REPORT TO THE TEXAS HOUSE OF REPRESENTATIVES

79TH LEGISLATURE

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The Honorable Tom Craddick
Speaker, Texas House of Representatives
P.O. Box 2910
Austin, Texas 78768-2910

Dear Mr. Speaker and Fellow Members:

The Committee on Regulated Industries of the 78th Legislature hereby presents its interim report for consideration by the 79th Legislature.

Respectfully submitted,

Phil King, Chairman

Bob Hunter, Vice-Chairman

Sylvester Turner, CBO

Joe Crabb

Todd Baxter

Ryan Guillen

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Introduction

On November 4, 2003, The Honorable Tom Craddick, Speaker of the Texas House of Representatives, issued nine interim charges to the House Committee on Regulated Industries. This report outlines the committee's examination of the issues, presents the facts and data obtained by the committee, raises legislative concerns, and summarizes the recommendations of the committee with regard to its interim charges.

Pursuant to House Rules, the Committee has jurisdiction over all matters pertaining to:

1. The regulation and deregulation of electric utilities and the electric industry;
2. The regulation and deregulation of telecommunication utilities and the telecommunication industry;
3. The regulation of science and technology, including telecommunication, electronic technology, and automated data processing;
4. Electric utility regulation as it relates to energy production and consumption;
5. Pipelines, pipeline companies, and all others operating as common carriers in the state;
6. The regulation and deregulation of other industries not specifically assigned to another committee under these rules; and
7. The Public Utility Commission of Texas, the Office of Public Utility Counsel, and the Telecommunications Infrastructure Fund Board.

The Committee membership includes Chairman Phil King, Vice-Chairman Bob Hunter, Sylvester Turner, Joe Crabb, Todd Baxter, Ryan Guillen, and Steve Wolens.

Executive Summary

Charge #1

Gather and review information on the overall status of the telecommunications market in Texas, including the effects of inter-modal competition and emerging technologies. Recommend changes to Texas law to encourage new investment and technological innovation consistent with market-oriented public policies and the interests of Texas families and businesses. Gather information on the Federal Communications Commission Triennial Review and recommend adjustments to Texas law.

Overview of Findings:

The status and success of intra-modal competition remains in debate. Efforts to deregulate legacy telecommunications networks have encountered a unique dilemma. The owner of the land-line telephone network is alleged by some to be a wholesale monopoly, but not necessarily a retail monopoly. Thus, the dilemma is how to mitigate perceived wholesale market dominance while still allowing the network owner to compete in the retail market.

Under the Federal Telecommunications Act and the Texas Public Utility Regulatory Act (PURA), all incentives for the network owner to provide its monopoly network at nondiscriminatory, competitive rates are regulatory, and there currently are no market-based solutions. Furthermore, the network owner's retail business competes directly with the network owner's wholesale customers, providing a theoretical incentive for the network owner to discriminate and engage in anticompetitive behavior against its wholesale customers.

However, inter-modal competition is increasingly vibrant and soon may overshadow the intra-modal debate. Inter-modal technology options that can support competitive communications services are expanding at a blistering pace and include traditional wire line, cable and fiber optics, and wireless with enhanced services and capabilities such as VoIP, WiFi, WiMax, EvDo, BPL, and VDSL. The extent to which these alternate platforms will allow the development of substitutable services (services a customer can readily substitute for another) will be critical to the development of vibrant inter-modal competition. In all cases however, these inter-modal communications platforms must interconnect to provide seamless and reliable services to consumers on competing platforms.

Federal communications law and policy remains ever evolving and there appears to be no quick end in sight. Unfortunately, the much anticipated Triennial Review brought little resolution to the uncertainty at the federal level. The Federal Communications Commission (FCC) continues to promulgate new rules with frequency in its effort to accommodate recent court rulings and policy directives.

Position:

It is not the legislature's role to protect a particular company or industry segment. Rather, the state's role is to protect competition in the marketplace and to ensure integrity with regard to consumer practices. To that end, competition is best measured not through the eyes of a company (or industry), but through the eyes of the consumer. The fundamental question (from a policy perspective) is not how a company's stock is performing, but what goods and services are available to consumers at home and in the workplace and at what prices and service levels such items are available.

The benefit of limited regulation is readily apparent in the wireless and broadband sectors – communications sectors in which there is limited or no state or federal regulation. In wireless and broadband technologies, we have seen rapid deployment and adoption (wireless phones now outnumber land lines), exponential technological innovation, and substantial price reductions.

On the other hand, traditional residential local telephone service, which has been highly regulated, has seen little technological innovation and prices and services have remained relatively constant. Whether regulation itself oppressed innovation or simply protected the status quo by suppressing the need to innovate is an interesting point of debate.

Changes in technology have far outpaced changes in state and federal law. For example, cable modem service, currently the leading means of broadband Internet access service, did not even exist when the legislature last undertook a full review of PURA. We should expect fast paced innovation to remain the norm. Therefore, it is essential that Texas provide a statutory framework for communications services that is technology neutral and flexible to accommodate these anticipated technological changes. Such a framework will permit incorporation of new technologies into the statutory scheme without the need for legislative action. It will also promote greater market efficiencies by permitting consumer demand (rather than statutory directive) to drive innovation and the provision of goods and services.

Recommendations:

Competition and technological advancement have radically changed the economic and regulatory equation. Texas can help provide economic and regulatory certainty for communications companies doing business in this state by creating a more supportive framework for open competition, economic investment, and technological innovation. Limited regulation must be at the centerpiece of this effort.

Texas communications law should be amended to ensure that it is technologically neutral in its application and enforcement.

Fees for intra-state switched access service remain substantially higher in Texas than most other states and are an impediment to more flexible pricing options and services for consumers. Intra-state access fees should be systematically lowered over a reasonable and defined period. In order to allow providers the ability to recover revenues currently recovered through intra-state access

fees, further retail pricing flexibility for basic service should be implemented. Lifeline eligibility also should be expanded but limited to basic service.

Charge #2:

Study broadband service deployment, including other states' models used to transition to a fully competitive communications marketplace and any new technologies of competitive providers.

Overview of Findings:

Broadband technology is quickly becoming the foundation for a new networked economy. President Bush has declared universal, affordable broadband access to be critical to national interests and a goal of his Administration. Despite the fact that broadband is widely available in urban communities, access remains limited in rural Texas and even in many suburban areas. It also should be noted that unacceptable deployment disparity exists within certain urban centers and neighborhoods.

Position:

It is in the best interest of all Texans to advance President George W. Bush's policy of ubiquitous, affordable access to broadband technology by the year 2007. Universal deployment offers incredible opportunities for business, education, health care, entertainment, and overall advancements in quality of life.

Recommendation:

Although public-private partnerships should be explored, legislators should resist the temptation to establish government funded and managed broadband networks. Consumer demand, not statute, will most effectively drive deployment and innovation. Consequently, reduction of regulatory encumbrances will increase open market competition and encourage broadband investment and deployment.

Charge #3:

Study the process of economic dispatch and determine possible methods to improve the competitive electric utilities market and reduce costs and pollution caused by inefficient power plants.

Overview of Findings:

Five years ago, the Texas Legislature enacted sweeping electric market reforms which generally have achieved the desired effect of encouraging competition and attracting investors to build clean, efficient generating plants. However, the success of deregulation has been somewhat masked by the unanticipated tripling of natural gas prices, the industry's primary fuel source, since the advent of retail competition.

The Electric Reliability Council of Texas (ERCOT), a nongovernmental entity, is responsible for managing the supply grid from a portfolio of suppliers. Unfortunately, the current ERCOT

model is not producing the most efficient use of existing power generation. The result is the continued use of older, high-emission power plants instead of newer power plants with lower emissions and a more economical pricing structure.

Position:
The prospect of implementing a bid-based, economic dispatch is consistent with the state's anticipated transition into a nodal market and appears to be a plausible initiative to increase economic development, reduce pollution (especially in non-attainment areas), and generally increase the competitiveness of the electric utility market.

Recommendation:
ERCOT is currently working on implementation of a nodal market design within which bid-based, economic dispatch will be possible. The committee declines to make any recommendations with regard to economic dispatch until implementation is complete. However, the Legislature should insist that implementation of a nodal market design remain a significant priority for ERCOT.

Charge #4:

Examine issues related to access of rights-of-way and easements to ensure state laws encourage non-discriminatory access for all broadband service providers regardless of technology used to offer the service or the regulatory status of the provider.

Overview of Findings:
Texas law should insure the equitable treatment of all communications service providers with regard to the application of government fees, terms, and conditions for access to the public rights-of-way. Unfortunately, for a number of reasons, including historical compensation structures, judicial rulings, changes in technology, and marketplace developments, the practice is not uniform or equitable among competitors.

Position:
To insure that consumers have competitive choices in the marketplace, there must be fair and equitable treatment of communication service providers at all levels of government. Simply stated, the playing field must be level for all players regardless of the technology through which the communications service is provided.

Recommendation:
Texas law should be amended to ensure that fees, terms, and conditions for access to the public rights-of-way are competitively and technologically neutral as they apply to any communications service provider.

Charge #5:

Examine the reliability of the electric utility service and review the authority and structure of ERCOT.

Overview of Findings:

Although Texans receive their electric power from many different utility companies, the independent, not-for-profit ERCOT is responsible for the reliability and security of the state's electricity market, as well as for fair and open access to the transmission and distribution system for all buyers and sellers of electricity.

ERCOT's board of directors is comprised of independent members, consumers, and electric power providers. However, it primarily is a "stakeholder" driven board, which has given rise to suggestions of conflict of interest.

ERCOT's budget has grown at a very alarming rate throughout its limited tenure, and its past management practices have proven far less than competent. Although it is not a state agency, ERCOT has the ability, in effect, to "tax" for its operating funds. The Public Utility Commission (PUC) has jurisdictional authority over ERCOT but has no significant budget oversight.

Texas's original deregulation scheme called for competition to develop in the state's non-ERCOT regions. But competition, such as that implemented within ERCOT, has proven impractical in non-ERCOT areas due to the absence of a Federal Energy Regulatory Commission (FERC)-approved Regional Transmission Organization (RTO) or similar entity. Texas lacks the authority to compel the establishment of an RTO due to FERC's preemptive jurisdiction.

Electric cooperatives and municipally-owned utilities within ERCOT are free to opt into competition. However, those that have explored entry have encountered significant and unacceptable impediments, specifically with regard to modeling.

Position:

Although it should remain a private entity, ERCOT holds a unique position of public trust. Its operations must, therefore, be open to public scrutiny, and its board must be independent in function to ensure that members can meet their fiduciary obligations.

Given ERCOT's unique ability as a private sector entity to self-fund in a manner similar to taxation and its direct impact upon the cost of electric power for consumers, the state must have substantial budgetary oversight of ERCOT. The PUC is the appropriate venue for such oversight.

Until an RTO or similar entity is in place, statutory mandates for competition in non-ERCOT areas will suggest operational uncertainty for the industry. Operational uncertainty translates into financial uncertainty, which is contrary to the public interest.

Electric cooperatives and municipally-owned utilities within ERCOT should remain free to opt into competition when it is in the best interest of their customers and shareholders. Entry should be encouraged by the removal of unnecessary impediments.

Recommendations:
The Legislature should refine ERCOT's board structure to minimize conflicts of interest and promote independence of action by directors and officers. It also should give the PUC clear budgetary oversight of ERCOT.

Rather than requiring non-ERCOT companies to repeatedly seek legislative waivers to competition, the state should not require competition in non-ERCOT regions until such time that a FERC-approved RTO is in place and the power region has been qualified by the PUC.

The legislature should ensure that the process for entry into competition by electric cooperatives and municipally-owned utilities is streamlined and that unnecessary impediments to entry are removed. In particular, modeling should be made readily accessible at a static and reasonable price for companies considering entry.

Charge #6:

Study the size and scope of the various broadband infrastructure platforms (e.g. cable, satellite, fixed wireless, DSL) in the state and how each are regulated under both state and federal law.

Overview of Findings:
Broadband is defined by the FCC as a service capable of transferring data at 200 kilobits per second in at least one direction. Simply put, broadband offers a larger pipeline for data to flow through, which allows for enriched information processing and video and audio capabilities. Broadband platforms include DSL, cable modem, satellite, fiber optics, and fixed or remote wireless service.

Broadband platforms operate in various regulatory environments:

- DSL - The federal government has exercised authority over some aspects of this service under the Federal Telecommunications Act, such as requiring tariffs, because of its status in interstate commerce and use of common carrier facilities. State jurisdiction is not entirely resolved, although the FCC has taken steps to preempt conflicting state authority.

- Cable Modem Service - The most commonly used broadband gateway to the Internet, the FCC has declared cable modem service to be an "information service," thereby exempting it from state regulation. However, that status is currently being challenged in the courts.

Just recently, the U.S. Supreme Court granted certiorari in *Federal Communication Comm'n v. Brand X*, No. 04-281, and will address the question of whether cable modem service should be classified as an "information service" consistent with the FCC's definition, or whether it should be classified as partly an information service and partly a telecommunications service, as it was defined by the Ninth Circuit. A decision is expected sometime after July 2005.

Notwithstanding this decision, there currently is no state authority and only limited local authority over cable modem service, although municipalities have sought to use their traditional cable franchising authority to impact issues relating to cable modem service.

- Wireless – Wireless uses radio signals instead of wire, cable, or fiber optics. Providers are subject to some broadcast regulation but, prices, terms, and conditions of service remain unregulated by any entity.

- Satellite – Retail prices, terms, and conditions of service are unregulated by any entity.

Position:
Local, state, and federal regulatory authority over these mediums is mixed, confusing, and in flux.

Recommendations:
The Texas Legislature cannot end the uncertainty caused by evolving and ambiguous federal law, but it can and should settle questions concerning the state's role in regulation of broadband, as well as that of local government.

Charge #7:

Determine how investment in broadband networks by both competitive local exchange carriers and incumbent local exchange carriers can be encouraged through public policy changes.

Overview of Findings:
The availability of broadband service across Texas is erratic. Upgrading telephone and cable lines is a massive, multi-billion dollar investment with no guaranteed customers or return on investment. Deployment of new wireless technology faces similar challenges.

Realization of ubiquitous broadband deployment will require substantial capital investment by several industries. The greatest impediment to such investment is statutory and regulatory uncertainty. Certainty allows providers to base their investment decisions on economic analysis alone. Statutory or regulatory uncertainty requires integration of political analysis into investment decisions. Uncertainty restrains access to capital investment in broadband.

Position:
The Legislature should seek to enhance economic certainty for industries that will be integral to the deployment of broadband technology. The FCC has taken steps to increase certainty where there is new investment by traditional telecommunications companies and cable companies. Texas must ensure that its statutory structure does not inadvertently undermine prospective deployment.

Recommendation:
The Legislature should employ a statutory framework that relies upon the marketplace and consumer preferences, rather than government intervention, to drive broadband investment and deployment.

All advanced telecommunications technologies – such as broadband, VoIP, and fiber-to-the-neighborhood networks – should be permitted to grow without traditional state regulation. Advanced telecommunications technologies generally should be excluded from state regulation.

Tax-supported entities should not be allowed to offer telecommunications or information services in direct competition with private industry.

Charge #8:

Examine the benefits and challenges associated with alternative forms of energy generation technologies, such as wind and hydrogen fuel cells, and what if any state government involvement should be considered. (Joint Interim Charge with Energy Resources Committee)

Overview of Findings:
Texas has great potential for development of renewable, non-polluting energy. Power sources such as wind, solar, and biomass could meet significant components of the state's energy needs. These power sources also can help address critical environmental issues in parts of the state. The key lies in developing technologies that will generate and transmit renewable energy affordably and reliably.

Wind power deployment in West Texas has been impressive, and its economic impact on local communities has been significant. However, wind power development has been constrained due to insufficient transmission capacity to carry the energy from its generating source to the ultimate consumer. The prospect of delivering emission-free power is of particular interest in non-attainment areas such as Dallas/Fort Worth.

Position:
State law should not promote a specific form of renewable energy; rather the market and technological innovation should drive development of this energy sector. The legislature's primary role should be to ensure that sufficient transmission capacity is available to deliver energy produced by alternative generation technologies to the appropriate market. This position is consistent with Texas's model of structural separation in the electric power industry.

Recommendation:
The state should ensure proactive transmission planning and funding to help meet the state's renewable energy goals. Evaluation of potential transmission projects should be allowed to take into account not only direct economic costs, but also potential environmental benefits. Particular attention should be given to delivering clean, renewable energy to Texas's non-attainment regions.

Charge #9:

Monitor agencies and programs under the committee's jurisdiction, including identifying possible ways to merge or streamline agency functions to produce long-term financial benefit to the state and better efficiency of the agencies.

Overview of Findings:
The PUC is comprised of three members. The Open Meetings Act makes it unlawful for a majority of any commission to meet to discuss that commission's business unless the meeting is conducted in a forum that is open to the public. Thus, it is unlawful for two PUC commissioners to even discuss most PUC business in a non-public forum.

The net affect of this quorum rule is highly problematic, in that it impairs even the most basic executive level interaction. Open communication is critical to the success of any organization. However, the current PUC model prevents frank discussion and the exchange of ideas between commissioners. Most issues cannot be discussed at all except at public hearings, where a commissioner's comment or mere "brainstorming" can be misinterpreted and have unintended market impact.

Position:
The telecommunications and electric power markets are vital to the state, its economy, and its citizens. These markets are also sensitive to regulatory uncertainty and particularly vulnerable to the discussion by commissioners of proprietary or sensitive information at open meetings. Indeed, these discussions can cause unnecessary and harmful market fluctuations which could impair the burgeoning competitive markets, especially if proprietary, competitively sensitive information is released to competitors or the general public through an open meeting. Additionally, both markets are critical to homeland security and to maintaining a stable, impervious infrastructure in which the state and its agencies can operate.

Commissioners must have the freedom to discuss business without fear that market observers will misinterpret their comments or that sensitive information may inadvertently be released. Yet today, two commissioners cannot simply sit and discuss the most basic issue without violating the law. What enterprise of any nature could function well under such circumstance? This inability to communicate leads to inefficiencies and staff dominance of issues.

Recommendations:
The number of PUC commissioners should be increased from three to five.

The Sunset Commission's recommendations regarding the PUC, ERCOT and the Office of Public Utility Council should be fully reviewed and taken under serious consideration by the Legislature.

Public Hearings Summary

The Committee held eight public hearings where it took both invited and public testimony on the interim charges. Seven hearings were held in Austin, and one hearing was held in Weatherford. Additionally, one subcommittee was appointed for interim charge number 3, and it held one public hearing in Austin. The hearings took place on:

1. September 29, 2004 at 10:00 a.m. in the Capitol Extension, Room E1.036
   - The Committee took invited testimony on the status of the electric industry in Texas.
   - The Committee met jointly with the Senate Business and Commerce Committee and the Electric Utility Restructuring Legislative Oversight Committee.

2. September 24, 2004 at 9:00 a.m. in the Capitol Extension, Room E2.010
   - The Subcommittee on Interim Charge Number 3 took invited testimony.

3. August 26, 2004 at 8:00 a.m. in the Fine Arts Center of Weatherford College in Weatherford, Texas
   - The Committee took invited testimony.

4. May 12, 2004 at 11:00 a.m. in the Capitol Extension, Room E2.010
   - The Committee took invited testimony on interim charge number 6.

5. May 3, 2004 at 1:00 p.m. in the Capitol Extension, Room E2.010
   - The Committee took public comment on interim charge numbers 3 and 5 and invited testimony on interim charge number 5.

6. April 28, 2004 at 11:00 a.m. in the Capitol Extension, Room E2.010
   - The Committee took invited testimony on interim charge number 3.

7. April 26, 2004 at 1:00 p.m. in the Capitol Extension, Room E2.010
   - The Committee took invited testimony on the status of the electric utility industry in Texas.

8. March 30, 2004 at 10:00 a.m. in the Capitol Extension, Room E2.012
   - The Committee took invited testimony on the status of the telecommunication industry in Texas.

9. March 22, 2004 at 10:00 a.m. in the Capitol Extension, Room E2.012
   - The Committee took invited testimony on the status of the telecommunication industry in Texas.

Findings and Observations

Charge #1

Gather and review information on the overall status of the telecommunications market in Texas, including the effects of inter-modal competition and emerging technologies. Recommend changes to Texas law to encourage new investment and technological innovation consistent with market-oriented public policies and the interests of Texas families and businesses. Gather information on the Federal Communications Commission Triennial Review and recommend adjustments to Texas law.

Status of Telecommunications Market in Texas

The telecommunications industry has undergone a revolution. In 1995, the 75th Texas Legislature significantly amended the state's Public Utility Regulatory Act (PURA) with regard to telecommunications. The goal of that legislation was to introduce competition in the telecommunications sector, and in today's view, the results are encouraging. There are currently over 450 local exchange carriers in the state, 10 voice over internet protocol (VoIP) providers, eight wireless providers and three cable telephony providers – all working to provide enhanced telecommunications services to Texas customers. Even though not all providers offer service across the state, in many cases customers can choose from more than 15 local phone service providers and up to 10 providers for broadband Internet service.

While many can agree that the Texas telecommunications market is certainly more diverse and competitive than it was merely ten years ago, it must still be weighted against sound, principled measures for competition. Understanding how widespread competition in Texas has become concerning service offerings from multiple providers in both rural and urban areas is critical, as is our understanding of product differentiation, innovation and market sustainability.

According to the Public Utility Commission of Texas (PUC), as of June 30, 2003, Texas customers purchased 10.45 million Incumbent Local Exchange Carriers (ILEC) landlines in comparison to 2.26 million Competitive Local Exchange Carriers (CLEC) lines.[1] Across Texas, as of June 30, 2003, customers generated 10.7 million wireless mobile subscriptions and signed up nearly 1.61 million subscriptions for broadband services as well.[2] However, since 1999, the total number of landlines has declined slightly with CLEC market share showing slow but steady growth, especially in the residential and small business arena. Overall, Texas ranks 8th nationally on CLEC penetration with close to 3 million lines in Texas.[3]

[1] Testimony of Paul Hudson, Chairman, Public Utility Commission of Texas, before the Texas House Committee on Regulated Industries, March 22, 2004.
[2] Id.
[3] Id.

Mobile wireless subscriptions have risen from almost 5.8 million in 1999 to over 10.7 million today, with the trend continuing to move upward.[4] Mobile wireless providers have combined innovative and exciting services with aggressive customer pricing to fuel the strong growth in this segment of the market. The same is the case with broadband. While adoption has been much slower in comparison to mobile wireless use, broadband stands poised to re-energize the lagging telecommunications sector by creating new jobs, enhancing customer services and promoting technological innovation. In Texas, broadband subscription is now at an all time high.

While competition has certainly taken hold, Texas must remain a strong environment for telecommunications companies to do business. Texas can accomplish this goal by providing economic and regulatory certainty for telecommunications companies doing business in the state and creating a framework for open competition that encourages investment and innovation while providing consumers with access to newer technologies and services.

Effects of Inter-Modal Competition

Inter-modal competition refers to the competition between traditional wireline companies and alternative market entrants such as cable/fiber or wireless competition. Currently, 3-5 percent of the market has dropped wire line in favor of wireless. Evidence indicates that a limited but growing proportion of consumers in the mass market use wireless as their primary line or have chosen to use wireless services in lieu of wireline services for all of their local exchange services. Wireless service plans that may serve as a wireline replacement for consumers are those that are priced competitively to analogous wireline services, include sufficient anytime minutes to accommodate a customer's normal inbound and outbound calling patterns, and avoid time overage charges.

Clearly, the growing significance of intermodal competition is revealed in the evidence that major carriers are considering the prospect of consumers' subscription to wireless services in lieu of wireline services when engaging in research, and development of corporate strategies and market offerings. However, other evidence suggests that most consumers may still continue to find the costs, including opportunity costs, of using wireless telecommunications services in lieu of wireline telecommunications services to be prohibitive.

But wireless substitution isn't the only challenger in the marketplace, cable companies and others are providing VoIP phone service to customers via broadband lines and VoIP appears poised to begin an aggressive entry into the competitive marketplace, offering customers low cost rate plans and unlimited national calling from the use of a single high speed data connection.

Emerging Telecommunications Technologies

Today, there are many emerging technologies in the telecommunications sector. The most talked about is, of course, Voice over Internet Protocol or VoIP but many other competing technologies are beginning to mature as well. Wireless technologies such as WiFi, WiMax and EvDo are

[4] Id.

beginning to enter the market at varying strengths while technologies utilizing existing infrastructure such as broadband over power lines (BPL) are also beginning to take shape. Additionally, current broadband offerings such as DSL (Digital Subscriber Line) are being enhanced to provide greater speeds and bandwidth capability as with VDSL (Very High Bit-rate Digital Subscriber Line). Finally, advanced media offerings such as fiber to the curb/home (FTTC/FTTH) are also making significant in-roads within Texas, allowing companies to pipe voice, video and data up to 20 times faster than DSL and six times faster than cable-modems.

To assess the policy issues raised by emerging broadband technologies requires a basic understanding of these new technologies, a discussion of their evolution, and a look at their strengths and weaknesses. We have outlined a brief discussion of these technologies below.

VoIP

Voice-over-Internet Protocol (VoIP) uses software instead of traditional circuit switching to carry voice messages. Voice communications are digitized into data packets and routed in that form over either managed IP networks and/or over the public Internet to a desired location using an IP address. Customers can use VoIP to reduce phone and fax costs and to support applications like unified messaging, in which voice, fax, and email are combined.

Nearly every telecommunications company calls for the FCC to refrain from regulation or to ensure only "light touch" regulation. Some of the rules that apply to telecommunications providers concerning E911 services will need to be reviewed to allow VoIP providers access to information, as well as allowances to law enforcement to intercept calls in criminal investigations. However, many of the rules that apply to traditional telephony (access charges, for example) may not necessarily need to be applied to VoIP at this time.

Many experts see VoIP as a transformational technology, one that will bring productivity gains for business and lower prices for consumers. When compared to wireless service, it can be seen that emerging technologies such as VoIP bring benefits to the market most quickly and visibly when allowed to flourish amongst competitors in a free market environment.

WiFi & WiMax

The most easily recognized wireless services are cellular phone and PCS service, but wireless increasingly has many other uses. WiFi allows a computer user access to the Internet in airports and coffee shops, and in an ever-widening host of other locations.

It works by simply installing small, relatively inexpensive terminal equipment to a broadband connection at a desired location, which then allows for wireless access within a 300-foot radius. According to a recent report, an estimated 99 million people will have WiFi enabled technology by 2006.[5]

[5] Michael D. Gallagher, Assistant Secretary for Communications and Information, National Telecommunications and Information Administration, U.S. Department of Commerce, *Moore Meets Marconi: Spectrum Policy for the 21st Century*, p. 18, October 1, 2004, Available at http://www.ntia.doc.gov.

WiMax is an evolving standard for wireless networking intended to serve the last mile in the same way that WiFi serves the last several hundred feet of networking. WiMax may be able to extend service as far as 10-30 miles past the last portion of networking. According to industry reports, Intel plans to build WiMax into its Centrino chip platforms, which power 80 percent of all PCs, by 2006,[6] and industry analysts are predicting a six-fold growth in WiMax sales over the next three years.

EvDo

EvDo is a 3g wireless network capable of connections that are up to sixty percent faster than cable modem service. EvDo can work over existing cell phone networks and deliver a connection wherever a mobile phone signal exists. Currently, EvDo is not offered ubiquitously across the United States.

Broadband over Power Line (BPL)

America's power companies own significant rights-of-way along their power grids. If power lines could be used for broadband, these companies would offer powerful competition in the broadband service market. Power companies might bring broadband to areas not served by cable or DSL and could offer a viable solution to the problem of the last mile. Last-mile technology is any telecommunications technology, such as wireless radio, that carries signals from the broad telecommunication along the relatively short distance (hence, the "last mile") to and from the home or business. Or to put it another way, it is the infrastructure at the neighborhood level. In many communities, last-mile technology represents a major remaining challenge to high-bandwidth applications such as on-demand television, fast Internet access, and Web pages full of multimedia effects. Today, in addition to "plain old telephone (dial-up) service" or POTS, last-mile technologies that deliver voice, data, and TV may include DSL, cable, wireless, satellite and VoIP service.

Transmitting signals over power lines can be problematic, and there are concerns by some that the signals may interfere with government radio communications or other state and private radio operators. However, testing by governmental agencies and suggested rulemaking by the FCC have resulted in strong proposals to lower the risk of harmful interference.

More problematic than line interference at this point is the fact that many power line companies are still regulated by state commissions. While power line companies might be able to offer robust competition in the broadband service market, in order to do so regulatory certainty is needed from the Legislature regarding many of the current public utility laws.

VDSL

VDSL (Very High Bit-rate Digital Subscriber Line) is the newest of the DSL technologies, being proposed for shorter local loops, perhaps up to 3000 feet. VDSL operates over the copper wires in phone lines in much the same way that ADSL does, but there are a couple of distinctions.

[6] Id at 23.

VDSL can achieve incredible speeds, as high as 52 Mbps downstream (to your home) and 16 Mbps upstream (from your home). That is much faster than ADSL, which provides up to 8 Mbps downstream and 800 Kbps (kilobits per second) upstream.

Fiber to the Curb/Home

Fiber service to the internet uses fiber-optic cable and associated electronics - instead of copper wires - to directly link residential and business customers to the provider's network. Fiber-optic systems have been used in telecommunication networks for years, but primarily for long distance networks or for large business applications.

In the spring of 2003, the three largest Regional Bell Operating Companies (RBOCs) - BellSouth, SBC, and Verizon - announced their adoption of a common set of technical specifications for the delivery of fiber-to-the-premise (FTTP). Of these companies, only one, Verizon, has taken any serious strides forward. Verizon has announced commitments to pass approximately 1 million homes with FTTP and expand the technology to more than 100 central offices across nine states by the end of 2004. In fact, early in the summer of 2004, Verizon began offering its "Fios" FTTP service in Keller, Texas – the first city in the country – along with other select locations in California and Florida. In addition, Verizon plans a Fios video offering to give consumers an alternative to cable TV in 2005.[7]

Encouraging New Investment and Technological Change

The regulation of telecommunications began during a period when the regulation of numerous industries by individual state governments began extending to an increasing number of industries. Market abuses by industry monopolies and concerns by consumers and regulators alike led to the regulation of businesses such as trucking, utilities, railroads, and telecommunications. State and federal governments sought to have greater control over price, quality, and entry under the pretext of promoting the public interest and protecting consumers.[8]

Most often, regulators would adopt a formula known as "rate-of-return" regulation in order to achieve the preceding goals. Under the policy of rate-of-return regulation, it was the job of the regulator to set prices that protected consumers and allowed the firm to cover its costs and earn a reasonable profit on its investment.[9]

Today, state and federal regulators face a completely different set of economic and technological questions regarding telecommunications policy. At the writing of this report, several important federal telecommunications rules were in a state of change as the FCC continues to formulate new policy to accommodate recent court rulings. These court rulings were meant to clarify

[7] Jim Duffy, *Verizon Details FTTP Plans*, NetworkWorldFusion.com, July 26, 2004, http://www.nwfusion.com/news/2004/072604verizon.html.
[8] Testimony of the Hon. Dick Armey, Chairman, Citizens for a Sound Economy, before the Texas House Committee on Regulated Industries, March 22, 2004, Available at http://www.freedomworks.org/informed/issues_template.php?issue_id=1717.
[9] Id.

bitterly disputed sections of the Federal Telecommunications Act, and Texas must ensure that its current and future telecommunications policies align with new and existing federal policies. As such, changes to Texas law regarding telecommunications policy requires that an open and competitive market exist to provide consumers and businesses with the technological innovations they desire. The emerging broadband market requires regulators to re-evaluate past policies, as the market now contains new stakeholders. Given the rapid pace of change in the telecom industry and in its technology, it is important that the regulatory framework within which it exists does not stifle innovation or investment in this critical sector of our economy.[10]

In order to accomplish this goal, Texas law must be technologically and competitively neutral, in that it should not favor one technology or provider over another. Instead, the market should drive innovation and deployment of technology.

With both wireless and cable networks challenging the primacy of the old copper loops, the point has been reached that questions the value of continued economic regulation in the face of increased and vibrant competition. At this point, the goal should be to establish a framework of open competition that encourages investment and innovation while providing consumers access to new technologies and services.[11]

Additionally, Texas telecommunications laws must provide certainty to investors and companies that ambiguous laws and pervasive regulation will not leave the core of their investments subject to another company's access. During the legislative hearing process the desire for statutory and regulatory certainty was the most common theme expressed throughout all segments of the telecommunications industry. The need to base business decisions solely upon economic analysis, rather than political analysis, was clearly expressed. The inability to predict legislative intervention into the market place and inconsistent application of rules by regulatory bodies were the greatest deterrents to capital investment.

FCC Triennial Review

Congress passed the Federal Telecommunications Act in 1996. The goal of the Act was to promote competition, even at the local level. Under the Act, the regional "Baby Bell" companies (now known as Incumbent Local Exchange Carriers, or ILECs) were forced to open their networks to competitors at rates set by the federal government. This process came to be known as unbundling and, to encourage competition, the ILECs were offered an inducement: if they opened their local networks, they would be allowed to enter the long distance market. The ILECs were to open their lines to new Competitive Local Exchange Carriers (CLECs) whenever it could be demonstrated that the CLEC would be impaired if it was denied access. In turn, once it could be demonstrated that competition existed in the local market, the ILECS could enter the long distance market. Texas pushed to enact this model on an aggressive schedule and, in 2000, the ILECs in Texas were allowed into the long distance market. Texas was clearly a frontrunner

[10] Id.
[11] Id.

in this case, second in the nation behind New York in promoting competition and opening markets.

In the Triennial Review, the FCC ruled that a CLEC would be impaired when lack of access to an element created a barrier to entry.[12] These barriers might include economies of scale, sunk costs, first-mover advantages, and barriers controlled by an ILEC. The D.C. Circuit generally upheld this definition. However, the court directed the FCC to include special access services in its impairment analysis and thus vacated the FCC's determination that wireless carriers were impaired without access to dedicated transport.[13]

The FCC has determined that ILECs' broadband (fiber to the home) networks, hybrid loops with packet switching, and line-sharing (allowing competitors to use part of the local telephone loop to carry data traffic, while the ILEC uses another part to carry voice traffic) need not be unbundled.[14]

The court upheld this, stating that without evidence that CLECs are impaired without those elements, forced sharing "would skew investment incentives in undesirable ways… [and] inter-modal competition from cable ensures the persistence of substantial competition in broadband."[15] The FCC had delegated the decision about switching for mass-market customers (residential and small business) to state public utility commissions, giving nine months for policy decisions. The D.C. Circuit found such delegations unlawful and required the FCC to revisit this ruling.[16] The court also vacated the FCC's nationwide impairment determinations with respect to high-capacity voice-grade lines (also known as DS1 & D3) and dark fiber.[17]

Overall, the FCC's attempts to implement the unbundling requirements of the Act were disputed hotly almost since the Act was passed. The D.C. Circuit set aside several aspects of the FCC's most recent rules, the Triennial Review,[18] in March 2004 in *USTA II*[19] including the requirement of ILECs to unbundle under section 251 of the Act. This was the third time that the courts overturned this same set of rules. The FCC and the Justice Department determined not to seek Supreme Court review of the *USTA II* decision, although several competitive carriers, state commissions, and others filed petitions for certiorari with the Supreme Court on June 30, 2004.

On August 20, 2004, the FCC released an Order and rulemaking notice that details a 12-month plan to provide certainty to the industry while the FCC seeks comment on how best to respond to

[12] *Triennial Review Order* at ¶ 61.
[13] *United States Telecom Ass'n v. FCC*, 290 F.3d 415 (D.C. Cir. 2002) ("*USTA I*").
[14] *Triennial Review Order* at ¶ 260, 272.
[15] *United States Telecom Ass'n v. FCC*, 359 F.3d 554, 585 (D.C. Cir. 2004) ("USTA II").
[16] Id at 585.
[17] Id at 585.
[18] Report and Order on Remand and Further Notice of Proposed Rulemaking (FCC 03-36) released by the Federal Communications Commission ("FCC") on August 21, 2003 in CC Docket Nos. 96-98, 98-147 and 01-338, (Triennial Review Order).
[19] *United States Telecom Ass'n v. FCC*, 359 F.3d 554, 585 (D.C. Cir. 2004) ("USTA II").

the *USTA II* decision in developing new final unbundling rules. In October 2004, the FCC took a strong step towards clarification by granting the RBOCs relief from broadband unbundling obligations under section 271 of the Act. The relief applies to FTTH loops, FTTC loops, the packetized functionality of hybrid copper-fiber networks, and packet switching.

The FCC extended the same broadband relief under section 271 that it granted under section 251 in the Triennial Review Order and in subsequent clarifications of that Order. Consequently, RBOCs cannot be obligated to provide under section 271 those broadband unbundled network elements (UNEs) that are no longer required under section 251.

Charge #2

Study broadband service deployment, including other states' models used to transition to a fully competitive communications marketplace and any new technologies of competitive providers.

Broadband Service Deployment

Robust broadband deployment is the next logical step in creating the new-networked economy. Broadband is a term used to characterize "advanced telecommunications capability," which the FCC defines as communications infrastructure capable of transferring data at a speed of at least 200 kilobits per second (Kbps).[20]

Broadband connections at home or in business provide Internet users with a connection that is "always on" and allows users to download large files in seconds or to browse rapidly through Web pages. Broadband technologies include Digital Subscriber Line (DSL), cable modem, satellite, fiber, and fixed or remote wireless service, all of which have much higher rates of transmission than standard dial-up access.

In today's market, broadband technologies are driving progress, and the mission to deploy broadband technologies has gained significant attention at the national and state levels. In a speech delivered in Albuquerque, New Mexico, on March 24, 2004, President George W. Bush outlined his vision for "universal, affordable access for broadband technology by the year 2007," arguing that such access would keep the nation on the cutting edge of technology and world trade while offering families "new ways to receive doctors' advice in their homes."[21] In Texas, during testimony before the House Regulated Industries Committee on March 30, 2004, Texas Agriculture Commissioner Susan Combs indicated that a lack of access to "affordable and competitive telecommunications services" has impeded rural economic development in the state. Noting that high-speed Internet access increasingly has become a business necessity, Commissioner Combs touted broadband expansion as a way of promoting growth in commerce

[20] FCC, *Inquiry Concerning the Deployment of Advanced Telecommunications Capability to All Americans in a Reasonable and Timely Fashion, and Possible Steps to Accelerate Such Deployment Pursuant to Section 706 of the Telecommunications Act of 1996*, CC Docket No. 98-146, Second Report, FCC 00-290 (August 21, 2000).

[21] Tedd Holladay, *Expanding Broadband Access in Underserved Areas*, House Research Organization, June 24, 2004, available at http://www.house.state.tx.us/analyses/hro/research.php.

and tourism and in expanding health-care options for medically underserved regions of the state.[22]

Believing advanced telecommunications services improve the quality of life and economic opportunities for citizens, advocates of broadband share the goal of expanding access to those services. Some consensus exists regarding certain strategies, such as the benefits of encouraging public exposure to broadband at school and in the workplace. However, differences arise regarding options for promoting broadband availability. Some favor an active role for the state in developing a broadband policy to eliminate unequal access by managing the deployment of advanced services. Others favor a "market-based" approach incorporating tax relief for broadband companies and consumers, reducing regulatory burdens on providers, and other incentives.[23]

Survey - Broadband Access and Internet Use

Several published reports show that rural residents have less access to the Internet in general, and to broadband services in particular, than do their urban and suburban counterparts.

According to a February 2004 report entitled "Rural Areas and the Internet" by the Pew Internet and American Life Project,[24] just 52 percent of rural residents nationwide used the Internet on a regular basis in 2003[25] compared to 67 percent of urban residents and 66 percent of suburban residents.[26] When it comes to Internet availability, only 75 percent of rural residents reported that broadband access was available to them.[27] This is in contrast to 95 percent of urban residents and 90 percent of suburban residents who had access to broadband services.[28] From 2000 to 2003, the use of cable modems, DSL and other broadband services grew quickly, with the proportion of urban Internet consumers who used broadband rising from 8 percent to 36 percent,[29] while suburban use during this period grew from 7 percent to 32 percent.[30] Comparatively, the use of broadband in rural areas grew from 3 percent in 2000 to just 19 percent in 2003.[31] While high-speed Internet has increased among rural residents, it is lagging behind the rest of the nation.[32]

[22] Testimony of Susan Combs, Commissioner, Texas Agriculture Commission, before the Texas House Committee on Regulated Industries, March 30, 2004.
[23] Tedd Holladay, *Expanding Broadband Access in Underserved Areas*, House Research Organization, at p. 1, June 24, 2004, available at http://www.house.state.tx.us/analyses/hro/research.php.
[24] Lee Rainie, *Rural Areas and the Internet*, Pew Internet and American Life Project, February 2004, http://www.pewinternet.org/pdfs/PIP_Rural_Report.pdf.
[25] Id. at 2.
[26] Id.
[27] Id. at 4.
[28] Id.
[29] Id.
[30] Id.
[31] Id. at 4.
[32] See Figure 1.0 - Broadband Subscribers in Texas.

A report prepared in May 2004 for the Texas Department of Information Resources by the Telecommunications and Information Policy Institute at the University of Texas at Austin reveals further trends with regard to the extent of broadband use in Texas. *E-Government Services in Texas: Results of a Public Survey*[33] demonstrates increased exposure to online applications, heightened use of computer equipment, and increased broadband access in both urban and rural Texas.

Broadband Demand

The central question surrounding what steps, if any, the state should take to expand access to broadband services is the extent to which demand exists for the technology in underserved areas.[34] Eighty percent of America's Internet users still use dial-up access.[35] Broadband connections at home or in business provide Internet users with a connection that is "always on" and allows users to download large files in seconds or browse rapidly through Web pages. Broadband access also enriches online activities by providing a considerably larger pipe for data to flow through and high-speed access to the Internet offers vastly expanded opportunities for individual Internet users and especially for commercial use.

Despite research by the Pew project and others, there is a shortage of public data that would allow policymakers to better measure how much demand exists in Texas for the expansion of broadband services.[36] The state currently does not collect data that documents which communities have access to advanced services because the PUC lacks the regulatory authority to collect information on the extent of telecommunications infrastructure from service providers. Since much of this information is proprietary and secure in nature, many service providers are reluctant to issue such information for fear of competitors obtaining it. However, the PUC does include some aggregated, county-level data on broadband availability in its report to the Legislature on the scope of competition in telecommunications markets.[37]

Another challenge facing those who wish to expand the availability of broadband is that sparsely populated areas often are underserved because rural residents live far from the network and do not represent enough potential profit for providers to break even on investments necessary to extend access to isolated communities.[38]

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[33] Sharon Strover, *E-Government Services in Texas: Results of a Public Survey*, Telecommunications and Information Policy Institute at the University of Texas at Austin, July 2004, http://www.dir.state.tx.us/egov/report/surveycitizen2004.doc.

[34] Tedd Holladay, *Expanding Broadband Access in Underserved Areas*, House Research Organization, at p. 3, June 24, 2004, available at http://www.house.state.tx.us/analyses/hro/research.php.

[35] National Telecommunications and Information Administration and Economics and Statistics Administration, U.S. Department of Commerce, *A Nation Online: How Americans are Expanding Their Use of the Internet*, Washington, D.C., 2002, p.24.

[36] Tedd Holladay, *Expanding Broadband Access in Underserved Areas*, House Research Organization, at p. 3, June 24, 2004, available at http://www.house.state.tx.us/analyses/hro/research.php.

[37] See Figure 2.0 - Broadband Providers by County.

[38] Tedd Holladay, *Expanding Broadband Access in Underserved Areas*, House Research Organization, at p. 4, June 24, 2004, available at http://www.house.state.tx.us/analyses/hro/research.php.

In the past, government has intervened to address this problem in other utility services through subsidized or mandated access, with the Universal Service Fund for telephone service and the Rural Electrification Project for electricity. However, some observers believe that broadband access is not as essential as these utility services, and the primary barrier to broadband deployment is the low demand for the technology in underserved areas. Simultaneously, it may be asserted that increased demand for broadband will lead to an expanded supply.

Advanced Services Rules

In 1999, the 76th Legislature enacted Senate Bill 560, which established a mechanism for requiring the deployment of advanced services to rural areas by certain telecommunications companies, which offer broadband services in urban parts of their certificated territories. As of September 1, 2001, an applicable company must provide reasonably comparable advanced services at reasonably comparable prices within 15 months of receiving a "bona fide request."[39] In May 2002, the PUC adopted rules to implement this requirement and established a "competitive response process" by which another carrier could offer advanced services to the community.[40] The competitive response process is intended to provide opportunities for alternative broadband providers to offer services and thus remove the ultimate responsibility from an ILEC.

To take advantage of the provision, a representative from a rural area must submit to the PUC a request made to a telecommunications provider for advanced services. Advanced services are themselves a subset of "high-speed" services, which the FCC defines as having the capability to transmit data at speeds faster than 200 kbps in at least one direction, typically downstream.[41] This request then is posted on the PUC website for 60 days, during which time companies are free to submit proposals to the applicant to provide service in the area. If no company responds to the initial posting, the applicant can submit a bona fide retail request (BFRR) that identifies the need for at least 150 lines of service to specific retail customers within 14,000 feet of a central office in the area. Within 30 days of the publication of the BFRR in the *Texas Register*, each provider of local exchange service in the area that also offers advanced services in an urban area is required to submit a proposal for providing advanced services in the rural area. A company can contest its obligation to provide advanced services in an area after it has submitted its proposal.

[39] PURA §55.014. The requirements under this section apply to Chapter 58 electing companies and CLECs that hold either a certificate of operating authority or a service provider certificate of operating authority. This section does not apply to Chapter 59 electing companies or small ILECs governed by Chapter 52. For the purposes of this section, an "urban area" is defined as a municipality with a population of more than 190,000.

[40] PUC Subst. R. §26.143, effective May 15, 2002.

[41] FCC, *Inquiry Concerning the Deployment of Advanced Telecommunications Capability to All Americans in a Reasonable and Timely Fashion, and Possible Steps to Accelerate Such Deployment Pursuant to Section 706 of the Telecommunications Act of 1996*, CC Docket No. 98-146, Second Report, FCC 00-290 (August 21, 2000) ("*Second Report*") at ¶11.

In the end, the PUC determines which company is required to serve the community. Since the adoption of the PUC's advanced services rule in 2001, only two communities have participated in the process, leading some to question its effectiveness.

Supporters of the advanced services rule assert that the provision offers a market-driven mechanism for the deployment of advanced services to underserved areas while safeguarding an economic return for firms that undertake the extensive capital investment that broadband deployment requires. The 150-line threshold requires rural areas to demonstrate actual demand for broadband before companies upgrade their networks, protecting providers against incurring economic losses that could result from investing in communities where demand is weak and dispersed. Critics of the advanced services rule contend that the requirement of 150 lines of service in each BFRR is unrealistic, since the low population density of rural areas means that many communities are unable to take advantage of the rule. They suggest reducing or abandoning the 150-line threshold requirement, allowing the PUC to calculate the cost and profitability of each request and award services based on more inclusive criteria.[42]

Other State Models for Deployment

The Technology Network (TechNet), a national network of more than 200 CEOs and senior executives in the high technology and biotechnology industries, released a 2003 report entitled "The State Broadband Index," which assesses state policies that affect broadband deployment and demand.[43]

According to the report, Michigan and Florida lead the nation in creating policies that encourage next-generation broadband networks. Texas ranks fourth out of ten on the poll. Texas's fourth place ranking is due to its elimination of barriers to rights-of-way (ROW) access, active encouragement of broadband deployment, and recognized leadership in adopting e-government initiatives, including telemedicine and distance-learning programs.[44] "Broadband service can make a tremendous impact on rural Texas by jumpstarting economic development, expanding business opportunities, and improving quality of life," explained Agriculture Commissioner Susan Combs. "With 77 percent of our state's 254 counties classified as rural, broadband service is important for our children to learn, for our businesses to sell outside their communities, and for our families to make connections across the country and world."[45]

Michigan received the highest marks for adopting comprehensive policies that encourage the deployment and promotion of advanced telecommunications. The linchpin of Michigan's broadband policy is its Link Michigan Initiative,[46] a four-step plan that focuses on:

[42] Tedd Holladay, *Expanding Broadband Access in Underserved Areas*, House Research Organization, at p. 6, June 24, 2004, available at http://www.house.state.tx.us/analyses/hro/research.php.
[43] The State Broadband Index, technet.org, June 2003, http://www.technet.org/press/Press_Releases/?newsReleaseId=2527.
[44] Id at http://www.technet.org/press/Press_Releases/?newsReleaseId=2529.
[45] Id.
[46] Id at http://www.technet.org/resources/SummaryFindings_BB_Top10_States.doc.

1. Aggregating demand by tying together requests for broadband service among multiple public sector and educational users in order to expand deployment for advanced services networks.
2. Reforming and streamlining right-of-way access for broadband firms.
3. Improving public access to information on network installation schedules and the locations served by networks.
4. Providing financial assistance and legal authority for local governments to develop their own local advanced services networks.

Colorado has taken steps to eliminate right-of-way barriers to deployment by encouraging coordinated rights-of-way with multiple providers, placing a reasonable cost limit to fees, and prohibiting municipalities from demanding in kind compensation beyond ROW fees. Colorado also has created the Colorado High Speed Digital Network (CHSDN) to leverage public-sector demand for broadband service and expand network access to all regions of the state. The state serves as the anchor tenant on the CHSDN through the Multi-Use Network, an initiative that opens the private broadband network to public and nonprofit entities. This creates sufficient demand to encourage telecommunications providers to expand their infrastructure into regions that otherwise might be underserved. The "State Broadband Index" calls on states to consider a range of policies critical to broadband deployment, including:[47]

1. Legislation that standardizes and expedites rights-of-way permitting.
2. Adoption of a state-wide broadband strategy and creation of a lead broadband agency.
3. Comprehensive infrastructure mapping.
4. Policies to enable wholesale municipal networks.
5. Innovative initiatives that increase private sector deployment.
6. Financial incentives to reach underserved communities.
7. Demand-promotion efforts including enhanced e-government.

Charge #3

Study the process of economic dispatch and determine possible methods to improve the competitive electric utilities market and reduce costs and pollution caused by inefficient power plants.

Background

On May 12, 2004, after two public hearings on the issue, interim charge number 3 was referred to a subcommittee consisting of Todd Baxter, who chaired the subcommittee, Joe Crabb, and Ryan Guillen. The subcommittee conducted an approximately three-hour public hearing on the

[47] Id at http://www.technet.org/press/Press_Releases/?newsReleaseId=2527.

charge on September 26, 2004. While the committee and subcommittee took extensive testimony on the subject of economic dispatch and a zonal versus nodal model for managing transmission constraints, it is important to understand the background and context related to these hearings.

It has been five years since Texas commenced a competitive retail electricity market for customers served by the Electric Reliability Council of Texas (ERCOT). The move to competition occurred through two major legislative initiatives in the last decade: amendments to the Public Utility Regulatory Act in 1995 to deregulate the wholesale electricity market, and sweeping legislation in 1999 that restructured the electricity market and established retail competition.

These electric market reforms enacted by the Texas Legislature have generally achieved the desired effect – attracting investors to the state who have entered the market to build thousands of megawatts of new, clean, efficient combined cycle generating plants.[48] As a result, retail electric providers enjoy an abundant supply of power at competitive prices and have been able to pass along significant savings to Texas electric consumers — fueling the success of the retail electric market in ERCOT. The current design of the *wholesale* market, however, including the method in which power plants are dispatched in the ERCOT system, often leaves the cleanest and most efficient generation units underutilized.

In setting up the wholesale market structure, ERCOT stakeholders established a zonal model for managing transmission congestion that employs a portfolio-based dispatch of generation resources. A zonal model takes a theoretically simplified approach to congestion management by the transmission grid operator, assuming – incorrectly – that only a few, identified transmission lines cause commercially significant constraints and that all generators within a congestion "zone" have equal value for relieving the constraint.

Under portfolio dispatch, the grid operator permits a generation owner to respond to zonal deployment instructions by utilizing any of the generating plants in its portfolio. However, this portfolio dispatch can, and does, cause additional local (or intrazonal) congestion, which the system operator then must relieve through unit-specific dispatch instructions.

The costs of relieving local congestion are borne by all consumers on the grid. It has become apparent over time that the current ERCOT wholesale market model does not provide sufficient market incentives to produce the most efficient utilization of existing infrastructure. The sub-optimal portfolio dispatch has resulted in the continued use of old, high-emission power plants instead of replacement in the dispatch with the newer plants designed to reduce pollution and further lower electric prices.

[48] 26,000 MW of new generation has been built in ERCOT since 1995, *Report on Existing and Potential Electric System Constraints and Need Within the ERCOT Region*, October 1, 2004.

Further, the current ERCOT model actually distorts the price signals that otherwise would point to the need for specific system improvements in particular areas, such as the addition of new generation, transmission system enhancements, or demand-side management programs. Finally, the current zonal model rewards inefficiency by socializing certain costs rather than directly assigning those costs to the point of cause, creating regional subsidies that did not exist prior to the zonal market structures being put in place and leading to improper incentives that serve to increase costs.

Following the lead of almost every other competitive electricity market around the United States, the PUC approved Substantive Rule §25.501 on August 21, 2003, to establish a nodal market model in ERCOT, which the commission said would "promote economic efficiency in the production and consumption of electricity; support wholesale and retail competition; support the reliability of electric service; and reflect the physical realities of the ERCOT electric system." The PUC established a timeline to complete the transition to a nodal market by October 1, 2006. For more than a year, market participants, PUC staff, and ERCOT staff have been working in tandem as the "Texas Nodal Team" to develop specific market design principles, policies, and protocols that will lead to a more economic dispatch of resources in ERCOT.

Economic Dispatch Defined

Economic dispatch is a long-standing concept used by electric companies to govern how and when generating units are used. Economic dispatch can be defined as the process by which a generating system consisting of multiple generating facilities is operated to maximize the efficiency of the system and minimize its operating costs. It involves using the system's most efficient (lowest operating costs) generating unit that is not already fully utilized when additional capacity is needed and backing down or taking off the least efficient (highest operating costs) operating unit when the need for capacity is decreased.[49]

In short, the goal of economic dispatch is to shift usage from generation that is more expensive to less expensive. Transmission lines have a certain capacity for electricity flow that cannot be exceeded without damaging equipment and possibly causing severe problems within the transmission grid.

A transmission constraint occurs when the demand for electricity exceeds the amount of electricity that can flow from generators through the transmission system to the end-use customers who need the electricity. Economic dispatch must take into account the capacity of the transmission system as decisions are made about which generator should increase or decrease production. Therefore, transmission constraints influence economic dispatch and the degree to which overall generation efficiency can be achieved.

Although economic dispatch is an objective in both regulated and competitive markets, the means for accomplishing economic dispatch vary by market. For example, in ERCOT, the current market structure allows those with generation portfolios to minimize their own individual

[49] www.altusgroup.com/electricityglossary/e.asp.

portfolio costs by dispatching the generation in their portfolio in a least cost manner, allowing individual portfolio owners to meet their contractual obligations in the most efficient way. The implementation of Senate Bill 7, by establishing the independent system operator, enhanced the level of economic dispatch in ERCOT beyond that which was achievable in the regulated environment. However, the full opportunity for economic efficiencies is available through a broader application of economic dispatch principles, not just by portfolio owners, but also by having ERCOT dispatch for the entire system.[50]

Currently, ERCOT's form of economic dispatch contrasts with the way economic dispatch is accomplished in other domestic and international markets, such as those in the northeastern United States where an independent system operator dispatches all generation to minimize total system bid costs. Although entities in these other regions may own a portfolio of generation, the owners bid each individual unit into the market and the independent system operator economically dispatches the units, taking into account the bid amounts and transmission constraints.

This economic dispatch is accomplished by increasing production by less expensive units and decreasing production from more expensive units, regardless of the unit's ownership. In ERCOT, only balancing energy, a market that represents less than ten percent of the total energy bought and sold in ERCOT, is economically dispatched by ERCOT as the independent system operator. Balancing energy is used to balance supply and demand in real-time. Broader economic dispatch can be achieved in ERCOT using a bid-based day-ahead process wherein generator owners may offer their individual unit capacity at a price they are willing to accept. ERCOT would determine the best economic dispatch based on those bids while honoring all transmission constraints.

This day-ahead process results in the most efficient dispatch for the ERCOT market and ensures that needed units are notified in advance that they will be dispatched the next day. Further, broader implementation of economic dispatch will improve the price signals seen and reacted to by market participants, resulting in better control of transmission system "congestion" costs that are rapidly increasing in ERCOT.[51]

The Geography of the ERCOT Region

The ERCOT region is comprised of congestion zones, separated by commercially significant constraints (CSC). A CSC is defined as a point in the transmission grid where there is a transmission constraint that affects commercial activity to a significant degree.[52] Conceptually, in a zonal model, all CSCs would be identified and all generators and loads would be assigned to congestion zones based on their ability to influence congestion on the CSC. For example, a

[50] Presentation of Ross Baldick, Department of Electrical and Computer Engineering, The University of Texas at Austin, before the Texas House Committee on Regulated Industries Committee, Subcommittee on Interim Charge #3, September 24, 2004.
[51] Id.
[52] ERCOT Protocols, Section 2, Definitions.

generator or load close to the CSC has greater influence on the constraint than a generator or load located far away. A generator may be a single generating unit or a collection of generating units at a power plant. Loads are end-use customers served by retail electric providers. To fully effectuate the zonal model, CSCs should be chosen such that congestion within any zone is minimized. In practice, this has not occurred in ERCOT.

When the restructured market opened in July 2001, three congestion zones existed: the North Zone, South Zone and West Zone. A fourth congestion zone, the Houston Zone, was introduced in January 2002 followed by a fifth zone, the Northeast Zone, introduced in January 2004. These congestion zones are defined, or separated, by CSCs. The CSCs in place today reflect the direction in which power is constrained. For example, the CSC between the South and North Zones is the South-North CSC because the directional flow of power from the South Zone to the North Zone is constrained. The current CSCs are South-North, West-North, South-Houston, North-Houston, and Northeast-North.

The ERCOT Protocols provide for the addition of new congestion zones as congestion is identified. For example, a Northeast Zone was formed when congestion costs reached nearly $60 million in June 2003.[53] Other areas of major congestion such as the DFW area have not been addressed even though congestion costs were more than $127 million in 2003.[54] However, Potomac Economics, a consultant to the PUC's Market Oversight Division, recommends in its *2003 State of the Market Report* that ERCOT create the DFW area as a separate zone in the near term.[55]

Failure to recognize congestion within zones negates the fundamental basis for a zonal approach wherein enough zones would be established such that congestion in a given area would be assigned to the parties causing the congestion and reflected in the prices for the given area. This price transparency would result in providing the right price signals for new generation investment and transmission additions.

ERCOT Congestion Costs

In today's market structure, market participants do not receive the right price signals because prices are based on the energy price for the congestion zone or the entire ERCOT market. Indeed, the Potomac Economics report concludes that the current market structure provides incentives for some suppliers to act in ways counter to the incentives present in a good market design.[56] Providing correct incentives for good market decisions requires more direct assignment of congestion costs to those entities that cause the congestion, which can be accomplished by implementing broader economic dispatch in ERCOT.

[53] Project No. 25937, PUC Investigation Into Possible Manipulation of the ERCOT Electric Market.
[54] www.ercot.com/Participants/publicmarketinfo/OOMC_LCEnergyPayment-4.
[55] Potomac Economics, Ltd., *2003 State of the Market Report for the ERCOT Wholesale Electricity Markets*, Executive Summary, p. xxi, August 2004.
[56] Id. at 117.

Under broader economic dispatch, such as that being described in the Texas Nodal discussions underway at ERCOT, the costs of solving congestion would appear in the generation prices at each generator node. For example, lower generation node prices would lead generators to reduce production while higher generation node prices would lead generators to increase production. The nodal system would evaluate the condition of the ERCOT system every five minutes and provide price signals through nodal prices to generators to meet system demand and solve congestion.

When the restructured market opened in July 2001, all congestion costs were socialized to the entire ERCOT market. In other words, all loads were charged their load ratio share of congestion costs without regard to causation. The PUC in Docket No. 23220, *Petition of the Electric Reliability Council of Texas for Approval of the ERCOT Protocols*, recognized that this could be a problem and, in its order approving the ERCOT Protocols, established triggers for moving to direct assignment of congestion costs. Once the triggers were met, the commission's order required ERCOT to directly assign the congestion costs within six months.

There are two types of congestion costs: (1) inter-zonal, which is congestion that occurs in flowing power from one zone to another; and (2) intra-zonal, which is congestion that occurs within a congestion zone but does not affect the interface between zones. Therefore, for example, congestion that occurs on the South-North CSC is inter-zonal congestion, but congestion that occurs within the South congestion zone, for example, that does not impact the CSC flow is intra-zonal congestion.

The triggers for both inter- and intra-zonal (local) congestion were set at $20 million on a rolling twelve-month average basis. The trigger for inter-zonal congestion was met about one month after the market opened. The trigger for intra-zonal congestion was met in March 2002.

For the period of July 2001 to May 2002, inter-zonal congestion costs totaled approximately $175 million.[57] Direct assignment of inter-zonal congestion was implemented on February 15, 2002. Direct assignment of these inter-zonal costs means that all loads in a congestion zone pay for the congestion costs incurred to get power into that zone from another zone; whereas, before direct assignment, loads in all of ERCOT paid such costs. For the period June 2002 to May 2003, after the implementation of direct assignment for interzonal congestion, the costs fell dramatically to $25.6 million.[58]

The drop in congestion costs was a direct result of assigning the cost responsibility to the market participants that caused the congestion by flowing power from zone-to-zone. Market participants previously had an incentive to move power from zone-to-zone because it was economical to flow power from the less expensive zones to the more expensive zones instead of

[57] ERCOT's *Report on Existing and Potential Electric System Constraints and Needs within the ERCOT Region*, October 1, 2002. The reporting period was July 31, 2001 through May 31, 2002.
[58] ERCOT's *Report on Existing and Potential Electric System Constraints and Needs within the ERCOT Region*, October 1, 2003.

contracting for power in the expensive zone. This incentive existed as long as all loads in ERCOT paid the inter-zonal congestion costs, rather than solely the market participants that were causing the congestion costs by flowing the power from zone-to-zone.

Once costs were directly assigned, instead of flowing power across the zones, market participants implemented other risk management strategies such as contracting with generators in zones with limited import capability or purchasing transmission congestion rights in order to financially hedge congestion risks. Direct assignment produced beneficial behavioral changes in the market where inter-zonal congestion was involved.

When intra-zonal congestion costs met the trigger in March 2002, total local congestion costs were $33 million. However, since no direct assignment of these costs has been implemented, local congestion costs have increased eight-fold to $265 million at year-end 2003. In October 2002, ERCOT contracted with several generators for local reliability through Reliability Must-Run (RMR) service. In 2003, the total amount paid by all loads in ERCOT for RMR service was $134 million. To date, ERCOT has expended nearly $859 million on local congestion and RMR service in the 37 months leading up to August 2004.[59]

As referenced in the Potomac Economics report, even though these costs are caused in specific locations because most of these actions are taken to maintain local reliability, the costs are borne by load throughout ERCOT.[60]

Socializing these costs results in incentives contrary to efficient and economical market design. The Potomac Economics report examined the incentives related to out-of-merit capacity dispatch instructions by ERCOT used to relieve local congestion. The report concluded that "uplift payments for OOMC [out of merit capacity] are substantial enough to provide significant incentives to behave in ways that maximize the likelihood of receiving them" and found "that QSEs [qualified scheduling entity] with resources that frequently receive OOMC instructions regularly delay the decision to commit those units until after ERCOT determines which resources to select for OOMC."[61] In the DFW area, Potomac Economics found that "approximately 20 percent of the resources receiving OOMC instructions would clearly have been economic for the QSEs to self-commit" and that "units frequently committed out of merit are often voluntarily committed when ERCOT does not provide an OOMC instruction."[62]

Potomac Economics concluded that the incentives for this behavior result in: (1) ERCOT incurring OOMC costs to commit resources that are otherwise economic and that should be committed without supplemental payments; (2) resources being committed out of merit, crowding out other resources which can result in over-commitment of the system which is

[59] www.ercot.com/Participants/publicmarketinfo/OOMC_LCEnergyPayment-4.
[60] Potomac Economics, Ltd., *2003 State of the Market Report for the ERCOT Wholesale Electricity Markets*, Executive Summary, p. 114, August 2004.
[61] Id. at 69.
[62] Id. at 74.

inefficient and can distort market price signals; and (3) conduct that tends to obscure the information on which ERCOT relies to manage reliability.[63]

It is noteworthy that the Potomac Economics report supports the need for a nodal market in ERCOT.[64] The independent analysis showed that entities in Dallas/Fort Worth and the North Zone are collecting unnecessary congestion payments due to improper incentives brought about by not assigning the cost of congestion to the entities contributing to congestion.

In the words of the PUC's consultant, "a number of the market issues identified in this report would be most effectively addressed by the introduction of the Texas Nodal markets that are currently being considered for implementation in 2006."[65] Potomac Economics stated with respect to congestion in particular: "The most comprehensive solution…is to implement nodal electricity markets since properly structured nodal markets would virtually eliminate the need to commit and dispatch resources out of merit. Such markets would substantially improve the efficiency of the management of local congestion, as well as the management of interzonal congestion….Hence, we strongly encourage the continued development and adoption of the Texas Nodal markets that are currently under consideration."[66]

The PUC's rules appropriately call for an October 2006 implementation date. In the meantime, the Potomac Economics report called for changes in the current market to provide proper incentives to those participating in the market. We encourage the PUC to consider speedy implementation of Potomac Economics' recommendation to directly assign local congestion costs and any other changes that would improve the incentives provided in the current zonal market design with minimal costs to implement.

Implementation of broader economic dispatch will more directly assign these congestion costs resulting in better market decisions to control costs. The market has already experienced the benefits of applying cost causation principles when the inter-zonal congestion costs were more directly assigned.

Impact of Broader Implementation of Economic Dispatch

Some market participants have expressed concern that implementation of broader economic dispatch, such as Texas Nodal, will significantly increase the costs to consumers in the areas of Texas where the most congestion occurs. All load in 2003 paid $0.93/mwh in order to reimburse ERCOT for the $265 million paid to generators to solve local congestion. Table 1 shows the amount of congestion occurring in each zone and the amount paid through the socialized congestion costs.[67]

[63] Id. at 69.
[64] Potomac Economics, Ltd., *2003 State of the Market Report for the ERCOT Wholesale Electricity Markets*, (August 2004).
[65] Id. at v.
[66] Id. at 74-75.
[67] Calculation based on ERCOT study of 2003 energy usage by zone as shown at http://www.ercot.com/Participants/PublicMarketInfo/2003_Load_MWh_by_CMZone.xls. The results showed the

Table 1:
Comparison of Actual Zonal Congestion Cost to Zonal Congestion Payments

Zone	Zonal Congestion Cost[68]	Zonal Congestion Payment[69]	Percent of Zonal Cost Paid
North	$ 196,253,123	$ 106,160,077	54%
Houston	$ 19,089,068	$ 72,550,551	380%
South	$ 29,506,179	$ 67,645,801	229%
West	$ 20,495,489	$ 18,987,429	93%

As shown, the Houston and South Zones paid a $90.1 million subsidy for North Zone congestion and an estimated $1.5 million subsidy for West Zone congestion.

If, however, local congestion costs in 2003 were allocated to the zones in which the costs were generated, the change seen by the load, based on average 2003 spot prices in ERCOT of $41.25/MWh, is shown on Table 2.

Table 2
Comparison of Congestion Costs/MWh to 2003 Average ERCOT Spot Price

Zone	Current Zonal Congestion Cost[70]	Actual Zonal Congestion Cost[71]	Percent of Average 2003 ERCOT Spot
North	$ 0.9314	$ 1.7218	1.92%
Houston	$ 0.9314	$ 0.2451	-1.66%
South	$ 0.9314	$ 0.4063	-1.27%
West	$ 0.9314	$ 1.0054	0.18%

following zonal energy usage: 113,978,412 MWh North; 77,893,657 MWh Houston; 20,385,790 MWh West; and 72,627,688 MWh South. Total ERCOT 2003 MWh were 284,885,547 based on ERCOT data.

[68] www.ercot.com/Participants/publicmarketinfo/OOMC_LCEnergyPayment-4 as of 9-20-04--For OOMC data, North Zone includes DFW and North; Houston Zone includes Houston, West Zone includes West and South Zone includes Austin, Corpus, Laredo, San Antonio, South and Valley. For out of merit energy (OOME)/local balancing energy service (LBES), North Zone includes DFW and North; Houston Zone includes Houston; West Zone includes West and Wind; and South Zone includes Austin, Corpus, Laredo, San Antonio, South and Valley.

[69] Zonal Congestion Payment = MWh * the average zonal intra-zonal congestion cost of $0.9314.

[70] Current Zonal Congestion Cost = $265,343,859/284,885,547 MWh.

[71] Actual Zonal Congestion Cost = Table 1 Zonal Congestion Cost/Zonal MWh.

While some assert that energy prices in the North Zone would double, the evidence does not support such claims.

In addition to the cost of local congestion, ERCOT also socializes the cost of reliability must-run (RMR) units. An RMR unit is a generator that the owner states will be retired or mothballed, but ERCOT determines is needed for local reliability.

The cost of RMR in 2003 was $134,215,963[72] or $0.47/MWh and was paid to units in the South and West Zones. In 2003, ERCOT contracted with 1,341 MWs of generation.[73] Table 3 shows the effect on loads in each zone of the socialization of these costs as well as the local congestion costs.

Table 3
Comparison of Actual Zonal Congestion Cost to Zonal Congestion Payments Including RMR

Zone	Zonal Congestion & RMR Cost[74]	Zonal Congestion & RMR Payment	Percent of Zonal Cost Paid
North	$ 196,253,123	$ 159,857,860	81%
Houston	$ 19,089,068	$ 109,247,998	572%
South	$ 134,531,422	$ 101,862,332	76%
West	$ 49,686,209	$ 28,591,632	58%

Similar to the local congestion costs, if RMR costs were also included in the zonal allocation, the percent impact would be as shown in Table 4.

Table 4
Comparison of Congestion Costs/MWh to 2003 Average ERCOT Spot Price Including RMR

Zone	Current Zonal Congestion & RMR Cost	Actual Zonal Congestion & RMR Cost	Percent of Average 2003 ERCOT Spot
North	$ 1.4025	$ 1.7218	0.77%
Houston	$ 1.4025	$ 0.2451	-2.81%
South	$ 1.4025	$ 1.8523	1.09%
West	$ 1.4025	$ 2.4373	2.51%

[72] www.ercot.com/Participants/publicmarketinfo/RMR/2002 and 2003 Details of Reliability Must Run Costs as of 03-17-04 – West Zone RMR costs include costs for Ft. Phantom, San Angelo and Rio Pecos plants. All others are in the South Zone.
[73] This amount decreased to 1,253 MW in 2004 due to the implementation of an exit strategy and discontinuance of the Rio Pecos RMR contract.
[74] Includes $105,025,244 for the South Zone and $29,190,719 for the West Zone.

While some market participants have expressed concern about increases caused by zonal allocation of both RMR and local congestion, the impact as a percent of average 2003 ERCOT spot prices is less than 3% in all cases. Of note, since 2003, TXU Energy and the City of Garland announced retirement or mothballing of 1,471 MW and 77 MW of generation in the North Zone, respectively. ERCOT studied the need for any of these units to provide RMR service and announced on May 29, 2004, that one of the TXU units was required for RMR service. TexasGenco also submitted applications for RMR related to units it mothballed, but ERCOT determined that none of the units was needed for RMR service.

Economic Dispatch Improves Reliability

Implementing a broader economic dispatch will assist ERCOT in maintaining system reliability because of better integration of system reliability and market functions. In a nodal market, prices at each node are transparent. If congestion arises, generators can see the price signal, ascertain the impact to their planned operations, and decide to increase or decrease their output in ways that solve the congestion. The system operator, to the extent the price signal did not result in clearing the constraint, can then step in and issue instructions to the generating units it determines are needed to solve the congestion at the lowest possible cost.

Under the current ERCOT market structure, these price signals exist only for the interfaces between zones. Market participants can see those prices and adjust their planned operations accordingly, thus providing a market solution to the interzonal congestion. However, because market participants cannot see prices for congestion other than the zonal interfaces, there is no possibility of a market response to solve local congestion. This structure results in ERCOT exercising command and control procedures in order to maintain reliability.

The zonal structure, by not allowing for market solutions, not only increases market inefficiencies because the dispatch is administratively rather than market driven, but also produces less integration between the competitive market and reliability. Even if one matched the zonal structure with unit-specific bidding to solve all congestion, tight integration between market response and reliability would be lacking because generators would see only the market-clearing price of the congestion zone, not a price reflective of their specific location.

What Proponents Say

When the PUC adopted §25.501 to transition to a nodal wholesale market design for ERCOT, the order explained that the new market design is expected to yield the following important benefits: reduced local congestion costs; reduced opportunities for gaming and manipulation in the wholesale electricity market; increased price transparency and liquidity in the wholesale electricity day-ahead energy market; increased locational price transparency for resources; more efficient and transparent dispatch of resources in real-time; improved citing of new resources; and a reduction in the amount of new transmission facilities needed to support the reliability of, and competition in, the wholesale electricity market. The PUC noted that the nodal market design would provide participants in the wholesale and retail markets with more accurate

wholesale prices, which not only will facilitate better-informed price responses and consumption decisions by customers in those markets, but also will lead to deployment of new technology and generation resources where they are needed.

The PUC anticipates that the short-term investment for transition to a nodal market will reap between $262 million to $402 million in savings during the first five years after implementation and between $643 million and $1.08 billion in savings over the first 10 years.[75]

Proponents, including power generators, wholesale power marketers, and some retail electric providers, as well as the independent market monitor for ERCOT and several economists advising the Texas Nodal Team, suggest that the changes contemplated by the PUC will lead to:

1. Increased use of the state's most efficient and least-polluting generation units.
    - Greater use of new combined cycle generating plants will reduce emissions in Texas because less fuel is burned in these plants, and there will be lower emissions per unit of fuel used. The multiplicative effect can result in a reduction in emissions of 65% or more.[76]
    - Fine-tuning the market to allow the newest and cleanest units to be dispatched more often will result in lower consumption of Texas's vital natural resources and will greatly aid the state in its effort to clean the air in major metropolitan areas – all while enhancing overall system performance and reliability.

2. Enhanced competition in the electric power industry.
    - The enhanced transparency afforded by nodal pricing will enable market participants in both the wholesale and retail markets to make better decisions about contracting for power. This will lead to keener competition and more liquidity, because everyone can see the going price for electricity.[77]
    - Proponents point to other competitive markets, such as the PJM market in the mid-Atlantic region, and the markets that serve New England and New York, that have implemented a nodal model successfully. These markets have experienced increased liquidity and enhanced competition as a growing number of companies participate in the marketplace.

3. Lower electricity prices for retail customers.
    - Enhanced competition has put downward pressure on the price of electricity. Fuel-adjusted electricity prices in PJM, for example, dropped 9.5 percent from

[75] Preamble to PUC's Substantive Rule 25.501, Wholesale Market Design for ERCOT.
[76] Presentation of Ross Baldick, Department of Electrical and Computer Engineering, The University of Texas at Austin, before the Texas House Committee on Regulated Industries Committee, Subcommittee on Interim Charge #3, September 24, 2004.
[77] Id.

2002 to 2003.[78] Prices dropped 6 percent during the same period in the New England market.[79]

4. A more efficient use of the state's electric transmission system.
   - Prior to the electricity market reforms enacted in the 1990s, each transmission-owning utility operated its own system, with ERCOT only providing coordinating services between the utilities. Today, ERCOT actually operates the high-voltage transmission network from a single control center near Austin.
   - A major benefit of legislative restructuring to date has been to break down regulatory and market barriers to allow independent companies to build clean, efficient generation resources to serve load all across the state. However, the operation of the transmission system lacks the truly regional character necessary to access the most cost-efficient generation in the state.
   - ERCOT, acting as the independent transmission system operator and operating the day ahead and real time energy markets associated with the nodal market design, will provide two key benefits to the long-term health and efficacy of the power grid. First, ERCOT will have all the information it needs to more efficiently match generation and load around constraints in the transmission system. Secondly, ERCOT and market participants will have a more detailed understanding of the system's greatest problems and the most cost-effective solutions.

5. Improved system reliability.
   - In today's market, ERCOT receives information from market participants regarding anticipated generation and load. ERCOT lacks much of the real-time data needed to efficiently operate the system. An integrated nodal market requires ERCOT to utilize better models, gives ERCOT staff more real-time information to manage the system, and provides greater control to dispatch the most economic and efficient units in the state to meet the electricity needs of consumers at any given time.
   - While the current zonal portfolio dispatch model may allow individual companies to run their generation units in such as a way as to maximize their value, it clearly does not result in the optimal dispatch for the system as a whole. A nodal market, with ERCOT operating a market based on economic dispatch, will not only maximize efficiency but also increase overall system reliability.

6. Reduced ability to "game" the system for higher profits.
   - The increased transparency of the proposed nodal market would make it more difficult for a company to exercise market power or game the system in an

[78] *2003 State of the Market* report for PJM, March 4, 2004.
[79] *2003 State of the Market* report for New England Independent System Operator, June 29, 2004.

effort to increase profits. With accurate, specific prices visible to ERCOT and to other market participants, companies would not have the ability to manipulate the market undetected.

What Opponents Say

Opponents, including some power consumers in the Dallas/Fort Worth area and participants in two municipal aggregation projects, have voiced several concerns about the proposed nodal market:

1. Too costly to implement in Texas.
    - Opponents estimated that it would cost as much as $500 million to implement a nodal market, when one considers the cost of the new software for ERCOT, new systems for all market participants and the hiring of additional staff to manage a highly complex system. This cost estimate was made almost two years ago and was achieved by extrapolating from preliminary data provided by a few market participants to the PUC. More recent cost estimates indicate that setting up the nodal market may cost approximately $100 million. This $100 million would be a one-time charge. It is around 40% of annual local congestion costs and represents about half a percent of annual retail sales in ERCOT.[80]

2. Electricity prices for customers in Dallas/Fort Worth will increase dramatically, hurting that area's economic development efforts.
    - As prices become more accurate and congestion costs are no longer socialized to customers throughout ERCOT but rather are assigned to the sources of that congestion, opponents claim that electricity prices could double for consumers in Dallas/Fort Worth. An analysis of potential retail rate increases in the Dallas/Fort Worth area based on "assigning" the current costs of local congestion to wholesale prices in each zone where the congestion arises, and incorporating those wholesale prices in retail rates, suggest a less than 3% change in retail rates.[81] This analysis also shows that the overall average prices for electricity across ERCOT will decrease because more efficient, lower cost generating plants will be used and committed day-ahead to serve load.[82]

3. Federal environmental regulations prevent companies from building needed generation in Dallas/Fort Worth.

[80] Presentation of Ross Baldick, Department of Electrical and Computer Engineering, The University of Texas at Austin, before the Texas House Committee on Regulated Industries Committee, Subcommittee on Interim Charge #3, September 24, 2004.
[81] Id.
[82] Id.

- Nodal market opponents assert that, while nodal prices will appropriately signal that additional generation resources are needed in the Dallas/Fort Worth area, emissions caps will prevent investors from building new generating plants or adding to existing generating plants there. Testimony at the Economic Dispatch Subcommittee hearing, however, suggests that sufficient emissions reductions credits (ERCs) may exist today to enable 2000 megawatts of new generation to be built in the Dallas/Fort Worth area.[83] Additionally, new technologies that do not produce emissions may be implemented with the appropriate price signals.

4. Companies would be more likely to exercise market power and abuse.
    - Nodal market opponents assert that the complexity of nodal pricing will make it easier to "game" the system.
    - All the economists hired by ERCOT and the PUC to evaluate the Texas Nodal market design agreed that the transparency of nodal markets makes it more difficult to exercise market power compared to the zonal market.[84] Indeed, Potomac Economics report cited numerous instances where the zonal market incentives cause generators to act in a way that maximizes their deployments (and payments) by ERCOT — deployments that are paid for by all customers across ERCOT.[85]

5. Large consumers would find it more difficult to establish bilateral contracts.
    - Texas Coalition of Competitive Electricity testified that the day-ahead market in the Texas Nodal design will force all transactions into that market or in the real-time market, thereby eliminating industrial customers' ability to enter into long-term bilateral contracts.[86] That has simply not been the case, however, in other markets where nodal market designs have been implemented. In PJM, for example, more than 70% of forward transactions occur in the bilateral market.

Economic Dispatch Outside ERCOT

In addition to technological advances such as economic dispatch, there are several simplistic principles that would help to improve the electrical market in Texas - particularly outside of ERCOT. One of those principles is consistent, clear, and uncomplicated legislation. Steady regulation and certainty in the regulatory environment allows for the predictability that utilities need to make capital intensive decisions for the state's infrastructure. With those capital

[83] Testimony of Charles Griffey, Reliant Resources, before the Texas House Committee on Regulated Industries Committee, Subcommittee on Interim Charge #3, September 24, 2004.
[84] Id.
[85] Id.
[86] Testimony of Stephanie Kroger, Texas Coalition of Competitive Electricity, before the Texas House Committee on Regulated Industries, Subcommittee on Interim Charge # 3, September 24, 2003.

additions comes reliability that enhances the service territory with strong growth and economic development.

According to Dan Ford of Lehman Brothers, the benefits of steady and fair regulation are as follows:[87]

- Higher reliability due to extended planning horizons.
- Low rates due to cost of capital advantages.
- High employer attraction and retention rates.
- Strong rate base growth and valuation.

Because investor-owned electric companies tend to be capital-intensive, the growth of infrastructure of the electric industry-especially electric generation and transmission and distribution lines-is ultimately contingent upon creating a business attractive to investors. Regulatory uncertainty creates an unfavorable environment to investors and the investment community.

Ford further testified that for companies operating outside of ERCOT, there is little chance for an independent system operator or RTO to be established in the foreseeable future. Those companies need the certainty and steady regulation that does not require them to try opening their areas for competition until such organizations are in place, so that investors in their companies don't have to forego recovery of their investment.[88]

One proposal would be to enact legislation for those non-ERCOT regions (not previously delayed by statute) that will delay competition in those regions until a FERC-approved RTO is in place and the power region has been qualified by the PUC.

Summary

In the three years since ERCOT moved to a competitive market, the system has undergone a continual evolution to address challenges and problems that have emerged. During that time, for example, the ERCOT board of directors has approved 280 protocol revisions. The PUC's recommendation to adopt a new market design with a day-ahead energy market, nodal pricing, and a centralized, security-constrained economic dispatch is part of that evolutionary process to ensure ERCOT can provide efficient, reliable electricity to millions of Texans.

The PUC's recommendation to adopt a nodal market design in ERCOT was made after significant study of the implementation of such a design in other competitive electricity markets around the nation. Currently, only California and ERCOT use a zonal market structure. Based on testimony presented to the Committee on Regulated Industries, comments made by ERCOT operations staff and recommendations included in the *2003 State of the Market Report*, there appears to be a growing body of evidence that the nodal market design would lead to the most economic dispatch of available generation resources. In addition, transparent and accurate price

[87] Testimony of Dan Ford, Lehman Brothers, before the Texas House Committee on Regulated Industries, August 26, 2004.
[88] Id.

signals would lead to the displacement of old, inefficient power plants that contribute to the state's air quality problems by new, highly efficient and clean generation units.

Though the cost-benefit study has yet to be completed at the time of the writing of this interim report, early cost projections indicate that the implementation of a nodal system, particularly if it is modeled after one of the existing markets, would cost about the same amount that ERCOT currently spends on its annual capital budget. However, as Potomac Economics noted throughout the *2003 State of the Market* report, the one-time investment would solve many of the problems that currently plague ERCOT.

It is the recommendation of the Committee on Regulated Industries that the Texas Legislature support the PUC's efforts to improve the market design for ERCOT, as well as the ongoing efforts of ERCOT staff and stakeholders working through the Texas Nodal Team to develop the apparatus and protocols to implement a nodal market design. Given the broad cross-section of stakeholders involved in developing these protocols and the vast expertise they bring, the members of this committee believe it is in the best interest of the citizens of Texas that this process continue to move forward undeterred, so that they may benefit from a market model that employs the economic dispatch of resources and ensures long-term electric reliability in ERCOT.

Charge #4

Examine issues related to access of rights-of-way and easements to ensure state laws encourage non-discriminatory access for all broadband service providers regardless of technology used to offer the service or the regulatory status of the provider.

Rights–of–Way and Easements

Technological and marketplace developments in the communications and broadband industry have created a range of new issues relating to non-discriminatory treatment by municipalities for compensation and access to public rights-of-way.

Texas currently has a municipal rights-of-way compensation scheme that is intended to treat all telecommunications services and providers in a competitively neutral manner. The goal of such a policy is to ensure that the competitive choices available to consumers in the marketplace are not limited by the inequitable application of government fees, terms, or conditions for rights-of-way access.

Due to a variety of factors, however, there are several ways in which Texas laws do not result in uniform or equitable treatment of communications services and providers. These factors include judicial rulings, technology changes, and marketplace developments. For robust inter-modal competition to develop on competing communications platforms, Texas statutes should be updated to ensure the competitively neutral application of laws for municipal rights-of-way compensation. Fair and equitable treatment of services and providers by all levels of government is key to ensuring that consumers have competitive choices in the marketplace.

State law currently obligates a certificated telecommunications provider (CTP) to pay municipalities an access line fee for every "access line" provided within the municipality. Even if a CTP uses the facilities of another entity and does not place any of its own facilities in the public rights-of-way in order to serve its customers, the CTP must pay an access line fee to the municipality. The amount of the access line fee is established by the PUC in accordance with a statutory formula. Access line fees are uniformly imposed on a defined set of services of all CTPs. The PUC has updated the definition of an access line to include the VoIP based voice service offerings of a CTP. However, if a provider is not certificated, but offers a service such as VoIP based voice service, an access line fee is not collected.

Texas law prohibits a municipality from imposing additional fees, such as permit and excavation fees, on a CTP. A municipality is also prohibited from requiring that a CTP donate any services or facilities for the public right-of-way due to the anti-competitive effects of such requirements. These protections do not exist for non-CTP network providers.

Federal law allows municipalities to impose a franchise fee on cable service providers in an amount not to exceed 5 percent of the cable operator's gross cable services revenues as compensation for use of the public rights-of-way. A federal district court in Texas and the Fifth Circuit have determined that a cable service provider that uses the facilities of an affiliate telecommunications company and does not place any of its own facilities in the public rights-of-way in order to serve its cable service subscribers is not subject to municipal cable franchise requirements and may not be assessed any franchise fee.[89]

If local or state government imposes a fee on some services, but not on others, the retail prices of competing service offerings are skewed in the marketplace and competition is hindered. This not only thwarts the development of competition but also limits customer choice.

Cable & Right-of-Way Access

Cable operators and/or their affiliates that use their cable network to provide circuit switched telephone services do so as a certificated provider, and even those providers using VoIP technology have submitted to traditional state certification in Texas to offer VoIP based voice service. As a result, when a cable operator or its affiliate uses cable facilities to provide voice services, two fees are paid to the municipality for access to public rights-of-way. The cable operator pays a franchise fee pursuant to its municipal franchise obligation and the affiliate offering voice service pays an access line fee pursuant to its statutory obligation as a CTP.

On the other hand, when a cable services provider uses the facilities of a telecommunications affiliate to provide cable services, only one fee is paid to the municipality for access to the public rights-of-way. The telecommunications company pays an access line fee pursuant to its statutory obligation as a CTP, but the video affiliate pays no cable franchise fee.

VoIP & Right-of-Way Access

[89] See *City of Austin v. Southwestern Bell Video Services, Inc.*, 193 F.3d 309 (5th Cir. 1999).

In the past, all providers of telecommunications services were certificated by the PUC and used traditional circuit switched technology. Today, voice services can be transmitted over non-traditional broadband networks using technologies such as VoIP.

In February 2004, the FCC initiated a proceeding to examine the appropriate regulatory classification and treatment for providers using VoIP technology to provide voice services. The primary issue to be addressed is whether VoIP based voice service is a telecommunications service, an information service, or a hybrid of those two service classifications. The FCC's conclusion is forthcoming.

Due to the considerable uncertainty over the appropriate regulatory classification of VoIP based voice services, some VoIP based voice service providers have sought state certification as telecommunications providers, but others have not. Generally, the affiliates of cable operators providing VoIP based voice services in Texas have become certificated as telecommunications providers and are providing voice services under the same regulatory structure set out in state law for other competitive telecommunications providers. This includes the payment of access line fees as required under state law. Other VoIP based voice service providers, however, have determined not to become certificated as telecommunications providers. Because such providers are not certificated, they are not subject to and do not pay any access line fees to the municipalities where they are providing service. Similarly, since these non-certificated VoIP based service providers "re-sell" or purchase access from other facilities-based providers and do not install any of their facilities in the public rights-of-way, any other form of right-of-way use fee is not remitted to the municipality where the service is provided.

Fiber Deployment & Right-of-Way Access

At least one telecommunications company, Verizon, has undertaken the construction of a new "fiber to the premises" network in certain municipalities. It is expected that Verizon will deliver voice, video programming, and broadband services over fiber to the customer's premises. This fiber deployment will overlay Verizon's traditional copper wire to the home and may some day replace the existing copper wire to the home. It appears at this time that Verizon intends to offer its cable video service in a manner that would subject it to a cable franchise fee. It would, therefore, pay a cable franchise fee for the new fiber deployment and pay a telecommunications access line fee for services offered over its legacy copper network. It may be appropriate for the state to provide clear and consistent guidance to municipalities to ensure that local governments treat all broadband providers in a fair and equitable manner in terms of municipal obligations for access to public rights of way.

Federal law provides that the amount of right-of-way use fees, if any, that a municipality may impose on a telecommunications provider is limited to "fair and reasonable compensation" for use of the public rights-of-way. There is a long-standing debate between municipalities and telecommunications providers regarding what is meant by "fair and reasonable compensation." In general, municipalities contend that "fair and reasonable compensation" means "rent" or "fair market value," while telecommunications providers assert that to meet the definition of "fair and

reasonable compensation," a right-of-way use fee charged by a municipality must be directly related to the actual costs incurred by the municipality when the telecommunications provider makes use of the rights-of-way.

The state law right-of-way compensation scheme that imposes access line fees on all certificated telecommunications providers was enacted in response to litigation in Texas challenging then-existing right-of-way compensation requirements based on a percentage of a provider's gross revenues. While the access line fees are not cost-based and are imposed on a service basis, the access line compensation scheme has not been challenged.

In Texas, considerable pressure exists on municipalities to increase the amount of revenue collected from telecommunications providers and cable operators. While the existing rights-of-way compensation scheme clearly produces competitive inequities, it is important to note that efforts to remedy these inequities could affect municipal budgets.

Charge #5

Examine the reliability of the electrical utility service and review the authority and structure of ERCOT.

Reliability of the Electrical Utility Service

Although Texans receive their electrical power from many different utility companies, the reliability and security of the transmission of electricity is ensured by a single, independent, not-for-profit organization – the Electric Reliability Council of Texas (ERCOT). ERCOT is one of ten electric reliability regions in North America operating under the reliability and safety standards set by the North American Electric Reliability Council (NERC). As a NERC member, ERCOT's primary responsibility is to facilitate reliable power grid operations in the ERCOT region by working with the area's electric utility industry organizations. The PUC has primary jurisdictional authority over ERCOT to ensure the adequacy and reliability of electricity across the state's main interconnected power grid. An independent board of directors comprised of independent members, consumers, and electric utility market participants governs ERCOT.[90]

Officially founded in 1970, but having roots extending back to World War II, ERCOT has maintained the reliability of electric power in Texas for several decades. Today, its role is expanding in response to the Texas Legislature-mandated restructuring of the electric utility industry.[91] ERCOT oversees day-to-day transactions and retail operations among all market participants. These include consumer requests to switch retail electric providers (REPs), move-in and move-out transactions, and financial settlements. No other independent system operator (ISO) in the nation performs these functions. The technical intricacies behind the implementation of Texas's retail market at ERCOT are quite extensive, requiring substantial knowledge of ERCOT processes in order to maintain the integrity of the system.

[90] About ERCOT, http://www.ercot.com/AboutERCOT/Index.htm.
[91] Id.

In the current Public Utility Regulatory Act (PURA), ERCOT is charged with nondiscriminatory operation of Texas's electric market, system-wide transmission planning, network reliability, and ensuring the reliability and adequacy of the regional grid. In addition, ERCOT ensures open access to the transmission and distribution system for all buyers and sellers of electricity.

Together, the passage of wholesale electrical competition in 1995 and retail electrical competition in 1999 have helped spur the construction of dozens of new power plants, helping to ensure that Texas continues to have reliable sources of power. As such, the PUC forecasted that the ERCOT grid would have an overall available generating resource capacity of approximately 81,000 megawatts (MW) in 2004,[92] which exceeds user demand by approximately 33 percent on a peak usage day. This is known as the "reserve margin." ERCOT has reported that Texas's reserve margin is expected to remain above 30 percent through 2008, providing sufficient generation for our growing state in the near future.

To ensure consistent and strong reliability in the Texas electrical grid, several key areas of importance must be closely monitored and addressed. Specifically, those areas include the maintenance of the current electrical grid within ERCOT, the reliability and interconnection capabilities of non-ERCOT providers located within Texas, and ensuring adequate levels of transmission investment within ERCOT.

Authority and Structure of ERCOT

The PUC has primary jurisdiction over ERCOT activities. ERCOT is governed by a balanced, stakeholder board of directors, made up of members from each of ERCOT's seven electric market groups. A Technical Advisory Committee (TAC) advances policy recommendations to the board of directors. The TAC is assisted by four standing subcommittees, as well as numerous workgroups and task forces. The board of directors appoints ERCOT's officers to direct and manage ERCOT's day-to-day operations, accompanied by a team of executives and managers responsible for critical components of ERCOT's four operations areas.[93]

Maintaining the Grid

Electric power systems require a careful, real-time balance between the amount of electricity generated and the amount being consumed by end-users. When large imbalances exist between generation and use, electric systems are designed to protect themselves by shutting down and isolating affected sections. Much of the western half of the nation is interconnected, as are the grids in the eastern United States.

Eighty-five percent of Texas's electric load, however, is on the grid managed by ERCOT. Thus, what happens in the eastern and western national systems does not affect the reliability of the ERCOT grid. Texas has long enjoyed a reliable electric infrastructure, and the progress toward enhancing the transmission infrastructure will help ensure preparation for emergencies. Though

[92] PUC Data.
[93] About ERCOT, http://www.ercot.com/AboutERCOT/Overview.htm.

no electric grid is immune to interruption, ERCOT and other parts of Texas continue to take steps to minimize the likelihood of a widespread blackout similar to the one that occurred in the Northeast United States on August 14, 2003. Texas's transmission and distribution utilities have invested $1.3 billion in transmission lines during the past five years.[94]

Still existing are some significant transmission constraints which member companies, regulators and state leaders continue to address to ensure that our current high level of reliability is maintained. Texas must continue to provide ways to spur appropriate capital investment in the electric grid by providing timely recovery of investment in transmission and distribution lines and by assuring adequate rates-of-return. Executing in a way that balances the economic impact on customers and market participants with maintenance of a reliable transmission grid will be critical to Texas in the coming years.

Non-ERCOT Grid Reliability

Companies that provide electricity in Texas that are located outside the ERCOT grid are working with FERC and various regional utility reliability councils or "power pools" of interconnected suppliers to ensure the reliability of the power grid. For reliability purposes, the non-ERCOT power pools are interconnected with the nation's larger grids, but in emergencies they can be isolated. As with ERCOT, one function of these regional organizations is to maintain significant reserves of power for use by member utilities in supply emergencies.

Transmission Investment and Constraints

Transmission lines are the high voltage conductors that move electricity from power plants to distribution systems which deliver power to customers. Ensuring adequate transmission capability is essential for electric reliability. Because of increases in population and overall economic growth, Texas has built many new power plants, requiring more transmission lines. A new power line may be needed when new power plants are built, or if existing power lines are not sufficient to meet demand, due to population or industry growth.

While transmission and distribution utilities (TDUs) have invested more than $1.3 billion in transmission lines during the past five years, Texas still faces several transmission challenges, including significant constraints within ERCOT, such as in the Dallas/Fort Worth Metroplex, the Rio Grande Valley, and West Texas. ERCOT market participants, regulators, and ERCOT continue to address these issues to ensure that our current high level of reliability is maintained.

Routing and siting of transmission lines is often a contentious and difficult process. While approximately eighteen months is required to permit and build a new natural gas plant, siting and constructing a transmission line can take three to five years. Ensuring certainty that transmission lines can be built to relieve congestion is key to maintaining reliability of Texas's electric system.

[94] Testimony of Paul Hudson, Chairman, Public Utility Council of Texas, before the Texas House Committee on Regulated Industries, August 22, 2003.

Typically, TDUs work with ERCOT to determine the need for transmission lines, with appropriate regulatory bodies setting the rate-of-return. The PUC is responsible for setting the regulated rate of return for the cost of service related to the construction of transmission lines in ERCOT. For other grids, FERC is the responsible regulatory entity. To maintain and enhance the reliability of the transmission and distribution system in Texas, the PUC must continue to set the rates of return high enough to encourage investors to provide capital for TDUs. If returns are set too low, investors will seek better returns elsewhere, which will put Texas' ability to build more transmission and distribution lines at risk.

Charge #6

Study the size and scope of the various broadband infrastructure platforms (e.g. cable, satellite, fixed wireless, DSL) in the state and how each are regulated under both state and federal law.

Broadband Infrastructure Platforms

Broadband is a term used to characterize "advanced telecommunications capability," which the Federal Communications Commission (FCC) defines as communications infrastructure capable of transferring data at a speed of at least 200 kilobits per second (Kbps). Broadband access enriches online activities by providing a considerably larger pipe for data transmission, featuring:

- The ability to send and receive large amounts of data quickly, practically in real time.
- A reliable connection that is "always on."
- Effective capabilities for telecommuting and videoconferencing so that a person could work at home or attend a meeting or conference without traveling.
- Rich multimedia applications and games.
- The capability to conduct fast, secure e-commerce, and large-scale business-to-business transactions.
- Telemedicine services.
- Opportunities for distance learning and job training from the home.
- The benefits of virtual collaboration on projects among people in different locations.

Broadband infrastructure platforms include Digital Subscriber Line (DSL), cable modem, satellite, fiber, and fixed or remote wireless service, all of which have much higher rates of transmission than standard dial-up access. Each technology is discussed below.

Digital Subscriber Line

Digital Subscriber Line (DSL) is an Internet technology that provides a dedicated digital circuit between a user and a telephone company's central office (CO), allowing for high-speed Internet data transfer over existing 2-wire copper telephone lines. The family of DSL technologies is referred to as xDSL. Within this family, the two primary categories are ADSL and SDSL. The key difference between these two groupings is the asymmetrical or symmetrical transfer of Internet data, respectively.

- *ADSL:* Asymmetric Digital Subscriber Line (ADSL) is called asymmetric because the download speed is significantly higher than the upload speed. The speed inequity makes this technology more suitable for residential or small business users, where higher-speed uplink is not as important. Most ADSL's duplex bandwidth is devoted to the downstream direction, sending data to the user.
- *SDSL:* Symmetric Digital Subscriber Line (SDSL) is a commercial-grade DSL solution, suitable for businesses that may be running servers or applications that send out large amounts of data. SDSL does not provide voice capabilities, so an additional phone line must be installed. Uplink and downlink speeds are equivalent, with reliable service along the dedicated line. Generally, SDSL solutions will also offer the user a number of static IP addresses.

Inside the user's ADSL modem is a splitter, which divides the existing phone line into two bands: one for voice and one for data. A channel separator within the modem then divides the data channel into two parts - a larger part for downstream data and the smaller part for upstream data, which explains the asymmetric nature of data transfer.

The data is then transported over telephone wires to the CO no more than 18,000 feet away from the user connection site. At the CO, the data is received by another ADSL modem. Within this modem is another POTS splitter, which separates voice calls from data. Voice calls are directed to the public switched telephone network and data is passed on to the digital subscriber line access multiplexer (DSLAM). The DSLAM links many ADSL lines to a single, high-speed, asynchronous mode line, which in turn connects to the Internet backbone at high speeds. Information from the Internet to the user follows this route back to the user.

DSL – State and Federal Jurisdiction

The federal government has exercised authority over some aspects of DSL under the Federal Telecommunications Act, such as requiring the filing of tariffs with the FCC since DSL is considered inherently interstate in nature. With regard to state jurisdiction over DSL, however, the extent of state jurisdictional authority is unresolved at this time.

Cable Broadband

Most broadband Internet access in the U.S. today is provided over the cable TV infrastructure. Cable TV companies provide broadband Internet access over their networks (primarily to residential customers) by installing a device called a cable modem in customers' homes. A cable modem connects a customer's personal computer to a network node that is shared by about 350-700 customers (with the expectation that only some fraction of customers will use the system at any given time). Each shared network in turn connects to the computers at a cable company's main office, which are connected to the Internet backbone. The cable company acts as its customers' Internet Service Provider (ISP).

Once the cable modem is installed, the customer has an "always on" connection to the Internet. The Internet connection does not interfere with the customer's cable TV service. It is important to note that a customer is not required to purchase cable TV to get broadband cable service.

Cable - State and Federal Jurisdiction

Currently, the state has no authority over cable modem service. Cable modem service has been declared an "information service" by the FCC, which carves it from state regulation via the Federal Telecommunications Act. However, the 9th Circuit Court of Appeals recently held that cable modem service is a "telecommunications service" and that ruling is under appeal.[95] It is worth mentioning that there is limited regulatory oversight of cable television at the local level.

Wireless Broadband

Wireless broadband systems use radio signals instead of telephone wire (copper, twisted pair), TV cable (hybrid fiber coax cable), or fiber optics to send and receive data and sometimes voice.

Wireless providers primarily employ what is known as "fixed" wireless technology to provide last mile broadband Internet access to residential and business customers. The technology is "fixed" because it relies on a stationary signal base, unlike "mobile" systems that allow users to move from place to place. Mobile wireless alternatives currently include Wireless Local Area Networks (LANs) and Internet connections for some hand-held computers and cell phones.

Providers operate all wireless broadband services over either licensed or unlicensed radio frequencies. The radio spectrum also supports other services such as pagers, cell phones, private radio dispatch, microwave, television, and radio broadcasting.

Fixed Wireless

In a fixed wireless system, a technician installs a small antenna, sometimes called a dish or a transmitter, on a customer's home or business (usually on the roof) and then wires it to a special modem connected to the customer's computer, providing an "always on" connection.

The customer's antenna uses radio waves to connect to the provider's central antenna, which in turn accesses the Internet through a public switched telephone network. To work properly, the customer's antenna needs a clear line-of-sight to the provider's central antenna, which is usually placed on a tall building, mountain, or tower. Bad weather, thick foliage, hills, tall buildings, or other obstructions can interfere with the line-of-sight. Depending on the type of technology used, fixed wireless systems can serve customers up to 35 miles from the provider's central antenna.

Mobile Wireless

Wireless LANs give users within a building or other limited area - like a campus - mobile access to their broadband network (wired or wireless), but the range typically is restricted to several hundred feet from a fixed network access point.

[95] *Federal Communication Comm'n v. Brand X*, 345 F.3d 1120 (9th Cir. 2003).

Wireless - State and Federal Jurisdiction
At the retail level, neither states nor the FCC regulate the prices, terms, or conditions of broadband services provided by wireless companies. Wireless providers themselves and their platforms are subject to some regulation via the spectrum wireless companies use, but regulation is limited in scope.

Satellite Broadband
Satellite broadband allows for asymmetrical high-speed data transfers from the Internet via satellite. The data signal travels from the computer to the satellite, and then from the satellite to the ISP, where the request is processed. The signal is then sent back to the user in the reverse order. There are two types of satellite broadband service: one-way and two-way.

One-way service requires the user to have an ISP (dial-up, cable modem, or DSL) for the uplink, while the downlink is supported by satellite. The satellite data downlink is just like the usual terrestrial link, except the satellite transmits data to the computer via a satellite dish at the user's home/office.

Two-way satellite configuration transmits and receives signals directly via the satellite without needing an additional phone line to support the connection for the upstream piece of the broadband service. In addition, unlike its one-way counterpart, two-way satellite broadband provides an "always on" connection.

Satellite - State and Federal Jurisdiction
At the retail level, neither states nor the FCC regulate the prices, terms, or conditions of broadband services provided by satellite companies.

Fiber to the Home/Premises/Curb (FTTH/FTTP/FTTC)
The Internet "backbone" is made up of fiber optic cables (very thin glass filaments) that have enormous bandwidth and use light pulses to carry information. Most customers, however, connect to the backbone through copper-based technologies like twisted pair or Hybrid Fiber Coax cable, which have limited bandwidth and limited capacity to carry integrated voice, video, and data services. Some providers are beginning to deliver integrated services over fiber optic cables that go from the Internet backbone directly to customers' homes or businesses. These cables may be buried, strung overhead, or run through existing structures like sewer lines.

Some providers are also using Gigabit Ethernet over fiber to provide customers with broadband access. The telecommunications research firm Communications Industry Researchers asserts that 16,000 U.S. homes currently have FTTH connectivity. It will likely be 10 years or more before FTTH becomes widespread.

FTTH/FTTP - State and Federal Jurisdiction
At this point, the extent of state and federal authority is unresolved.

Broadband over Power Lines (BPL)
BPL is a rapidly evolving market that utilizes electricity power lines for the high-speed transmission of data and voice services. The technology has roots extending to the 1940s. It has been used by power utilities for simple telemetering and control of electrical equipment in their networks.

BPL works by transmitting high frequency data signals through the same power cable network used for carrying electricity power to household users. Such a signal cannot pass through a transformer. This requires "outdoor devices" that combine the voice and data signals with the low-voltage supply current in the local transformer stations to bridge the last mile. In the house, "indoor devices" (adapters) are used in order to filter out the voice and data signals and for feeding to the various applications (e.g. PC/Internet, telephone, etc.).

BPL - State and Federal Jurisdiction
At this point, the extent of state and federal authority is unresolved. Current rulemaking on BPL by the FCC fails to mention state regulation issues.

Charge #7

Determine how investment in broadband networks by both competitive local exchange carriers and incumbent local exchange carriers can be encouraged through public policy changes.

How to Encourage Broadband Investment
Upgrading telephone lines to provide broadband service is a massive undertaking - one that requires the incumbent companies to shoulder enormous financial and technological risks. Billions must be spent installing new fiber-optic lines and implementing switching hardware. Even today, after tens of billions of dollars in investments, only about half of one industry leader's 60 million phone lines are ready for broadband. Moreover, unlike investments to update the old monopoly telephone service, those billions are being spent with no guaranteed customers and no guaranteed return.

Without rules to promote a more competitive and dynamic marketplace for broadband, Texans risk losing the promising potential broadband investment holds for the economy. Broadband currently resides at an inchoate stage before becoming the standard for online access - 80 percent of America's Internet users still use dial-up access and the existing regulatory framework threatens the promise of ubiquitous broadband deployment.[96] As a point of reference, when Congress passed the Telecommunications Act of 1996, the market was 90 percent voice, 5 percent wireless, and 5 percent data. Today it is 40 percent voice, 30 percent wireless, and 30

[96] National Telecommunications and Information Administration and Economics and Statistics Administration, U.S. Department of Commerce, *A Nation Online: How Americans are Expanding Their Use of the Internet*, Washington, D.C., 2002, p.24.

percent data.[97] Content providers continue to develop new products and services for consumers, but most consumers lack access to the technologies required for efficient access.[98] With more bandwidth-intensive content coming online, many long time users are at the point of upgrading their connections. Cable providers are taking advantage of this trend, yet other providers, such as DSL over phone lines, remain hamstrung by an overly burdensome regulatory framework. While falling prices and expanding service by cable providers are beneficial to consumers, the artificial regulatory impediments that make it difficult to justify additional investments in areas not yet served by broadband are highlighted.

Avoiding uncertainty and eliminating regulatory barriers to broadband deployment will increase investment in broadband technology, providing employment growth and increased output in Texas.

One study suggests that full broadband deployment would generate roughly 1.2 million jobs throughout the nation or more than twice the number of jobs lost recently in the telecommunication sector.[99] An additional estimate based on this data was released by the Citizens for a Sound Economy Freedom Works Foundation which found that the new jobs created by broadband would be beneficial to all 50 states, with 80,000 new jobs in Texas.[100] These new jobs would increase state output and create a source of increased growth for struggling economies here and in other states.

In fact, with both wireless and cable networks challenging the primacy of the old copper loops, Texas has reached the point where increasing competition has called into question the value of continued economic regulation. In the future, the communications market will be even broader, with satellite companies and perhaps even electric utilities playing significant roles. For the long run, the goal should be establishing a framework of interoperable broadband networks and open competition that encourages investment and innovation while providing consumers access to new technologies and services.

Adoption of a Statewide Broadband Policy

Some assert that the state should adopt a policy of universal service regarding broadband access, suggesting that active involvement by the state would best ensure that all Texans enjoy access to advanced telecommunications services regardless of their geographic or demographic status. Supporters of vigorous state involvement emphasize different options that could constitute a statewide broadband policy.

[97] Testimony of Blake Bath, Managing Director, Lehman Brothers Equity Research, before the House Committee on Energy and Commerce, February 5, 2003.
[98] See Figure 3.0 – Texas Broadband by Technology.
[99] Stephen B. Pociask, *Building a Nationwide Broadband Network: Speeding Job Growth*, Telenomic Research, February 25, 2002.
[100] Wayne T. Brough, *State Economies can Benefit from Broadband Deployment*, CSE Freedom Works Foundation, December 1, 2003.

Such measures could include requiring broadband providers to introduce services at the same rate across the state, encouraging network extension to unserved or underserved areas through public grants and tax credits, linking private sector providers with underserved communities, opening the state-administered network to underserved areas, and requiring the deployment and use of broadband by all state government offices.

Some supporters suggest that structurally separating the Texas wholesale and retail telecommunications markets would achieve the goal of ubiquitous broadband deployment and even further enhance local competition. Supporters contend that the successes evident in the separation of the wholesale and retail electrical market symbolize the opportunity to achieve the goal of promoting a more competitive and dynamic marketplace for broadband while simultaneously providing the regulatory certainty necessary to spur investment.

Opponents of an activist role for the state favor an unregulated marketplace, arguing that any broadband policy should rely on market forces to direct the scope and pace of broadband deployment. While these advocates support government attempts to increase demand for broadband technology, they generally oppose any direct government mandates that they predict could distort the market and grant one type of technology or provider an advantage over another.

Many of those who oppose direct government intervention argue that the low rate of adoption for this technology is the primary reason for patchy broadband service across the state. Thus, the state should focus on increasing exposure to the technology by encouraging the use of high-speed Internet in schools, government offices, and other public places. They support a broadband policy that would expand the use of e-government services, identify and lower regulatory barriers that impede broadband rollout, and facilitate rights-of-way acquisition for firms expanding their broadband facilities.[101]

Charge #8

Examine the benefits and challenges associated with alternative forms of energy generation technologies, such as wind and hydrogen fuel cells, and what, if any state, government involvement should be considered. (Joint Interim Charge with Energy Resources Committee)

Benefits and Challenges of Alternative Energy

[101] Tedd Holladay, *Expanding Broadband Access in Underserved Areas*, House Research Organization, at p. 6, June 24, 2004, available at http://www.house.state.tx.us/analyses/hro/research.php.

Due to its size and diverse climate, Texas has tremendous potential to harness clean, renewable energy resources such as wind, solar, and biomass. These resources are abundant, large enough by most accounts to meet all of the state's energy needs. The key lies in developing technologies that can tap this immense non-polluting resource affordably and reliably as well as setting up a regulatory and incentive structure that makes such investments viable.

Non-polluting technologies are now becoming commercially available, assisted by Texas's legislation that includes a "Renewable Portfolio Standard" mandating 2,000 MW of electricity generation from renewable resources by 2009.[102] A move toward renewables might also spur the economy, create jobs, and expand the tax base. Doing so would benefit the wind and solar rich rural regions of west and south Texas where jobs and economic development are most needed.

According to the PUC, Texas's commitment to creating renewable opportunities has four components:[103]

1. Instituting electric choice.
2. Adding a 2009 statutory goal of adding 2000 new MW of renewable generating capacity to the 880 MW that existed in 1999 (PURA §39.904).
3. Creating a simple and effective Renewable Energy Credit (REC) trading program.
4. Crafting a transmission system that encourages the development of renewable resources while providing certainty in both transmission rates and interconnection terms.

The result of these components has thus far been emission reductions and economic development for the state and its citizens.

Renewable Energy Credit (REC) Trading Program

The REC is a tradable instrument that represents all the renewable attributes associated with one MWh of production from a certified generator. RECs may trade separately from energy RECs, are issued based on calendar-year dates and have a useful life of three years. Each Retail Electric Provider in Texas is assigned a specific number of REC requirements each year based on the amount of load served 2004 mandate expected to equal 1 percent to 1.2 percent of retail sales ERCOT administers the program.[104]

Texas Renewables

Texas has sufficient amounts of oil, gas, coal, and uranium, but the state's renewable resources are overly abundant. In Texas, the potential energy from wind, solar, and biomass, which is useful energy derived from plants or animals, is equal to 400 times the state's annual energy consumption. Wind energy alone could provide eight times as much power as all of the state's electric generation plants combined.

[102] PURA § 39.904.
[103] Testimony of Barry Smitherman, Commissioner, Public Utility Council of Texas, before the House Committee on Energy Resources, September 28, 2004.
[104] Id.

Aside from wind, solar, and biomass energy, the potential of other renewable resources is more limited. For instance, most of the state's hydropower has already been developed, and Texas has scant potential in wave or tidal energy. The real question for renewables is not whether there are enough resources, but rather when technologies will be available that allows this enormous potential to be employed reliably and affordably. In some cases, such as wind energy, the answer is now.

Wind Energy

Wind energy is a competitively priced renewable energy source available in abundant, undepletable quantities in several areas of Texas. Key direct benefits of wind energy use are freedom from fuel price risks, long-term price certainty, security of supply due to in-state availability, and minimal exposure to environmental compliance risks.

As a new and growing Texas-based energy resource, wind offers substantial economic development benefits, such as job and tax base creation. Experience with existing projects suggests that every 1,000 MW of wind capacity installed in Texas adds $10 million per year in school finance revenues.

Key challenges of wind energy include the need for new transmission lines and impacts on utility operations due to intermittency. Studies by transmission planners and the federal government suggest these challenges can be met up to modest levels of wind penetration (10%) with moderate additional cost.

When compared to the current and projected costs of electricity production in Texas, the overall cost of wind – for generation of electricity, transmission costs, and ancillary services – appears competitive with conventional sources. Unless customer fuel charges decline from current levels, increased use of wind energy may even lead to overall sector savings while delivering incremental economic development and tax benefits to Texas.

Despite the strong fundamental drivers for growth in the Texas wind industry – namely cost-competitiveness and the increase in demand for environmentally beneficial resources – recent growth has been sluggish. This is due in great part to the absence of sufficient transmission capacity – sufficient capacity to carry the power from the wind farms to the market. Texas should ensure active transmission planning to meet the state's renewable energy goals.

Charge #9

Monitor agencies and programs under the committee's jurisdiction, including identifying possible ways to merge or streamline agency functions to produce long-term financial benefit to the state and better efficiency of the agencies.

The telecommunications and electric power markets are vital to Texas, its economy, and its citizens. These markets are also sensitive to regulatory uncertainty and particularly vulnerable to the discussion by PUC commissioners of proprietary or sensitive information at open meetings. However, the Open Meetings Act makes it unlawful for a majority of any commission to meet to discuss that commission's business unless the meeting is conducted in a forum that is open to the public. These open discussions can cause unnecessary and harmful market fluctuations, which could impair the burgeoning competitive markets, especially if proprietary, competitively sensitive information is released to competitors or the public through an open meeting. Additionally, both markets are critical to homeland security and to maintaining a stable, impervious infrastructure in which the state and its agencies can operate.

Open communication is critical to the success of any organization. However, the current PUC model prevents frank discussion and the exchange of ideas between commissioners. Commissioners must have the freedom to discuss business without fear that market observers will misinterpret their comments or that sensitive information may inadvertently be released. Yet today, two commissioners cannot simply sit and discuss the most basic issue without violating the law. This inability to communicate leads to inefficiencies and staff dominance of issues but could be rectified with the addition of two commissioners similar to the recent change that has produced favorable results at the Texas Department of Transportation.

The Sunset Commission made numerous recommendations regarding the agencies under the committee's jurisdiction which will be fully reviewed and considered by the Regulated Industries Committee during the 79th Session.

Glossary of Terms

Access Line: The circuit used to enter the communications network.
Access Network: The part of the carrier network that reaches the customer's premises. The access network is also referred to as the local drop, local loop, or last mile.
Asymmetric Digital Subscriber Line (ADSL): A data communications technology that can "piggyback" a standard voice telephone connection.
Bandwidth: (1) A measure of spectrum (frequency) use or capacity. For instance, a standard telephone conversation uses a bandwidth of about 3,000 cycles per second (3 KHz). A TV channel occupies a bandwidth of 6 million cycles per second (6 MHz). Cable systems occupy 50 to 300 MHz. (2) Also, the measure of capacity of a transmission channel.
Broadband: "True" broadband transmits voice, data, and video at rates of at least 1.5 Mbps (although today's networks commonly offer about 500 Kbps). Alternatively, "broadband" refers to any high-speed, always-on Internet connection.
Broadband over Powerline (BPL): a technology that allows Internet data to be transmitted over electric utility power lines.
Cable: A distribution system in which signals, picked up by elevated antennas, are delivered by cable to the receivers of subscribers.

Cable Modem Service: A service which utilizes a device that enables you to hook up your personal computer to a local cable TV line and send and receive data.
Central Office (CO): Telephone companies building in which end users' lines terminate at switching equipment that connects other end users to each other. Also known as End Office.
Competitive Local Exchange Carrier (CLEC): a company that competes with the already established local telephone business by providing its own network and/or switching.
Circuit: A switched or dedicated communications path with a specified bandwidth.
Digital Subscriber Line (DSL): Broadband technology that works over regular copper telephone cabling.
Economic Dispatch: the process by which an electric generating system consisting of multiple generating facilities is operated to maximize the efficiency of the system and minimize its operating costs.
Electric Reliability Council of Texas (ERCOT): the organization that administers Texas' electric power grid.
EvDo: A 3g wireless network capable of connections that are up to sixty percent faster than cable modem service which can work over existing cell phone networks.
Facilities-Based Carrier (FBC): A carrier that builds and uses its own facilities to provide service, rather than using the facilities of others.
Federal Communications Commission (FCC): an independent United States government agency, directly responsible to Congress with five commissioners appointed by the President, that is charged with regulating interstate and international communications by radio, television, wire, satellite and cable.
Federal Energy Regulatory Commission (FERC): an independent United States government agency that regulates the interstate transmission of natural gas, oil, and electricity. FERC also regulates natural gas and hydropower projects.
Fiber to the Curb/Home/Premise (FTTC/H/P): the installation and use of optical fiber cable directly to the curbs near homes or any business environment as a replacement for plain old telephone service.
Incumbent Local Exchange Carrier (ILEC): The traditional local telephone companies such as the former Bell companies, or local exchange carriers designated as such by state Public Utility Commissions.
Integrated Services Digital Network (ISDN): A digital telephone line that can be used for voice, fax, and data communications like a regular telephone line, but can transport data five times faster (or more) than a 28.8 Kbps V.34 modem and allow you to talk on the phone to one person while sending data to another.
Internet: An interconnected system of networks that connects computers around the world via the TCP/IP protocol.
Local Exchange Carrier (LEC): Telephone company lingo for your local telephone company.
Local Loop: This part of the telecommunications network connects end users to the central office network facilities. Twisted pairs of copper wire form the traditional medium of the local loop. Also known as the subscriber loop, local line and access line.

Last Mile: This part of the telecommunications network connects end users to the central office network facilities. Twisted pairs of copper wire form the traditional medium of the local loop. Also known as the subscriber loop, local line and access network.
Narrowband: This medium is capable of carrying voice, fax, paging, and relatively slow-speed data (not full video applications), typically at 64 Kbps or less.
Network Element: As defined in the Telecommunications Act of 1996, a facility or equipment used to provide telecommunications service.
Nodal: Of, relating to, resembling, being, or situated near or at a node or specific point.
Packet: A series of bits containing data and control information, including source and destination node addresses, formatted for transmission from one node to another.
Packet Switching: A transmission protocol in which data is divided into small blocks so that different packets could travel over different routes to avoid overloading a single facility. Paths are temporary and dynamic.
Packet-Switched Network (PSN): A PSN network carries information broken into digital "packets" that are transmitted independently and then reassembled in the correct order at the destination.
Point of Presence (POP): The point where the inter-exchange carrier's responsibilities for the line begin and the local exchange carrier's responsibility ends.
Point-to-Point: A circuit connecting two nodes only, or a network requiring a separate physical connection between each pair of nodes.
Plain Old Telephone Service (POTS): This term often is used to refer to analog voice telephone services provided over the public switched telephone network.
Public Switched Telephone Network (PSTN): The PSTN is the worldwide circuit-switched telephone network. Once only an analog system, these networks are digital, though most subscribers are connected via analog circuits.
Regional Bell Operating Company (RBOC): RBOCs comprise the U.S. local carriers created in the 1982 Consent Decree to break up AT&T. Seven were formed to serve as parent companies for the 22 then-existing Bell Operating Companies. Today, the remaining RBOCs are BellSouth, Qwest, SBC and Verizon.
Subscriber Line Charge (SLC): A monthly fee paid by telephone subscribers to compensate the local telephone company for part of the cost of maintaining the telephone equipment linking private homes to the telephone network. The SLC was originated at the same time as access charges to help support universal service.
T-1: A type of high-speed digital data connection that operates at 1.5 Mbps and requires a two-pair (four-wire) connection between the telephone company Central Office and the customer premises.
Tariff: A statement by a communications company that sets forth the services offered by that company, and the rates, terms and conditions for the use of those services.
Twisted Pair: A pair of wires used in transmission circuits and twisted about one another to minimize coupling with other circuits.
Unbundled Network Element (UNE-P): As defined in the Telecommunications Act of 1996, a facility or equipment used to provide telecommunications service.

Very High Bit-rate Digital Subscriber Line (VDSL): A form of Digital Subscriber Line similar to ADSL but providing higher speeds at reduced lengths.
Voice-over-Internet Protocol (VoIP): is a term used for a set of facilities for managing the delivery of voice information using the Internet Protocol. In general, this means sending voice information in digital form in discrete packets rather than in the traditional circuit-committed protocols of the public switched telephone network.
WiFi: Short for wireless fidelity and is meant to be used generically when referring of any type of 802.11 network, which refers to a family of specifications developed by the Institute of Electrical and Electronics Engineers for wireless local area network technology.
WiMax: a wireless industry coalition whose members organized to advance Institute of Electrical and Electronics Engineers 802.16 standards for broadband wireless access networks.

Figure 1.0

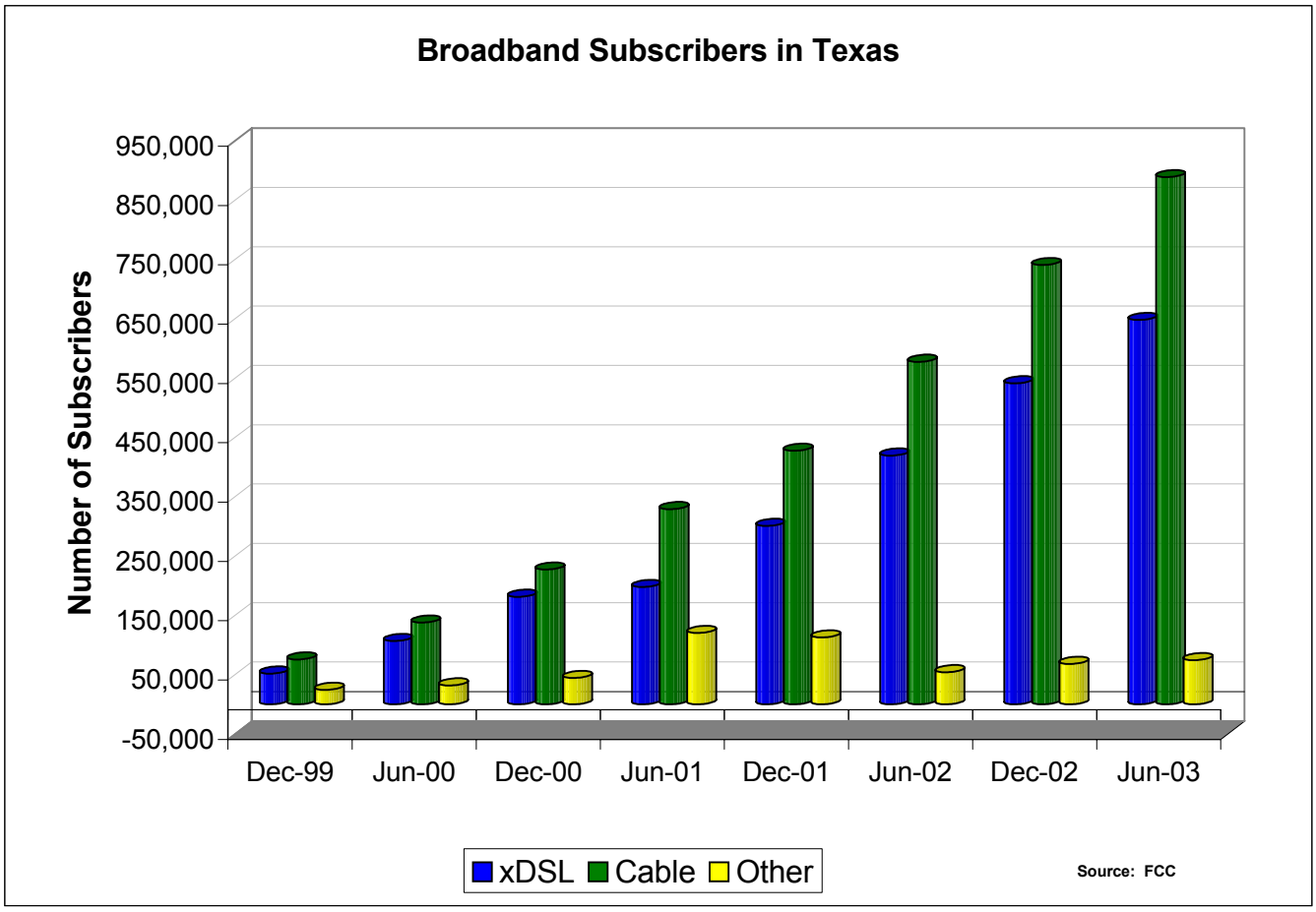

Broadband Subscribers in Texas
Number of Subscribers
950,000
850,000
750,000
650,000
550,000
450,000
350,000
250,000
150,000
50,000
-50,000
Dec-99
Jun-00
Dec-00
Jun-01
Dec-01
Jun-02
Dec-02
Jun-03
xDSL
Cable
Other
Source: FCC

Figure 2.0

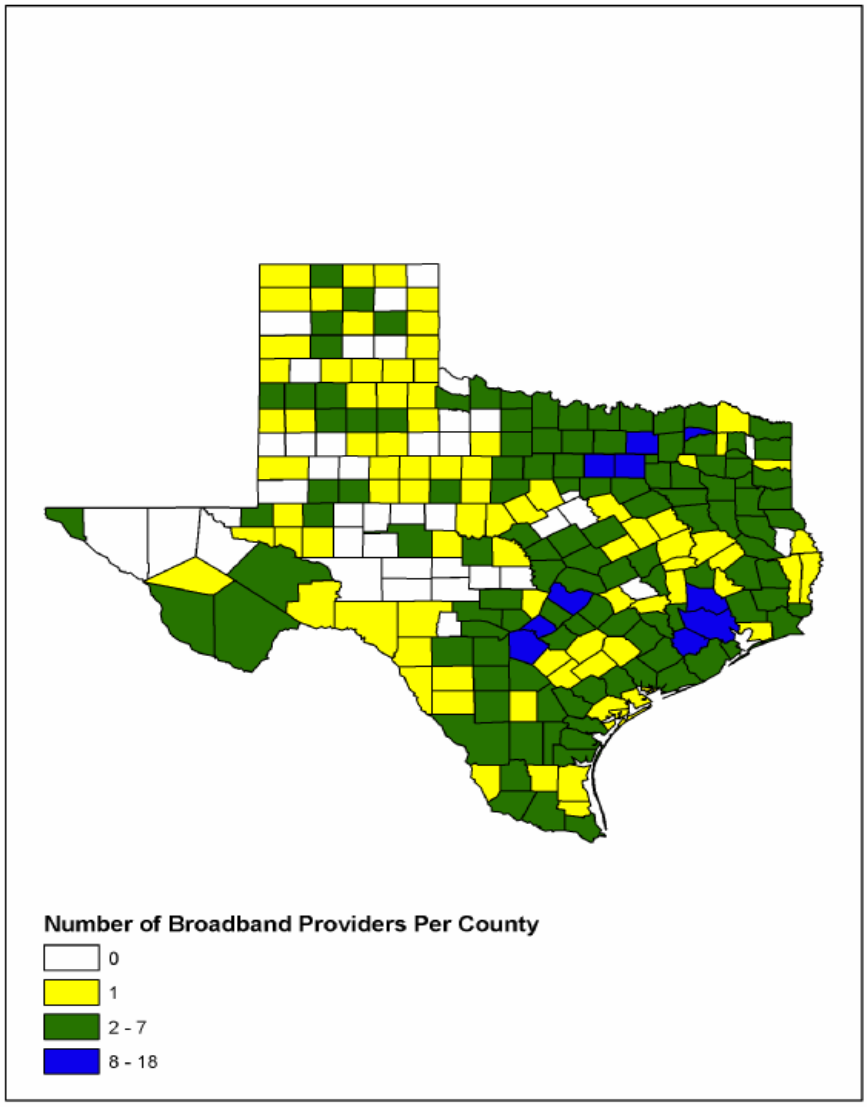
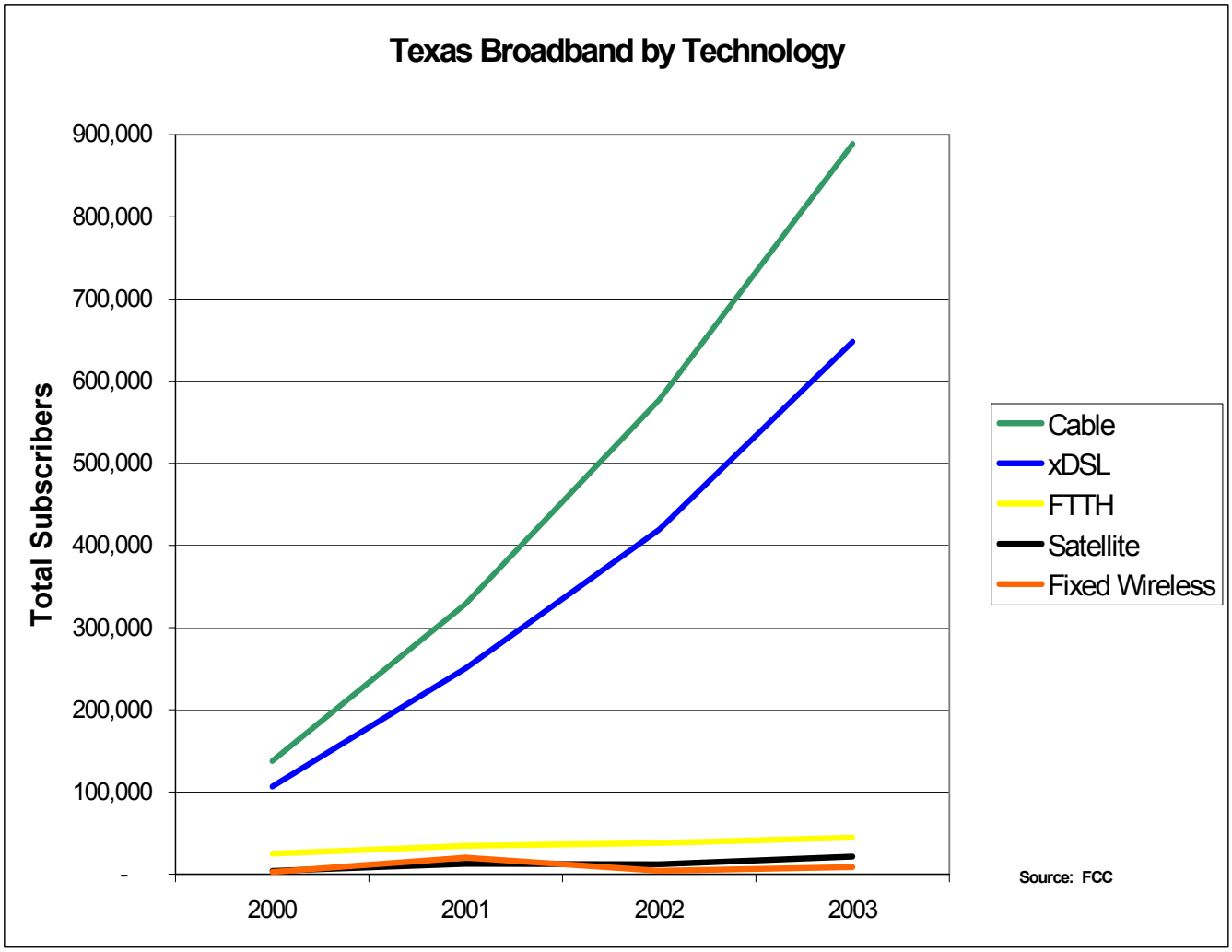


Figure 3.0


Texas Broadband by Technology
Total Subscribers
900,000
800,000
700,000
600,000
500,000
400,000
300,000
200,000
100,000
-
2000
2001
2002
2003
Cable
xDSL
FTTH
Satellite
Fixed Wireless
Source: FCC