distributed generation.

- ✓ Recommendation 22: The state should require TDUs to deploy advanced meters, with an appropriate cost recovery mechanism to ensure that TDUs earn a reasonable return on this investment. The PUC should have the authority to require deployment of advanced meters as rapidly as possible.
- ✓ Recommendation 23: The PUC should ensure that ERCOT incorporates the most cost-effective means of ensuring that all retail customers have the option to be settled on 15-minute interval data in order to receive the full benefits of changes in consumption behavior and generation from solar panels and other distributed sources.

4.5.2 Monitor and Review the Results of the PUC Energy Efficiency Study Required by HB 3693, and Adjust the Program as Indicated

The PUC will provide a comprehensive report to the 81st Texas Legislature, including evaluations of the potential for additional energy efficiency and DSM programs in the state, funding mechanisms, and whether the goals for reductions in peak demand growth should be increased.

- ✓ Recommendation 24: If the PUC study indicates a greater potential for cost-effective energy efficiency reductions, the state should raise the energy efficiency goals to the higher levels contemplated under current law.

4.5.3 Customer Education

- ✓ Recommendation 25: The PUC should incorporate additional messages about the benefits of energy efficiency, conservation, and demand-response programs into its customer education campaign. The state should fully provision this campaign using the System Benefit Fund.

5.1 OVERVIEW OF RETAIL MARKET

As discussed in Section 1 of this report, Texas' retail electricity market is widely regarded as the most successful in the nation, if not the world. Texas has more competitors, more products, more renewable energy options, and a wider range of choice than any other competitive electricity market. Texas' vibrant retail electricity market well positions Texas for meeting the energy challenges of the next several decades, as REPs will continue to innovate and create value-added services, such as energy efficiency and demand-response programs as they attempt to distinguish themselves from other competitors.

Through the end of March 2008, Texas' average electricity rates compared favorably with similarly situated states that have a large proportion of their electricity produced from natural gas, and even residential customers enjoyed choices that were comparable to, if not lower than, the rates that existed immediately prior to retail competition, even though natural gas prices were nearly 300 percent higher.

May 2008 was an immensely challenging month for the retail electricity market in Texas, especially for those REPs and customers electing to purchase electricity on a short-term basis. Natural gas prices, already at historic highs of $9 per MMBtu, increased another 33 percent by late May/early June to more than $12 per MMBtu. Additionally, the following factors affected the Texas wholesale retail electric markets:

- unexpected transmission congestion caused extreme and persistent price spikes in the South Texas and Houston areas of the grid,
- imports of power into those zones could not be accomplished due to a combination of unseasonably high temperatures and electricity demand, and
- transmission and generation maintenance outages lasted longer than expected.

Because a number of REPs were aggressively relying on the balancing energy and the short-term energy markets[14] to serve their customers, sometimes at fixed rates, these providers suffered severe liquidity problems, and had to exit the market. It is important to note that the vast majority of residential customers were protected from price spikes because they had chosen a retail electricity plan that provided for fixed prices or their provider had secured adequate long-term contracts such that only a small portion of their energy demand was served by the shorter-term energy markets.

While quick action by the PUC, ERCOT, and the Independent Market Monitor, appear to have addressed some of the congestion management issues, the events in May illustrate the need to continue the move to a nodal market and the need for many of the recommendations in this report. The move to a nodal market design will enable more effective congestion management, additional transmission capacity will permit enhanced imports of wind energy from West Texas, and aggressive DSM and deployment of advanced meters will empower customers to better manage their electricity consumption.

14 ERCOT obtains and deploys balancing energy to maintain the balance between load (energy usage) and generation and to resolve transmission congestion through a centralized auction process known as the balancing energy market. Approximately five percent of load is sold through the balancing energy market; the remainder is sold through bilateral contracts between independent parties.

5.2 Current Challenges

Persistently high and volatile natural gas prices combined with the hesitation to invest in coal generation because of uncertainty caused by the threat of federal carbon legislation, are the greatest challenges to the success of the retail electricity market. While Texas' retail market has successfully mitigated the impact of rapidly increasing natural gas prices on the majority of Texas customers, as discussed in Section 2, with such a significant amount of natural gas-fired generation on the margin in the ERCOT market, natural gas price volatility in the short-term will continue to be a challenge for REPs and customers. Such volatility can make it very difficult for REPs, businesses, and customers to plan their energy needs. However, Texas' retail market provides a wide range of options to help customers manage their needs including longer-term fixed price contracts, and short-term and demand-response options for customers who have the ability to shift their consumption patterns. The PUC and ERCOT should continue the transition to a more efficient wholesale market model, and the PUC should continue to refine market rules to ensure customers are adequately informed about their options and protected from deceptive and misleading practices. The PUC should also continue to vigilantly oversee the market to ensure that market power abuse and market manipulation does not artificially raise power prices.

5.3 Recommended Actions

5.3.1 Texas Should Resist Attempts to Re-regulate the Market and Instead Focus on Removing Barriers to Lower-Cost Generation Resources

The events of May and June 2008 will undoubtedly cause some to call for a re-regulation of the electricity market. However, as discussed in Section 2, in order to reduce electricity prices in Texas, natural gas must be moved off the margin by the addition of a large amount of non-natural gas baseload generation. While significant amounts of nuclear and coal generation are under development, uncertainty about the potential for costly regulation of CO_2 emissions is preventing these lower cost resources, especially coal, from being developed in the quantities sufficient to lower electricity prices. Also, uncertainty about long term storage of spent nuclear fuel is having the same effect on nuclear generation.

Re-regulation would effectively require the removal of all customer choices except a single monopoly provider who would be required to purchase electricity from the wholesale marketplace and/or construct new generation units. As shown in Section 2, the current costs of constructing new capacity make it unlikely that significant cost reductions will occur, and purchases from the wholesale market will not result in significantly different prices than REPs can obtain from the marketplace today. Re-regulation would also create significant uncertainty for companies, such as wind energy developers, looking to invest in the state. As discussed in Section 2, every other area of the country, whether regulated or not, faces significant costs of adding new generation over the next two decades. Texas is light years ahead of these other regions in adding new generation and transmission capacity, and Texas' competitive marketplace has placed the risk of substantial new capital additions in generation on the companies building these resources and not Texas customers. Reverting to a regulated market would subject Texans to substantial new costs without having a meaningful downward impact on the overall level of electricity prices.

Instead, Texas should adopt the recommendations in this report, accelerate the development of non-natural gas generation, reliably incorporate wind energy to the grid, remove barriers to the development of other types of generation, and offset the need for future capacity by expanding energy efficiency and demand-response programs.

✓ Recommendation 26: The state should resist efforts to re-regulate the market and instead adopt the recommendations in this plan, while retaining the oversight of the PUC and ERCOT over the market.

5.3.2 The PUC Should Revisit the Licensing Requirements for REPs, Given the Substantial Increase in Natural Gas and Electricity Prices Since Market Opening.

The PUC currently has very low certification barriers for companies to provide retail electricity service in the areas of the state open to competition. While these low barriers have permitted a wide range of companies to enter the market, the financial standards adopted for companies at market opening, when natural gas prices were $2 to $3 per MMBTU, may no longer be adequate with prices more than four times that level.

✓ RECOMMENDATION 27: The PUC should revisit its certification requirements for REPs and evaluate whether current standards are adequate given the significant change in natural gas and wholesale electricity market conditions since market opening.

5.3.3 Continued Customer Education

In 1999, the PUC was appropriated $12 million per year from the System Benefit Fund to conduct a statewide, comprehensive education campaign to inform Texans about the changes in the electricity market. In 2007, Governor Perry requested that the legislature restore the majority of this funding, but the legislature failed to fund this program adequately. As a result, the PUC's annual education budget is only $750,000, making it difficult for the PUC to continue the important work of educating Texans about the significant changes in the electricity market and how conservation tools can help customers manage their electricity usage.

✓ RECOMMENDATION 28: The state should reinstitute funding for the PUC's customer education efforts, and the Governor should direct the PUC to incorporate the topics addressed in this plan into the education campaign.

Section Six: Texas Energy Workforce Competitiveness

Texas' workforce is produced by the state's skills pipeline, which prepares, advances, and renews skills. The pipeline consists of the basic education (K-12), community and technical colleges, universities, private training providers, the workforce system, and corporations. When the skills pipeline works well, there is a flow of high school graduates who enter occupational training and colleges, producing graduates with specific skills needed by key industries. Building a next-generation skills pipeline is a core competitiveness need for the Energy cluster.

Understanding workforce demand and supply is the cornerstone of assessing how well the skills pipeline works. The demand and supply of Texas' workforce for the Energy cluster has been analyzed for the 10 year period starting in 2007. To determine workforce demand, critical occupations in the Energy cluster and the related knowledge, skills, and abilities (KSAs) were first studied. Industry projections were then used to estimate job growth through 2017.

The skills pipeline framework—preparation, advancement, and renewal—was used to guide analysis of the workforce supply. To do this, Texas was benchmarked against the U.S. technical workforce pipeline and training programs for industries with the greatest projected job growth. In addition, an economic impact model was used to forecast the technical workforce pipeline through 2017. Finally, a workforce gap analysis was carried out by comparing demand and supply growth rates through 2017. This analysis set the stage for identifying Texas' skills pipeline challenges from preparation (K-12) through advancement (community and technical colleges and university training) and renewal (re-training and employment options).

6.1 Projection of Workforce Demand by Key Occupations

Texas' Energy cluster workforce is projected to grow in the fossil fuels, nuclear, renewables, and transmission and distribution sectors a healthy 68 percent between 2007 and 2017, from about 40,000 to 66,000 jobs. (see Figure 42) Using an input-output model, occupational growth projections were made for 2017 resulting from industrial growth as projected by ICF industry analysts. Industry groups such as Nuclear and Renewables are projected to experience workforce demand growth of 150 percent and 100 percent, respectively. In 10 years, Renewables will continue to be the largest job-providing industry.

Figure 42: Projection of Workforce Demand in the Energy Cluster

Industry Groups	2007 Jobs	2017 Jobs	Total Change	% Change
Fossil Fuels	7,543	8,339	796	11
Nuclear	2,214	5,545	3,331	150
Renewable (Wind, Solar, Hydro, & Tidal)	18,427	36,903	18,476	100
Transmission and Distribution	11,330	15,636	4,306	38
TOTAL	39,514	66,423	26,909	68

Source: EMSI (Economic Modeling Systems, Inc.), Economic Impact – Input/Output, 2008

6.2 Workforce Supply Assessment

Given the outlook for skills demand and supply for occupations crucial to the competitive growth of the Energy cluster, how well is the Texas skills pipeline performing? The following section examines Texas' skills pipeline issues at each of these parts of the skills pipeline:

- Preparation: Are Texas students college- and work-ready?
- Advancement: Is Texas developing the right skills at the right time?
- Renewal: Is Texas retaining and harnessing the current skills base?

6.2.1 Preparation

Workforce development begins with the performance of the K-12 education system. Nationwide, and most notably in Texas, the demographics of the student and workforce populations have changed and continue to change dramatically. The overall population is aging, and with it the proportion of non-workers in the population.

As with many industries, the need for workers with college degrees in science, technology, engineering, and math (STEM) is growing in the Energy cluster. For these reasons, increasing high school graduation rates, enhancing readiness for college and work, and improved STEM capabilities are important to meeting workforce needs. Key performance indicators of the Texas preparation system are measures of retention and graduation rates as well as high-quality instruction in math and science.

In addition to reviewing standardized test scores, Texas high school completion rates were also analyzed. High school completion is critical for two reasons. First, Texas high school graduates constitute the pool of entrants to postsecondary education, and second, critical jobs in the Energy cluster require advanced technical education. High school completion is crucial for the Texas economy because competitiveness is heavily dependent on the availability of a trained and educated workforce.

Like many states, Texas faces significant challenges with respect to high school completion. In response to this challenge, Texas has been working to improve high schools by redesigning the traditional high school model to increase student achievement and ensure all students reach their academic and career goals. The Texas High School Project (THSP) created in 2003 and sponsored by the Texas Education Agency (TEA), the Office of the Governor, the Bill and Melinda Gates Foundation, the Michael and Susan Dell Foundation, and others, works to prepare high school students for college and career success. This $261 million public-private alliance provides a variety of options for high school success to accommodate differing learning styles. THSP makes grants to schools that target students at risk for dropping out of high school, providing strategies including tutoring, mentoring, and online acceleration programs.

6.2.2 Advancement

A fundamental issue is whether prospective workers are being prepared with the right skills. The U.S. Department of Labor's Occupational Information Network (O*NET) was used to link each of the most in-demand jobs with the required KSAs. The jobs that are most in-demand in the energy industry generally require core STEM KSAs. The core energy-related KSAs are presented in Figure 43. These KSAs are typically acquired through postsecondary proprietary technical schools, community and technical colleges, and universities.

Figure 43: Core Energy-Related KSAs

- Mechanical
- Engineering and Technology
- Production and Processing
- Education and Training
- Mathematics
- English Language
- Design
- Building and Construction
- Computers and Electronics
- Chemistry
- Customer and Personal Service
- Public Safety and Security
- Transportation
- Social Perceptiveness
- Instructing
- Critical Thinking
- Active Listening
- Service Orientation
- Technology Design
- Systems Analysis
- Judgment and Decision Making
- Science

Source: EMSI (Economic Modeling Systems, Inc.), Career Pathways - Competency Analysis, 2008

Compared to benchmark states, Texas has a similar proportion of postsecondary students going into degree programs related to energy occupations. For example, using data from the National Center for Education Statistics for 2008, 3.6 percent of postsecondary graduates in Texas are in engineering or engineering technologies as compared with 3.5 percent in California, 3.4 percent in Colorado, 3.3 percent in Illinois, 4.3 percent in Louisiana, 2.9 percent in New York, and 3.0 percent in Pennsylvania. The more important comparison, however, is not Texas to the benchmark states, but rather the U.S. to benchmark countries. For example, 9.3 percent of U.S. tertiary graduates are in the sciences, while Australia, Canada, and the United Kingdom produce 13.6, 11.6, and 15.1 percent, respectively.[15]

6.2.3 Renewal

One of the greatest concerns for the sustenance of many industries is the aging workforce. A related concern among employers is the amount of skill and experience lost as employees retire. In Texas, the workforce aged 55 and older accounts for 15.2 percent of the labor pool versus 12.3 percent only five years earlier.[16] In addition, evidence suggests the energy workforce is slightly older than in other industries—the median age for the U.S. workforce is 41 years, while the median age for the utilities industry, for example, is about 45 (just lower than the median age of oil and gas workers).[17]

The challenge of skill renewal among the existing workforce remains. Employers will need to support their employees in obtaining timely skill upgrades in order to remain competitive. Texas' community and technical colleges have been particularly active in assisting employers in renewing skills related to the rapidly changing Energy cluster in fields such as wind.

Employers will need to consider increasingly how to leverage opportunities among individuals who are not in the workforce, either from the military or declining industries.

Recruiting new workers, retaining current workers, and transferring knowledge from retirees to those who will take their place remain important challenges. Additionally, given the general decrease in younger workers, Texas is making great strides in developing and implementing programs to recruit and train a workforce for newer technologies. For example, Baylor University, Texas A&M University, the University of Texas Brownsville, the University of Texas El Paso, and the University of Houston all have programs in renewable energy. In addition, Texas Tech University, Texas Southern University, West Texas A&M University, Texas State Technical College, and The University of Texas at Austin have programs in wind power training. In fact, Texas State Technical College West Texas implemented one of the very first wind energy technician certification programs in the nation. Texas also has three programs dedicated to nuclear energy and five to solar power.

Texas has the largest investment nationwide in teacher performance pay. In 2006, the Texas Legislature authorized two teacher incentive pay programs. The Texas Educator Excellence Grant program (2008) awards approximately $100 million annually to high-performing or improving schools ranked in the top half of schools in percentage of economically disadvantaged students. The District Awards for Teacher Excellence program will begin in fiscal year 2009 and will provide rewards to teachers who contribute substantially to improved student achievement. Participation in this program is optional for all Texas school districts. Texas has taken a major step in the quest to attract and retain the best teachers with its investment in teacher performance pay programs.

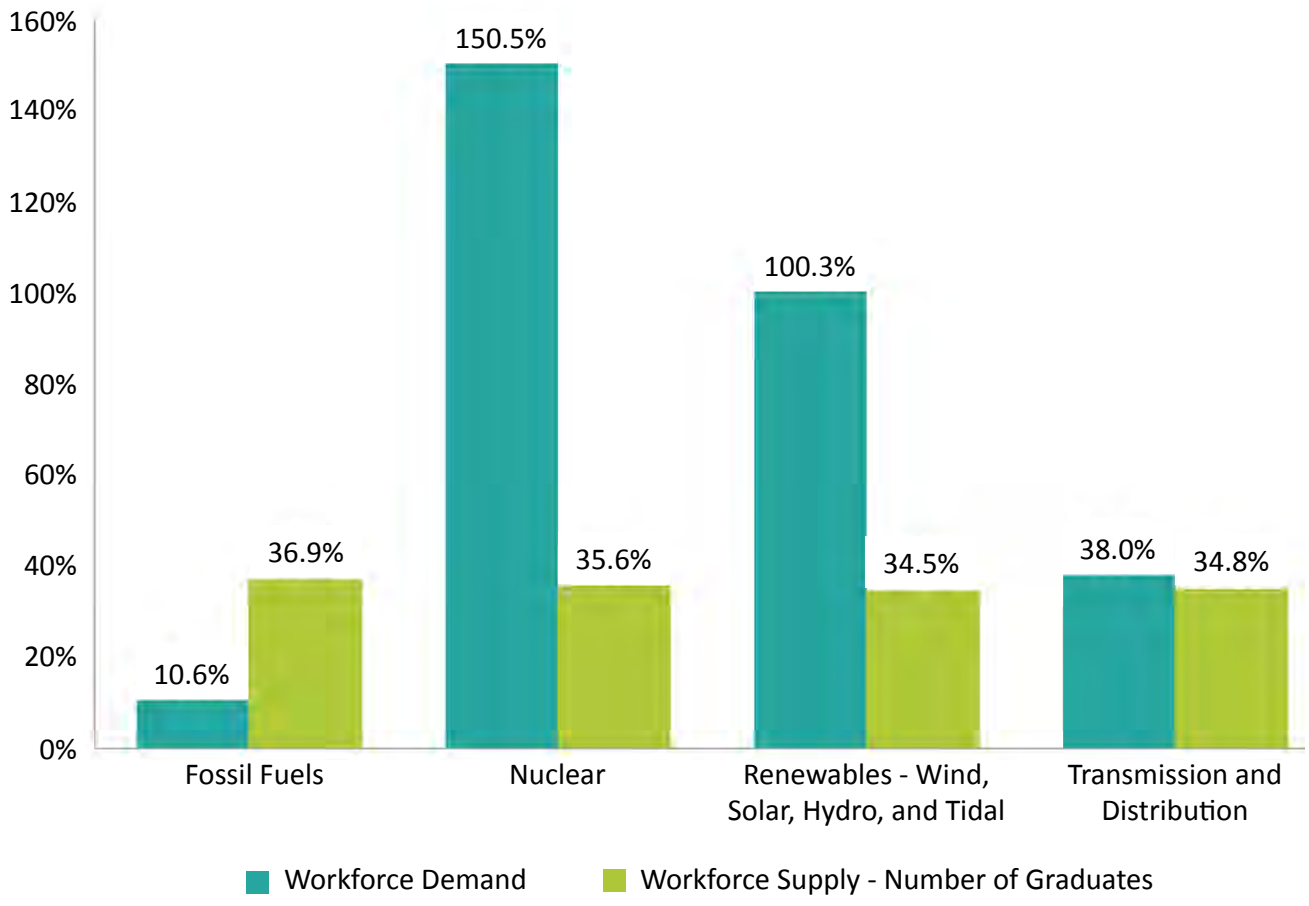
15 Organization for Economic Co-Operation and Development. 7 July 2008 <http://www.oecd.org>.
16 U.S. Census Bureau. "2006 American Community Survey." U.S. Census Bureau. 7 July 2008 <http://www.census.gov/acs>.
17 Center for Energy Workforce Development. "Gaps in the Energy Workforce Pipeline." Center for Energy Workforce Development 2007. 7 July 2008 <http://www.cewd.org/surveyreport/execsummary_cewdreport_oct07.pdf>.

6.3 Workforce Gap Analysis

One core question facing the Energy cluster is defining which skills are needed and how to best achieve their development, otherwise known as the skills gap. To analyze gaps between future needs and fulfillment capacity, workforce demand and supply for the Texas Energy cluster were forecasted. Analysis reveals that the rate of growth in workforce demand for Nuclear and Renewable far outpaces the growth in supply of trained professionals who can satisfy industry's workforce requirements. For the Nuclear industry group, the demand growth rate of 150 percent is matched by a 36 percent increase in supply rates. Similarly, for the Renewables industry group, a demand growth rate of 100 percent is matched by a 34 percent increase in supply rates. The other two industry groups, Fossil Fuels and Transmission and Distribution, are expected to satisfy their workforce demands with future supplies. Figure 44 below shows workforce demand and supply misalignments for 2017.

The primary skills pipeline challenge for the future Texas Energy cluster will be to ensure that the supply of qualified personnel meets the demand of the cluster's Nuclear and Renewables industry segments.

Figure 44: Workforce Demand-Supply Misalignment in the Energy Cluster Industry Group



Source: EMSI (Economic Modeling Systems, Inc.), Economic Impact/Output, 2008. Supply: Regression Analysis of Graduation Data from National Center for Education Statistics, Common Core of Data (CCD)

6.4 Texas Workforce Challenges

To ensure competitiveness in the Energy cluster, Texas needs to build a skills pipeline that consistently supplies trained, work-ready personnel. Based on the workforce analysis and modeling, review of Texas' position, and stakeholder inputs, the challenges faced by Texas' skills pipeline for these clusters includes the following:

6.4.1 Preparation Challenges

6.4.1.1 Preparing Students to Choose Careers in the Energy Cluster

Based on analysis of the Energy cluster, occupations in the Nuclear and Renewables sub-clusters are projected to experience a growth in workforce demand through 2017 that far outpaces the supply of skilled labor.[18]

One key workforce challenge for Texas is to familiarize students with the benefits of choosing a career in Energy. In general, students lack an understanding of available industry career choices and the educational path required to achieve career objectives.

6.4.1.2 Enhancing High-School Completion Rates, Improving Teacher Quality, and Better Preparing Students to Be College- and Workforce-Ready

Benchmark analysis indicates that Texas compares well with other states on elementary and middle school science standardized test scores. However, Texas has a high school completion rate that is lower than required to produce the workforce to meet the cluster's needs. A lower rate of high school completion translates into a smaller college-eligible student population and ultimately a smaller potential workforce for industry.

Perhaps the most important strategy for improving public education is to attract and retain high-quality teachers in hard-to-teach subjects (math and science) and geographic areas (inner cities, rural areas, and schools not meeting annual yearly progress for successive years). Texas has started addressing these challenges with its relatively large teacher incentive pay initiatives.

College-readiness, as defined by the Texas Higher Education Coordinating Board (THECB), refers to having the knowledge and skills necessary to begin entry-level college courses with a reasonable likelihood of success and not requiring developmental education.[19] The 2007 report by the Commission for a College-Ready Texas found a lack of rigor in the state's curriculum standards. Improving college readiness by better aligning curricula with college readiness standards, enhancing curriculum standards in math and science, and increasing rigorous applied-learning opportunities in Texas public schools is crucial to improving the competitive advantage of Texas' students.

18 See Figure 42 on page 62 for demand growth-rate vs. supply growth rate details.
19 Commission for a College-Ready Texas-Final Report, November 7, 2007, <http://www.collegereadytexas.org/>.

6.4.2 Advancement Challenges

6.4.2.1 Reviewing and Modifying STEM (Science, Technology, Engineering, and Mathematics) Curricula to Ensure it Reflects Knowledge and Skills Needed by Industry

High-level job analysis was carried out in the critical occupations in each cluster to identify the associated KSAs necessary for cluster success. Graduating students and employees with KSAs in the STEM areas are crucial to support projected industry growth and to feed into science and engineering occupations. More specifically, a workforce with KSAs in mathematics, chemical, mechanical, installation, and engineering and technology are the foundation for the work performed in the Energy cluster. Stakeholders validated these findings and suggested strategies needed to address STEM-related workforce gaps in professional and technical positions.

Both the career education programs and the college readiness efforts discussed above will be critical to increase early awareness, not only of career options, but also of the academic preparation needed to satisfy workforce requirements.

6.4.2.2 Developing a More Flexible Technical Education and Training System

Texas community and technical colleges cannot freely offer training in certain service areas, because it would require navigating cumbersome approval processes. Additionally, stakeholders' suggested approvals for training are often denied. This limited flexibility prevents certain businesses from securing needed training when pursuing new projects. Texas needs to address this jurisdictional challenge.

6.4.3 Renewal Challenges

6.4.3.1 Mitigating the Effects of Changing Demographics and Skill Obsolescence

Texas' Energy cluster is undergoing demographic change in the form of an aging workforce. Workers age 55 and up compose 15.2 percent of the labor force, up from 12.3 percent five years earlier. In addition, many workers face skill obsolescence due to declines in industry demands for certain skills, technological advancement, and process changes that have occurred in the industry over the last decade.

Texas faces a challenge of retraining existing workers with obsolete skills while infusing the labor pool with new workers to prevent severe workforce shortages at the entry and middle occupational levels, and also to offset the negative effects of an aging workforce.

6.4.3.2 Improve the Ability to Respond and Remain Ahead of the Competition

Like its global competitors, Texas faces the challenge of responding to economic conditions in an innovative, timely, and collaborative manner. To stay ahead of its competitors, Texas needs to address the following challenges.

- ✯ Strengthen capacity to better assess current and future workforce needs so that gaps between supply and demand in priority industries can be discerned. The lack of an industry-wide supply and demand database presents a challenge for educational institutions and individuals in planning and responding to emerging workforce needs and opportunities.
- ✯ Make information about job, education, and training opportunities in key industry clusters more easily accessible. Texas workforce and economic development would benefit by improving, developing, and deploying cross-agency strategies to respond to industry needs. Texas would also benefit by implementing regionally-focused strategies centered on its industry clusters.

6.5 Recommended Actions

Building the Texas workforce skills pipeline is a major issue that extends beyond the two clusters that are the focus of this report. Many clusters are suffering from deficits in skilled employees and a broader strategy needs to be developed. Proposed actions for addressing the skills pipeline challenges identified above are now presented.

6.5.1 Preparation Recommendations

Texas may prosper from several industries that are projected to grow, but these industries need quality workers. Some of these industries have recruitment challenges rooted in historical biases and misperceptions about the quality and diversity of jobs available. Other jobs require high school graduates to be college- and workforce-ready. Texas should address the challenge of preparing students to choose careers in all industries, including those in the Energy cluster, by acquainting students with career choices and getting them college- and workforce-ready.

- ✓ Recommendation 29: Texas should continue to invest in programs designed to generate interest in math and science. The state should increase the scale of successful programs that produce qualified math and science teachers in order to support more rigorous STEM education. Acquainting students with energy industry career options through online tools will also enhance interest and engage learners in STEM fields.
- ✓ Recommendation 30: Texas needs to increase high school completion rates and ensure that high school graduates are college- and workforce-ready. The state must adopt model curricula aligned with college and workforce requirements to reach higher standards.

6.5.2 Advancement Recommendations

- ✓ Recommendation 31: Texas needs to increase the number of postsecondary graduates with knowledge and skills that meet industry needs. The state should encourage colleges and universities to align their STEM curricula with energy workforce needs.
- ✓ Recommendation 32: Texas should improve the flexibility of its technical education and training system in response to industry needs across the state, regardless of service area boundaries. The state should examine ways to allow community and technical colleges to deliver training where employees are regardless of the college's location.

6.5.3 Renewal Recommendations

Texas can meet future workforce needs by continuing efforts to retrain workers from slow-growing industries and making it easier for skilled workers, such as those in the military, to transition into the Texas workforce. Texas should also increase its ability assess supply and demand gaps in the skills pipeline.

- ✓ RECOMMENDATION 33: The state should continue the Skills Development Fund, which supports training programs that respond directly to the workforce needs of Texas employers. This is an effective tool for helping to retrain workers and in meeting the needs of industry in a "just-in-time" manner.
- ✓ RECOMMENDATION 34: The energy industry should look to the military and declining industries to expand its workforce. Texas should work with the military to align occupation certification requirements so that re-training programs recognize the existing skills and training of armed forces personnel. The state should also focus on retraining workers from declining industries to enable their transition to high-need occupations.
- ✓ RECOMMENDATION 35: The state should create a Workforce Supply-Demand Database. Texas needs accurate data to assess the current and future workforce gaps between supply and demand in priority industries and occupations. This would require a collaborative effort among private industry, the THECB, the TWC, the TEA, and other relevant stakeholders.
- ✓ RECOMMENDATION 36: The state should establish a Texas Center for Workforce Innovation and Competitiveness to promote and support skills pipeline initiatives. The urgency of skills pipeline challenges calls for establishing an intermediary that can facilitate workforce partnerships in support of economic development priorities in regions across Texas. The center should house staff from the TEA, the TWC, the THECB, and the TWIC.

6.6 SUMMARY OF WORKFORCE STRATEGIC DIRECTIONS

The Texas Energy cluster has one of the largest workforces in the state. Building a skills pipeline may be one of the most important challenges facing Texas but the rapid pace of change in the industry means that Texas must ensure its ability to deliver a quality workforce.

Major energy firms are already learning to work closely with nearby high schools to introduce their career opportunities and build relationships that will hopefully lead to students remaining in school, graduating, and going on to receive training that will lead to a career in their industry. Enhancing the K-12 capacity to retain and prepare students is a principal challenge in this cluster or in any other. Fortunately, the system for advancing skills in Texas has been adaptive and is working more closely with industries to shape and deliver training programs that better match their needs.

Texas has a strong training infrastructure but the scale of challenges ahead, in terms of rapid changes in skills needs and an aging workforce, means there needs to be an increasing convergence of lifetime human capital management from preparation through advancement and renewal of skills. Industry and all educational and training institutions need to form new regional skills pipeline partnerships to achieve this. A new intermediary to help study, enable, and guide these changes may also be needed in Texas.

Section Seven: Implementing the Energy Plan

Texas is the undisputed leader in energy and petroleum production and consumption. In order to achieve this position, industry and government have worked together for decades to produce energy for use in Texas and to export resources around the globe.

However, the next century of energy development will prove to be more challenging than the first century. Texas will lead the nation in the development of new nuclear plants, use its vast underground reservoirs to store CO_2, produce electricity with clean resources like wind and solar, and develop ways to use the 250 year supply of lignite. In order to achieve the next century's goals, Texas must have a governance structure that fits its future goals.

The states' major energy regulatory, permitting, research, and assistance programs are dispersed throughout at least seven state agencies.

- The Public Utility Commission oversees the wholesale and retail electricity markets, including ERCOT and TDUs, and the system benefit fund to support low income citizens;
- The Texas Commission on Environmental Quality permits new electric generating plants and coal mines;
- The Railroad Commission regulates the oil and gas production in the state as well as lignite and coal production;
- The General Land Office issues permits for resource production, both wind and oil and gas, on state lands and off shore waters and has alternative fuels and conservation programs;
- The Comptroller directs the resources of the State Energy Conservation Office which disburses federal and other revenues used for energy efficiency;
- The Texas Department of Agriculture promotes the development of biofuels in Texas; and
- The Texas Department of Housing and Community Affairs disburses weatherization assistance grants.

The split of jurisdiction causes confusion for business and industry, and makes it more difficult to carry out a cohesive energy policy.

- ✓ Recommendation 37: The state should create a council of member agencies or designate an official tasked with coordinating energy functions.

Responsibilities: The Council or official should have the primary roles outlined below:

- Prepare Biennial Texas Energy Plan Update: With input from various agencies, prepare and release biennial Texas Energy update with annual updates and ongoing communication with the public and industry.
- Coordinate Implementation of Legislative Mandates: Coordinate implementation of legislative mandates with listed agencies to ensure that mandates are executed in a cohesive manner.
- Oversee the Granting and Administration of Innovation Prize: Oversee the granting and administration of the innovation prize for the storage of energy created in this plan.
- Oversee Nuclear Research: Oversee the partnership between institutions of higher education and industry to research opportunities regarding the entire nuclear fuel cycle, including recycling of spent fuel.
- Oversee the Granting and Administration of Innovation Prize: Oversee the granting and administration of the innovation prize for clean coal.

Governor's Competitiveness Council (GCC) members

Members with an asterisk beside their names resigned before the issuance of this report.

GCC Chairman: Michael Williams, Chairman, Texas Railroad Commission
Phil Wilson, Texas Secretary of State and Former GCC Chairman*
Tom Burbage, Executive Vice President and General Manager, Lockheed Martin Aeronautics Company
Don Cain, President, AT&T Texas
The Honorable Susan Combs, Texas Comptroller of Public Accounts
Deirdre Delisi, Chairwoman, Texas Transportation Commission
Aaron Demerson, Executive Director, Governor's Division of Economic Development and Tourism
Jim Epperson, Senior Vice President, State Legislative and Regulatory Affairs, AT&T Corp.*
Gayle Fallon, President, Houston Federation of Teachers
Buddy Garcia, Chairman, Texas Commission on Environmental Quality
Mike Greene, CEO, Luminant Energy
Sandy Kress, Chairman, Commission for a College Ready Texas
Ron Lehman, Employer Commissioner, Texas Workforce Commission
Johnny Lovejoy, II, President and CEO, Lovejoy and Associates
Gray Mayes, Director of Public Affairs, Texas Instruments, Inc.
The Honorable Don McLeroy, Chairman, State Board of Education
Charles McMahen, Past Chairman, Governor's Business Council
Ron McMillan, Regional Vice President of Governmental Affairs, Time Warner Cable
Bill Morrow, Chairman, Texas Emerging Technology Fund
Zeb Nash, Site Manager, ExxonMobil Chemical Company
Joseph O'Neill, III, Managing Partner, O'Neill Properties, Ltd.
Raymund Paredes, Commissioner, Texas Higher Education Coordinating Board
Robert Scott, Commissioner, Texas Education Agency
Barry Smitherman, Chairman, Texas Public Utility Commission
The Honorable Todd Staples, Commissioner, Texas Department of Agriculture
John Sylvester, Jr., Chairman, Texas Workforce Investment Council
Kip Thompson, Vice President of Global Facilities and Strategic Growth, Dell, Inc.
Jeffrey Wade, Executive Vice President and General Counsel, Lexicon Genetics, Inc.
Ric Williamson, Chairman, Texas Transportation Commission, posthumous
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