POWER TO SAVE

An Alternative Path to Meet Electric Needs in Texas

Produced by
Optimal Energy, Inc.

Report commissioned by
the Natural Resources Defense Council and Ceres

January, 2007

Optimal Energy

NRDC

The Earth's Best Defense

Ceres

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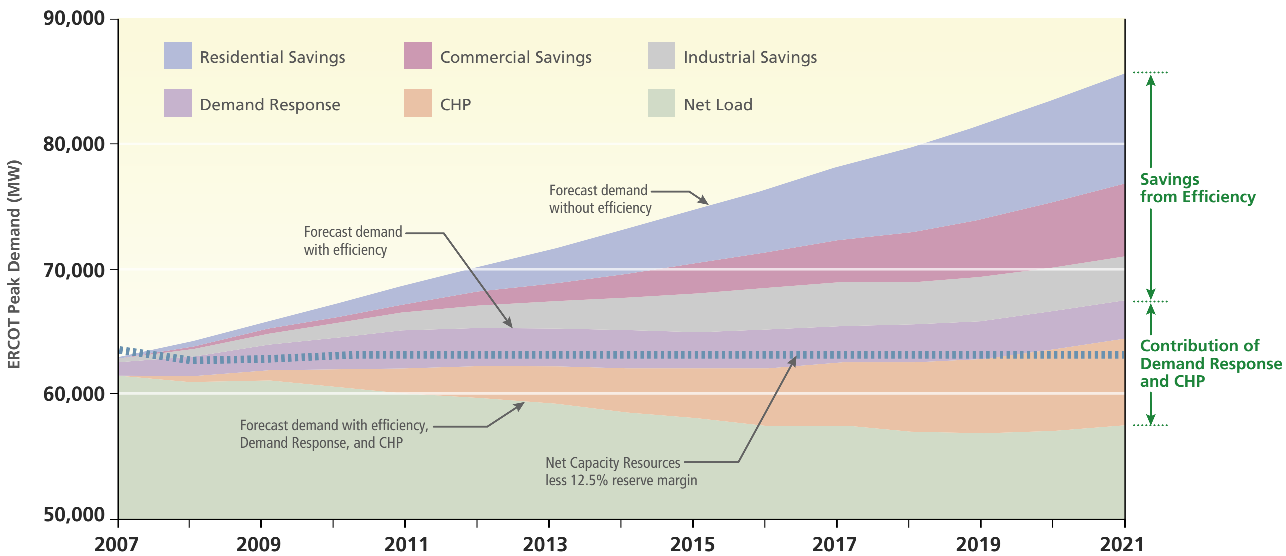
EXECUTIVE SUMMARY

The demand for electricity in Texas has grown significantly over the last several years as a result of robust economic growth, new building construction, and increasing energy use in existing buildings. Continued growth in electricity demand (often called "load growth") is expected to strain existing generation capacity in the near future. The Electric Reliability Council of Texas (ERCOT), which accounts for 85% of the state's electricity demand, estimates that available generation capacity will drop below the minimum level required to maintain reliability by 2008.[1] As a result of these trends and recent volatility in natural gas prices, some utilities have called for massive investment in new coal-fired power plants.

This study finds that a comprehensive effort to promote efficiency and other cost-saving demand reduction measures can meet Texas' electricity needs more reliably, at a lower cost and at a tremendous net economic benefit compared to building a new fleet of expensive and heavily polluting power plants. Over the next 15 years, boosting markets for more efficient products, lighting, cooling, heating and industrial processes can eliminate over 80% of forecast growth in electricity demand, while lowering consumer's energy bills. With additional measures to further reduce electricity demand and enhance reliability, Texas can completely eliminate its "load growth," resulting in a gradual *decline* in total electricity demand to more than 9% below current levels by 2021. Figure ES-1 provides a graphic representation of how reliability can be maintained without the need for large investments in new power plants.

Figure ES-1: Effect of Demand-Side Resources on ERCOT Forecast and Reserve Margin



ERCOT requires a reserve margin of 12.5%, which means that the available generation capacity should be equal to or greater than the actual peak energy load plus 12.5%. The dashed line represents ERCOT's estimated available capacity after allowing for the 12.5% reserve margin. The colored bands show the energy forecast and the effects of efficiency in the three major consuming sectors (residential, commercial, and industrial) and of Demand Response and CHP.

This approach also offers substantial economic and environmental benefits for Texas. The efficiency potential described in this report would provide $49 billion in economic benefits over the next 15 years, resulting in lower electricity bills for customers and reduced spending on electricity generation and transmission capacity by utilities. These benefits would be generated by an $11 billion investment in proven programs and policies focused on more efficient appliances, heating and cooling systems, and office equipment and improved building codes, resulting in *net benefits* to the Texas economy of $38 billion. Compared with the proposed $10 billion cost of just 11 new coal-fired generating plants (out of a total of 19 proposed), this investment comes with less risk and greater environmental and economic benefits for Texas.[2] Studies also show that investment in energy efficiency helps the local economy. Instead of importing fuel from outside the state, energy efficiency relies on local companies and retailers to provide energy management services and energy-saving products.[3]

Summary of Findings

Capturing the energy efficiency potential estimated in this report would:

- Eliminate the need to invest in thousands of megawatts of new power plants by reducing electricity demand by 0.5% per year, when pursued with other measures cited below.
- Generate $38 billion in net benefits for the Texas economy. For every dollar invested in efficiency measures, Texas would recoup approximately $4.40 in economic benefits in the form of lower costs to consumers and savings for utilities from reduced electric generation and delivery costs.
- Save 20,700 gigawatt-hours (GWh) of electricity each year by 2011, enough energy to power nearly 1.9 million households. By 2021, over 80,000 GWh would be saved annually, enough for more than 7 million households. These energy savings cost just 1.8 cents per kilowatt-hour (kWh), compared to over 7 cents per kilowatt-hour for the alternative of supplying energy from current generating plants. Compared to current projections for 2021, this translates into a 20% reduction in electric energy use.
- Reduce peak electric demand in Texas by almost 4,000 megawatts (MW) by 2011 and 18,500 MW by 2021 (equivalent to the output of 20 large power plants). Reducing the high demand for electricity on the hottest summer days provides dramatic savings in total generation costs, because maintaining the capacity and generating electricity to meet the peak demand is very expensive.
- Prevent 52 million metric tons of carbon dioxide (CO_2) emissions annually by 2021, over 20% of Texas' current emissions associated with electricity use. This is the equivalent to the annual emissions from 10 million cars. In contrast, TXU's plan to build 11 new power plants would double its CO_2 emissions.[4] Total CO_2 emission reductions over the life of the efficiency improvements would be 400 million metric tons. Concurrent reductions in sulfur dioxide and nitrogen oxides emissions would also help the three-quarters of all Texans who live in areas where these pollutants contribute to high ozone levels.

While this study focuses on energy efficiency, it also provides a preliminary look at the potential for additional strategies to contribute to load reduction and reliability.

- An estimated 20,000 megawatts of potential combined heat and power (CHP) capacity exists in Texas. Combined heat and power refers to the generation of both electricity and useful heat energy, usually by an industrial energy consumer for use at their own facility. This reduces the consumer's need to purchase power from a utility.

- Peak demand could be further reduced by approximately 3,200 MW of Demand Response capacity. "Demand Response" refers to technologies that enable a utility to remotely reduce the power consumption of their customers during times of high demand, for example by raising the set-point of thermostats to reduce the electricity consumed by air conditioning units.

As described in the report, combining ambitious energy efficiency actions with these strategies can eliminate load growth in Texas for many years. These findings are in line with those reported by the Western Governor's Association 2006 Energy Efficiency Task Force, which found that adoption of best practice policies and programs for just energy efficiency could reduce load growth by approximately 75% over the next 15 years.

Recommendations

For Texas to capture the efficiency resources identified in this analysis, multiple strategies must be pursued. Chief among them, we recommend:

- Increasing the state's efficiency resource standard (ERS) from 10% of load growth to at least 50% and preferably to 75% as described by the Western Governor's Association.
- Expanding investment in energy efficiency programs, such as is occurring in Vermont, Massachusetts, California, and numerous other states. Simply bringing all utility efficiency efforts in line with the performance of the City of Austin's municipal electric utility would meet over one-third of new load growth.
- Adopting higher efficiency standards for appliances such as DVD players/recorders and residential pool pumps, as has been done in several states.
- Updating commercial and residential building codes to at least 15% above the current codes, as with the successful code adopted by Frisco, Texas.
- Requiring electric utilities to invest in all cost-effective efficiency resources, removing utility financial disincentives to utility investment in efficiency, and allowing them the flexibility to design and deliver programs in response to customer and market needs.
- Requiring the Public Utility Commission of Texas (PUCT) to review the potential for energy efficiency and demand-side management and update efficiency goals and programs every two years.

This report uses regional and national studies to estimate the potential for energy efficiency in Texas. It is the first of several reports to be released over the next several months examining the potential for energy efficiency and demand-side investments in Texas. Subsequent reports prepared by the American Council for an Energy-Efficient Economy (ACEEE) will examine the efficiency potential in greater detail and make specific policy recommendations for Texas. In addition, these ACEEE studies will also explore the potential for demand response, combined heat and power, and on-site renewables and estimate the macroeconomic impacts of these policies.

1 INTRODUCTION & SUMMARY OF FINDINGS

1.1 Context and Scope

Texas electric loads have grown significantly over the last several years resulting from robust economic growth, new building construction and greater energy intensity in existing building stock. Forecasts for the Electric Reliability Council of Texas (ERCOT) network are for annual electricity use to continue to grow at an average of 1.9%/yr through 2020.[5] ERCOT's summer peak demand is expected to grow even more, at 2.3%/yr for the same period.[6] This rapid growth is expected to strain existing generation capacity. ERCOT estimates that available capacity margins will drop below their 12.5 percent minimum target level by 2008.[7]

Partly as a result of these needs, some utilities have called for massive investment in new coal-fired power plants to maintain reliability. This study identifies an alternative path, one that offers substantially lower load growth, increased reliability, lower consumer energy bills, substantial environmental benefits, and provides the Texas economy with nearly $38 billion dollars in present value net benefits over the next 15 years. It analyzes the cost-effective achievable efficiency opportunities in the ERCOT region from a combination of enhanced efficiency programs for residential, commercial and industrial electricity users, adoption of appliance standards and enhanced building codes, and other policy initiatives from 2007 to 2021.

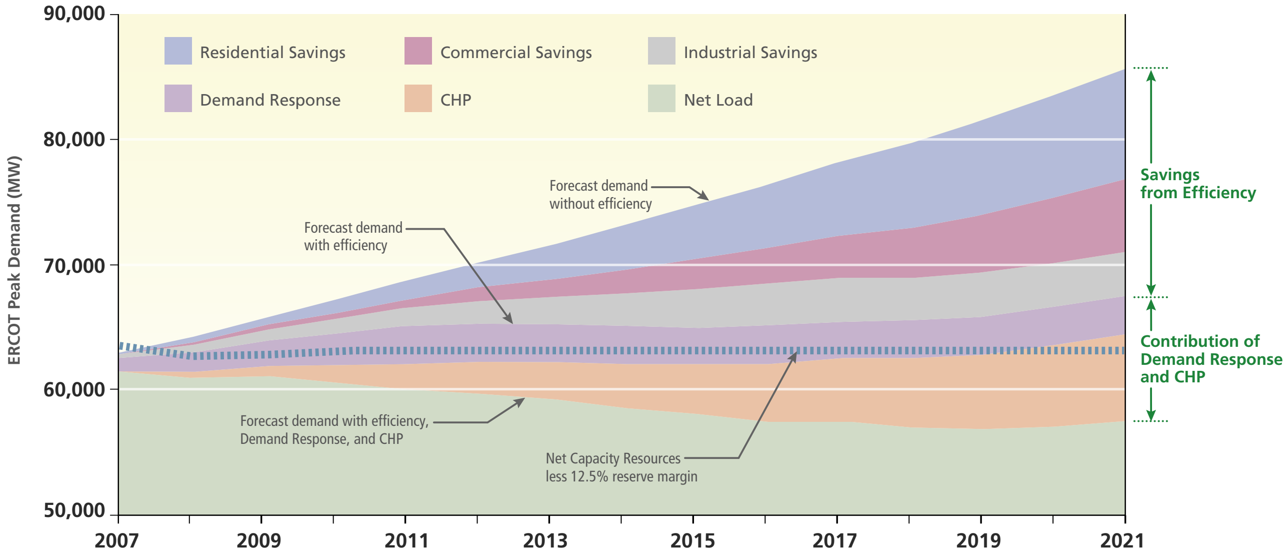
1.2 Summary of findings

Pursuit of ambitious energy efficiency actions can, over the next 15 years, eliminate over 80% of forecast electric *load growth* at costs substantially cheaper than new electric supply. We estimate total cost-effective achievable efficiency potential of 18,500 megawatts (MW) and 80,700 gigawatt-hours (GWh) by 2021, enough energy to power 7 million households. This represents 22% and 20% of forecast peak *total* load and annual energy consumption, respectively. Capturing this efficiency resource would meet 81% of forecasted peak demand load growth and 87% of annual energy load growth. Total peak demand annual load growth would drop from a projected 2.3% to only 0.6%. For annual energy usage, average annual load growth would go from 1.9% to only 0.4%.

Substantial emissions reduction would accompany these energy savings. By 2021, they would eliminate 52 million metric tons of carbon dioxide (CO_2) (over 20% of Texas' current emissions from electricity generation), 30,000 tons of nitrogen oxides (NOx), and nearly 90,000 tons of sulfur dioxide (SO_2)[8]

Capture of this achievable efficiency potential alone will alleviate the current reliability concerns to some extent. When this energy efficiency potential is combined with additional strategies to provide additional capacity, the result is a complete elimination of load growth and an average annual *decline* in peak load of 0.5%. Over 1,100 MW of demand response capacity already exists in Texas, which allows utilities to control certain customers' energy consumption during peak energy use periods; just six years ago there was approximately 3,200 MW of demand response capacity.[9] A ramp up to historic levels of demand response capacity would defer the reliability need to 2020, even assuming no additional capacity became available from other sources, such as renewables. Furthermore, while there are over 10,000 MW of generation capacity currently available from combined heat and power (CHP) installations, where customers generate both electricity and useful heat energy at their facilities for their own use or sale back to the electric utility, twice that amount of undeveloped CHP capacity in the state is estimated to be achievable within 10 years.[10] Figure 1 shows that tapping these resources in addition to investments in energy efficiency would forestall the need for new generating capacity to meet required reserve margins far into the future. This analysis focuses on the efficiency potential portion of these demand-side resources.

Figure 1: Effect of Demand-Side Resources on ERCOT Forecast and Reserve Margin



ERCOT requires a reserve margin of 12.5%, which means that the available generation capacity should be equal to or greater than the actual peak energy load plus 12.5%. The dashed line represents ERCOT's estimated available capacity after allowing for the 12.5% reserve margin. The colored bands show the energy forecast and the effects of efficiency in the three major consuming sectors (residential, commercial, and industrial) and of Demand Response and CHP.

Pursuit of efficiency resources would not only defer the need for aggressive investment in new generating capacity, but would also provide Texans with substantial environmental and economic benefits. Estimated total *net* benefits returned to the Texas economy would be $38 billion over the next 15 years — benefits derived from lower utility bills for customers and reduced spending on electricity generation and transmission capacity by utilities. This would be captured with an overall benefit-cost ratio of 4.4. In other words, for every dollar invested in efficiency, Texas would recoup $4.40 in savings. In addition, efficiency investments tend to retain the economic benefits within the Texas economy rather than going toward importing coal from outside the state.

1.3 Summary of Recommendations

Capturing the efficiency resource will require a redoubling of efficiency efforts. Texas should increase its current efficiency resource standard (ERS) from its current 10% of load growth (equal to just 0.23% of total current load) to at least 50% and preferably to 75%. Simply bringing investor-owned utility efficiency efforts in line with the performance of the City of Austin's municipal electric utility would meet over one-third of new load growth.[11] In addition, Texas should direct its utilities to invest in all cost effective efficiency resources identified through a planning process that considers supply and demand-side resources on an equal footing, remove current disincentives to utility investment in efficiency, and allow them the flexibility to design and deliver programs in response to customer and market needs. In conjunction with these expanded efficiency program efforts, Texas should update its current building codes and adopt effective appliance standards such as California has done. Pursuit of the above actions can avoid a risky and environmentally damaging investment in new coal fired power generation.

Consumers face many barriers to investment in energy efficiency improvements. These include:

- Difficulty in acquiring or lack of information about energy efficiency for consumers;
- Perceived risk of investing in less-familiar technologies and products;
- Split incentives, where the party investing in energy-using equipment and systems does not pay energy-related operating costs, such as in rented apartments and leased commercial space;
- Lack of capital to invest in the efficiency improvements or added incremental cost of higher efficiency products
- Lack of ability, and associated costs related to understanding and analyzing efficiency options when making decisions about energy-using equipment.

These and other barriers conspire to cause energy users to focus on the purchase costs of new equipment (which are typically higher for efficiency equipment) rather than striving to minimize their total costs associated with both purchasing and operating energy-using equipment and systems over their lifetime.

Proven strategies to overcome the many barriers to optimal energy efficiency investment have been used to varying degrees throughout North America over the past several decades. For Texas to capture the efficiency resources identified in this analysis, multiple strategies must be pursued. Chief among them, we recommend:

- Significant expansion of investment in energy efficiency programs, such as those in place in Vermont, Massachusetts, California, and numerous other states;
- Adoption of higher efficiency standards for appliances such as DVD players/recorders and residential pool pumps, as has been done in several states;
- Updating commercial and residential building codes to at least 15% above the current codes, as with the successful code adopted by Frisco, Texas;
- Removing utility financial disincentives for ambitious pursuit of efficiency by ensuring transmission and distribution utility's profits are not hurt by reduced sales from efficiency and rewarding them for exemplary performance; and
- Requiring the Public Utility Commission of Texas (PUCT) to review the potential for energy efficiency and demand-side management and update efficiency goals and programs every two years.

The remainder of this report provides more detail on the approach and assumptions used to estimate the size and value of the electric efficiency resource, detailed findings, and policy and program recommendations for Texas to capture achievable efficiency opportunities.

2 ELECTRIC EFFICIENCY ACHIEVABLE POTENTIAL

2.1 Current ERCOT Efficiency Efforts

In 1999 Texas passed legislation requiring investor-owned utilities (IOUs) to meet a minimum of 10% of electric load growth from efficiency resources.[12] With growth running at approximately 2.3% per year, this implies a target of 0.23% of total load. In 2005, this translated to a goal of 142 MW of peak demand reduction. Texas IOUs surpassed this goal, capturing 181 MW of peak demand reduction (0.3% of total 2005 peak) and 509 GWh of energy savings (0.2% of 2005 electric energy use). This was accomplished with utility investment of $80 million, or 0.4% of these utilities' 2004 revenue. Since electric utility restructuring in Texas, total savings have reached 592 MW peak load reduction (0.95% of load) and cumulative energy savings of 1,639 GWh.[13]

While these efforts are commendable, much more can be accomplished. For example, the City of Austin's municipal electric utility has been capturing *new savings* of approximately 0.8% of *total electric load each year* through efficiency efforts (more than three times as much than the Texas IOUs), spending about 3% of its revenues (roughly 7.5 times the proportional spending by the Texas IOUs).[14] California's current utility program efficiency goals are approximately 1% of load annually.[15] Vermont is poised to lead the nation in efficiency programs, with annual targets of approximately 2% of total electric load.[16] Leading jurisdictions are also investing a substantially larger portion of utility revenue on efficiency than Texas. For example, Massachusetts' spending is about 3.3% of revenue.[17] Vermont is phasing in funding increases over two years; 2008 funding will be 4.7% of revenue.[18]

Efficiency programs can capture efficiency resources far more cheaply than traditional supply alternatives even when they are pursued more ambitiously. For example, the Western Governor's Association estimated in 2006 that the total societal costs for expanded efficiency programs in its 18 state region (which includes Texas) that would reduce load growth by 75% would provide savings at a cost of 2.5 cents/kWh, or roughly a third of Texas' current avoided costs.[19]

2.2 Methodology

This analysis relied on a number of studies to estimate efficiency opportunities in Texas. The Southwest Energy Efficiency Partnership (SWEEP) estimated in 2002 that achievable electric efficiency potential over an 18 year period in a 6-state southwestern U.S. region was 33% of forecast load by 2020.[20] For Arizona and New Mexico, savings were estimated at 34% and 36%, respectively.[21] The SWEEP analysis considered opportunities from efficiency programs, building codes and appliance standards, and other policy reforms similar to those recommended here. In 2006 the Western Governor's Association's (WGA) Energy Efficiency Task Force developed an estimate for an 18-state Western U.S. region by reviewing seven major efficiency potential studies completed since 2001 for western states, including the SWEEP study. Some of these studies addressed areas like California and the Pacific Northwest, where ambitious efficiency efforts have been in existence since the 1980's. The WGA had previously set a goal equivalent to a reduction in electric usage of 1.4% per year.[22] WGA states:

> ***We conclude that widespread adoption of best practice policies and programs would not eliminate all load growth over the next 15 years, but it would reduce it by about three-quarters.***

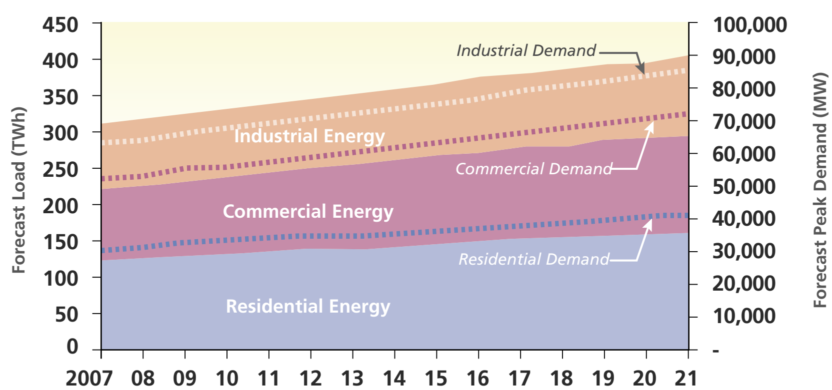
The Best Practices scenario reduces electricity consumption in 2020 by 20% relative to that in the Reference scenario, or the equivalent of electricity supply by 100 baseload power plants. Thus we conclude it is possible to achieve the energy efficiency goal enunciated in the WGA Clean and Diversified Energy Resolution, namely realizing 20% electricity savings by 2020. Moreover, even greater electricity savings may be possible through adoption of other strategies not included in our Best Practices scenario, such as R&D, technology transfer, or pricing initiatives.[23]

Our analysis applied data from these and other studies to current and forecast ERCOT loads to develop an efficiency potential estimate for ERCOT. We estimate significantly less potential than SWEEP, although in line with WGA. Various changes since the SWEEP study, the greater efficiency efforts in Texas than some of the Southwestern states, and other inputs resulted in our estimate on the lower side of recent available research in the area. We also modified the ramp up of activity in recognition that Texas efficiency efforts are currently substantially below maximum achievable levels. We applied savings from these studies to EIA's reference case ERCOT electric demand forecasts, broken out by sector. The residential and commercial sectors were further broken out by building type. For the industrial analysis, we relied on a study of industrial efficiency potential in New York State, making adjustments for the relative mix of industrial sector activity in New York and Texas. The sections below provide more detail on the methodology.

2.2.1 ERCOT Base Case Load Forecast

The starting point for the analysis is the "base case" forecast. This is an estimate of future electricity demand assuming "business as usual," including the current utility efficiency efforts. To determine the base case for the years 2007 through 2015 we rely on ERCOT's own energy forecast.[24] From 2015 through 2021 we increase the ERCOT forecast by the growth rates found in the U.S. Energy Information Administration (EIA) 2006 energy forecast for ERCOT which projects average annual load growth of 1.7% per year through 2021. EIA also forecasts peak demand growth of 2.3% per year through 2010. ERCOT's own peak demand forecast has growth slowing slightly in the longer-term, averaging 2.2% through 2021. The higher peak demand estimate reflects a decreasing load factor, which continues a trend in Texas that is presumably due to higher penetration of air conditioning and other weather-related end uses that disproportionately affect summer peak demand. Figure 2 shows the energy and demand forecasts by sector.

Figure 2: ERCOT Energy and Peak Demand Forecast through 2021



2.2.2 Efficiency Potential Analysis

We applied estimated efficiency savings as a percentage of load by year, sector and building type to sector-level energy forecasts. The efficiency savings are based on review of other regional potential studies and do not rely directly on detailed building and equipment data in Texas. For the residential analysis, we estimate potential separately for single and multifamily buildings. For the commercial analysis, four primary building types are analyzed — offices, retail, education, and food service. For each of these six total building types, savings are further broken out into existing and new construction. We assumed 80% of load growth was due to new construction, with the remaining due to growth in consumption in existing buildings. For residential buildings, we allocated 73% of energy use to single-family buildings, based on sales data from the SWEEP study. For commercial buildings, we allocated energy use based on data from the Commercial Building Energy Survey (CBECS) for the West South Central region, of which Texas represents a large fraction.[25]

The industrial analysis began with an estimate of the savings potential for several electrical energy end-uses (e.g., motors, process heating, lighting, etc.) in industrial facilities.[26] The savings potential for each of nine major manufacturing sectors was calculated using data from the U.S. Energy Information Administration on the distribution of energy consumption across these end-uses for each industry.[27] We then calculated a weighted average savings potential for the industrial sector in ERCOT from the actual 2004 electrical energy use and the total savings potential for each sector.

For the residential and commercial potential, the starting point is the total achievable energy potential by building type and year estimated for Arizona and New Mexico.[28] This potential was applied to the Texas building type loads, separately for existing and new construction. Penetration factors were then applied to reflect likely penetrations given reasonable but ambitious efficiency efforts, based on past experience with leading programs in North America. In general, maximum penetrations by 2021 were around 60% of the eligible efficiency opportunities.[29]

Residential and commercial peak demand savings associated with the energy reductions assumed similar efficiency load factors to those currently achieved by the Texas investor-owned utilities in 2005.[30] The industrial analysis assumes a load factor consistent with industrial consumption.

2.2.3 Economic Effects and Emission Reductions

To estimate the costs of achieving the estimated efficiency potential in the residential sector we implicitly adopted the costs from the SWEEP study by scaling their reported total program costs to our savings levels. For commercial, we estimate costs commensurate with the experience of other ambitious efficiency efforts and other studies. Industrial costs were estimated based on the mix of industry sectors and technologies assumed. In addition to the incremental costs incurred to invest in more efficient equipment, we also estimated the administrative, marketing and other costs to deliver ambitious programs to capture the efficiency. We assume program budgets of 30% of incremental efficiency costs for the residential and commercial sectors, and 15% for the industrial sector.

To estimate emissions reductions from efficiency investments, we apply emissions factors for Texas generation to our energy savings estimates. The factors for 2021 assume 12,000 new megawatts of coal-fired generation, with the balance of any needed capacity coming from non-carbon fuels (e.g., wind, nuclear).[31]

2.2.4 Additional Demand-Side Resources

We relied on past results to estimate the potential for additional demand-side resources in Texas. According to ERCOT, there is currently 1,112 MW of available demand response capacity.[32] As recently as 2000, there was 3,200 MW of demand response capacity.[33] We assume that this capacity could be regained over 5 years at approximately 500 MW per year. For combined heat and power (CHP), the American Council for an Energy Efficiency Economy estimates the potential to achieve 20,000 MW of additional capacity, in addition to the 10,000 MW installed circa 1999.[34] We assumed that this potential could also be tapped at the rate of 500 MW per year, beginning in 2008.

2.3 Detailed Results

2.3.1 Overall Findings

By 2021, we estimate overall reductions of 20% in forecast energy load and 22% in forecast peak demand. This translates into average annual load decreases of 1.5% and 1.7% for energy and demand, respectively. As a result, ambitious efficiency policies and programs can limit growth in energy usage to just one-fifth of the forecast growth over the next 15 years. This would provide $38 billion of net benefits to the Texas economy.[35] Nearly 400 million tons of CO_2 emissions would be avoided over the life of the measures.

2.3.2 Efficiency Potential

Total electric efficiency potential by sector and year is shown in Table 1. Because Texas already has a history of successful efficiency programs, immediate actions can be taken to begin to capture this potential right away. The modeled efficiency potential assumes a ramp up of activities, with full scale deployment within about 5 years.

Table 1: Energy Efficiency Potential by Sector and Year

	Energy Savings (gigawatt-hours)				**Peak Demand Reduction** (megawatts)			
Year	**Residential**	**Commercial**	**Industrial**	**Total**	**Residential**	**Commercial**	**Industrial**	**Total**
2007	710	618	2,406	3,734	228	151	305	685
2008	1,322	1,132	4,823	7,277	424	277	612	1,314
2009	1,965	1,758	7,248	10,970	631	431	919	1,981
2010	3,203	2,881	9,771	15,855	1,028	706	1,239	2,973
2011	4,379	3,952	12,409	20,741	1,406	968	1,574	3,948
2012	6,222	5,557	14,998	26,777	1,997	1,362	1,902	5,261
2013	8,553	7,672	17,838	34,063	2,746	1,880	2,263	6,888
2014	11,047	9,810	20,670	41,527	3,546	2,404	2,622	8,572
2015	13,541	11,991	23,610	49,142	4,347	2,938	2,995	10,280
2016	15,887	14,030	26,686	56,603	5,100	3,438	3,385	11,923
2017	18,219	16,214	27,014	61,446	5,849	3,973	3,426	13,248
2018	21,333	18,903	27,422	67,658	6,849	4,631	3,478	14,958
2019	23,683	21,581	27,651	72,915	7,603	5,288	3,507	16,398
2020	25,646	23,809	27,597	77,052	8,233	5,833	3,500	17,567
2021	27,306	25,289	28,118	80,714	8,766	6,196	3,566	18,529

Total cost-effective achievable efficiency potential by 2021 is approximately 18,500 MW and approximately 80,700 GWh. Capture of this efficiency resource would meet 81% of forecast peak demand load growth and 87% of annual energy load growth. Total peak demand annual load growth would drop from a projected 2.3% to only 0.6%. Annual energy load growth would drop to only 0.4%.

2.3.3 Economic Effects

The annual stream of efficiency savings were analyzed for cost-effectiveness based on the estimated value of marginal reductions in ERCOT electric loads, from ERCOT hub forward energy prices.[36] Total net benefits to the Texas economy from capture of efficiency resources would be $38 billion (present value, 2006$). In other words, from reduced investment in electric supply resources, the net wealth of Texas society would increase by this amount, while still meeting its energy needs at similar levels of service. An investment of $11 billion (present value, 2006$) would return $4.40 to the Texas economy for every dollar invested (a 4.4 benefit/cost ratio). The levelized cost of saved energy for efficiency resources would be $0.018/kWh, approximately 25% of estimated ERCOT avoided electric supply costs for 2007. Table 2 shows economic impacts from pursuit of the potential efficiency resources.

Table 2: Present Value Benefits and Costs of Efficiency Investments

	Benefits	Cost	Net Benefits	Benefit-Cost Ratio
Residential	16,791	4,800	11,991	3.5
Commercial	15,548	4,493	11,055	3.5
Industrial	16,666	1,757	14,909	9.5
Total	**49,005**	**11,050**	**37,955**	**4.4**

2.3.4 Emissions

In addition to providing billions of dollars to the Texas economy, reductions of greenhouse gases and other pollutants are substantial. Total CO_2 reductions would be nearly 400 million metric tons, with an annual reduction in 2021 equivalent to 14% of forecast Texas electric power generation emissions. Put another way, by 2021 the annual reductions would be equivalent to taking 10 million vehicles off the road. Table 3 shows emissions reductions.

Table 3: Emissions Reductions from Efficiency Efforts (metric tons)

	Annual (2021)	**Cumulative**
Carbon Dioxide (CO_2)	52,100,000	395,000,000
Sulfur Dioxide (SO_2)	87,100	660,000
Nitrogen Oxides (NOx)	30,800	233,000

3 POLICY AND PROGRAM RECOMMENDATIONS

3.1 Increase Efficiency Resource Standard and Expand Ratepayer Funded Efficiency Programs

The WGA notes, “leading utilities such as California’s investor-owned utilities, Austin Energy… are spending at least 2% of their revenues on energy efficiency and load management programs. These programs are cutting electricity use by 0.8-1.0% per year.”[37] Texas currently requires its investor-owned utilities to meet a minimum 10% of new load growth with efficiency, or approximately 0.23% of loads based on the forecast growth. Even just bringing investor-owned utility efficiency efforts in line with the performance of the City of Austin’s municipal electric utility would meet over one third of new load growth. Texas should follow other leading states and increase this standard to at least 50% of load growth, and preferably to 75%. Massachusetts and Connecticut have both taken recent steps to set goals to *completely eliminate all load growth from efficiency*. For example, the Massachusetts Division of Energy Resources on December 21, 2006 petitioned the Department of Telecommunications and Energy to develop an Efficiency Performance Standard that, combined with current MA utility efficiency programs, would eliminate 100% of load growth.[38] Similarly, the Connecticut Energy Conservation Management Board is pursuing a zero load growth scenario for energy efficiency in response to a directive from the Public Utility Commission.[39]

In addition, utilities should be directed to invest in all cost effective efficiency resources that are cheaper than new generation supply (see discussion of integrated least-cost resource planning below).

Texas investor-owned utilities (IOUs) spent $80 million on efficiency and load management programs in 2005, approximately 0.4% of their revenue. Vermont currently leads the nation with 2008 spending established at 4.7% of utility revenue. Massachusetts spends about 3.3% of revenue. Other leading states (particularly on the West Coast and in the Northeast) are spending well over 2%. Austin Energy (the City of Austin’s municipal electric utility) currently spends 3% of its revenue.[40] Texas should significantly expand its investment to at least 3% of revenue. An increase to 3% of revenue would translate to roughly 7.5 times the current investor-owned utility spending, bringing them up the level of Austin Energy and putting Texas on a par with other leading states. Spending of approximately 4% of revenue would be necessary to achieve the potential estimated here.

These expanded efficiency programs would provide very cheap resources. WGA notes:

> ***“DSM programs typically save electricity at a total cost of $0.02 – 0.03/per kWh (utility plus participant costs), meaning that improving end-use efficiency is the least expensive electricity resource…Also, many DSM programs reduce peak power demand more than they reduce electricity consumption in percentage terms, meaning the programs also improve the load factor for the utility system and improve system reliability.”*** [41]

Programs should address all cost-effective opportunities within the buildings sector, and all utility customers should be eligible to participate. Numerous examples of leading programs exist throughout North America and should be looked to for guidance on program design. In addition, a number of constraints currently applied to Texas investor-owned utility efficiency programs should be modified:

- **Remove the limit on financial incentives for projects in the C&I sector.** Currently, commercial and industrial customers may receive no more than 35% of the value of the energy saved from efficiency improvements as an incentive to make these investments.[42] In some cases, this is not sufficient and the investment is not made. In fact, incentive funds went partially unspent last year, in part because not enough customers felt that the efficiency investment was financially feasible. Program administrators should have flexibility to design programs to capture maximum cost-effective potential, and design incentive strategies necessary to do that, up to covering the full incremental costs of cost-effective efficiency measures in some cases.

- **Allow programs to demonstrate that they are cost-effective over the long-term.** Multiyear plans and funding commitments are necessary to enable program administrators to effectively plan long-term efficiency strategies and for their customers and equipment manufactures and vendors to effectively plan and respond to efficiency programs. Unfortunately, Texas requires that all efficiency programs be cost-effective (that is, generate more economic benefits than their cost) in all years.[43] Ambitious programs, especially those that attempt to transform markets for particular products to make higher efficiency units commonplace over time, often require initial efforts and costs to work with market participants that bear fruit long term. During this time, costs are incurred but large measurable savings have not yet accrued, making the program appear to be non-cost-effective in the short term. Again, program administrators need flexibility in program design.

- **Remove the cap on program administrative costs.** Program administrators should be subject to stringent performance criteria. However, with proper financial incentives and criteria, they should be allowed latitude to pursue efficiency based on an understanding of their customers and national best practices. Texas limits administrative spending to 10% of total costs.[44] Experience suggests that this is too low for an ambitious efficiency program. Administrative costs need not be capped when programs are subject to ambitious and measurable performance criteria and incentives. Under this approach, program administrators have every incentive to minimize unproductive spending and maximize program cost-effectiveness. This flexibility allows administrators the ability to trade-off spending among different budget line items while focusing on overall cost minimization.

- **Provide program administrators flexibility to design and deliver a portfolio of exemplary programs.** In general, the Texas programs are subject to many constraints that limit the available approaches. For example, all programs must be "standard offer" or "market transformation." While standard offer programs can be very effective at capturing inexpensive resources in the short term, they do not succeed in all markets, and rarely capture comprehensive savings within the markets they do target. Utilities may also not market the programs, instead leaving all services to be delivered by energy efficiency service providers.

3.2 Improve building codes

Texas currently has building codes that set the "floor" for energy efficiency in new construction. This code was passed in 2001 to help reduce emissions from electric utilities. The goal was to reduce energy use by 15%. Although the code exceeded that goal, it is now out of date and should be modified based on the latest standards, with mechanisms for timely automatic updates when new standards are developed. For example, current commercial building codes require buildings to comply with ASHRAE 90.1 2001 or the 2001 International Energy Conservation Code (IECC). These should be upgraded to the latest 2004 standards, as some states have already done. In addition, adopting innovative features that go beyond these standards should be considered, as appropriate for Texas. The city of Frisco, Texas adopted higher standards for new homes and commercial construction that have increased code-related savings to 30% within that community. We note that ambitious code training and technical assistance for architects and engineers, along with effective enforcement, is necessary for building codes to be fully effective.

3.3 Adopt appliance standards

Several states have adopted efficiency standards for appliances not covered by federal efficiency regulation, including Arizona, Oregon and New York.[45]

The WGA notes:

> ***California is leading the nation in developing and enacting minimum efficiency standards on appliances that are not regulated by the federal government. Other western states including Arizona, Oregon, and Washington have adopted appliance efficiency standards on some of the same products regulated by California. These standards are very cost-effective with energy bill savings paying back any additional first cost in two years or less in most cases.***[46]

Texas should follow other states' lead and adopt ambitious appliance standards, where appropriate.[47]

3.4 Create Incentives and Remove Disincentives for Utility Least Cost Planning

Texas relies on electric utilities to administer efficiency programs. This model has proven effective, along with other models. To improve effectiveness, however, Texas should reform its regulatory structure in two ways. First, it should remove disincentives for ambitious pursuit of efficiency by ensuring that transmission and distribution utilities' financial bottom line is not hurt by sales lost to efficiency. Second, it should require utilities to do integrated resource planning and to pursue the long term least-cost solutions to providing energy services, considering both demand- and supply-side resource alternatives on an equal footing.

From the utilities' perspective, even the most cost-effective efficiency (or distributed generation) resources installed on the customer side of the meter produce the same effect – a reduction in sales and, as a result, reduced revenues and profits until the next rate case. Changing the regulatory structure for transmission and distribution utilities can remove this disincentive to ambitious efficiency investment. Texas can ensure that utilities deliver reliable least-cost energy services to customers by adopting alternative regulation. This would remove both the incentive to increase electricity sales and the disincentive to run effective energy efficiency programs or invest in other activities that can reduce energy use.

In addition, the PUC should require utilities to review the potential for energy efficiency and demand-side management and revise goals and programs every two years. These goals should encourage maximum investment in demand-side resources and consider all alternatives to generation-based supply of energy services.

Finally, the PUC should establish a process where T&D utilities can recover the cost of their investments in energy over the life of the resource and without a rate case. This will minimize any short-term rate impacts from new resources.

4 CONCLUSIONS

Texas is faced with the need to expand electric resources to meet reliability needs. Investment in efficiency resources to meet most of this reliability need offers a cost effective solution, and along with relying on other demand-side resources such as demand response and combined heat and power, can effectively push out reliability concerns to beyond 2021. Capturing the efficiency resource will require a redoubling of efficiency efforts. Texas should increase its current efficiency resource standard (ERS) from its current 10% of load growth to at least 50%, and preferably to 75%. In addition, Texas should direct its utilities to invest in all cost effective efficiency resources identified through an integrated resource planning process, remove current disincentives to utility investment in efficiency, and allow them the flexibility to design and deliver programs in response to customer and market needs. In conjunction with these expanded efficiency program efforts, Texas should update its current building codes and adopt effective appliance standards. These actions can avoid a risky and environmentally damaging investment in new coal fired power generation.

Endnotes

1. *Report on the Capacity, Demand, and Reserves in the ERCOT Region*. ERCOT, June 2006. ERCOT includes 75% of the land area in Texas and most of the major population centers, including Houston, Dallas-Fort Worth, San Antonio, and Austin. In this report, although our analytical results are based on an analysis of the efficiency potential and loads in ERCOT, we often refer to policies, actions, and comparative results from Texas for ease of understanding.
2. TXU has proposed building 11 new power plants at an estimated cost of $10 billion. Other power producers have also proposed an additional 8 power plants.
3. *Energy Efficiency: Reduce Energy Bills, Protect the Environment*. Prepared by the National Action Plan for Energy Efficiency, www.epa.gov/cleanenergy/eeactionplan.htm.
4. *Fueling Texas' Future*, EnergyBiz*insider*, January 10, 2007.
5. ERCOT accounts for approximately 85% of Texas' statewide electric load. Forecast growth from the Energy Information Administration's Annual Energy Outlook, 2006, Supplemental Table 61. While the analysis considers ERCOT loads and efficiency potential, this report often refers to "Texas" rather than "ERCOT" for simplicity.
6. Energy Information Administration, Electric Power Annual 2005, Table 3.1; *Report on the Capacity, Demand, and Reserves in the ERCOT Region*, ERCOT, June 2006.
7. *Report on the Capacity, Demand, and Reserves in the ERCOT Region*. ERCOT, June 2006.
8. Eldridge, M., A. deLaski, and S. Nadel Opportunities for Appliance and Equipment Efficiency Standards in Texas, ACEEE Report Number ACEEE-A063, September 2006. Emissions factors for 2021 assume 12,000 new megawatts of coal-fired generation, with the balance of any needed capacity coming from non-carbon fuels (e.g., wind, nuclear).
9. *Report of the Generation Adequacy Task Force to the ERCOT Technical Advisory Committee: The ERCOT Reserve Margin Calculation*. 23 May 2005.
10. Elliott, R.N. and B. Hedman,*The Role of CHP in Addressing Texas' Need for Pollution Reduction*, ACEEE Report IE011, 2001.
11. Western Governors' Association, *Clean and Diversified Energy Initiative*, Energy Efficiency Task Force Report, January 2006, pp.24 and 40.
12. Senate bill 7 (SB7).
13. Frontier Associates LLC, *Energy Efficiency Accomplishments of Texas Investor Owned Utilities Calendar Year 2005*, June 20, 2006, p. 1.
14. In 2003 Austin Energy adopted a new strategic plan to capture an additional 15% energy savings from efficiency programs by 2020. Western Governors' Association, *Clean and Diversified Energy Initiative*, Energy Efficiency Task Force Report, January 2006, pp.24 and 40.
15. Ibid., p. 40
16. Efficiency Vermont, the nation's first statewide Energy Efficiency Utility, has been capturing approximately 0.9% of load annually under its historic funding levels. Efficiency Vermont, 2005 Annual Report, Summary, p. 4. Efficiency Vermont's funding will increase in 2008 by roughly two thirds. Goals associated with recent increases in funding authorized by the VT Public Service Board reflect an average annual savings of 1.7% from 2006 to 2008, however because of the funding phase in, 2008 savings will be significantly more than the average for the three years.
17. Massachusetts' system benefits charge of 0.25 cents/kWh averaged 3.3% of revenue during its first 4 years, MA Division of Energy Resources.
18. Personal Communication, Blair Hamilton, Managing Director, Efficiency Vermont.
19. Western Governors' Association, Op. Cit., p. 42. Avoided costs for ERCOT estimated at 7.3 cents/kWh in 2007, based on the forward electricity market prices as of December 5, 2006.
20. Southwest Energy Efficiency Project (SWEEP), *The New Mother Lode: The Potential for More Efficient Electricity Use in the Southwest*, 2002, p. ES-6.
21. AZ and NM are most similar to Texas in both climate and forecast load growth.

22. Western Governors' Association, *Op. Cit.,* p. vi

23. *Ibid*. p. x

24. Ken Donohoo, ERCOT, personal communication.

25. Commercial Building Energy Survey, 2003, Energy Information Administration, Table C19.

26. Optimal Energy, Inc., *Energy Efficiency and Renewable Energy Resource Development Potential in New York State – Final Report, Volume One: Summary Report* (August 2003), published by NYSERDA - Albany, NY.

27. Energy Information Administration, *Manufacturing Energy Consumption Survey 2002*. The nine sectors represent nearly 80% of total manufacturing electrical energy consumption in Texas; ERCOT is assumed to have the same distribution of industry as the state as a whole.

28. SWEEP, *Op. Cit.*

29. This results in relatively conservative estimates, significantly lower than the SWEEP estimates but fairly consistent with the WGA estimates.

30. Frontier Associates LLC, *op. cit*. These were developed by weighting the current mix of programs to more closely represent that likely to be pursued in an expanded portfolio of efficiency efforts. We assume a proportionately lower emphasis on load response efforts that Texas currently pursues. In addition, we also estimate a substantially lower ratio of peak demand savings from residential efficiency than that captured in 2005 by the IOUs given the heavy emphasis on peak loads.

31. Eldridge, M., A. deLaski, and S. Nadel *Opportunities for Appliance and Equipment Efficiency Standards in Texas*, ACEEE Report Number ACEEE-A063, September 2006. Emissions factors for 2021 assume 12,000 new megawatts of coal-fired generation, with the balance of any needed capacity coming from non-carbon fuels (e.g., wind, nuclear).

32. *Report on the Capacity, Demand, and Reserves in the ERCOT Region*. ERCOT, June 2006.

33. *Report of the Generation Adequacy Task Force to the ERCOT Technical Advisory Committee: The ERCOT Reserve Margin Calculation*. 23 May 2005.

34. Elliott, R.N. and B. Hedman, *The Role of CHP in Addressing Texas' Need for Pollution Reduction*, ACEEE Report IE011, 2001.

35. Present value, 2006$.

36. ERCOT hub on-peak forward energy prices were used from 2007-2009. For 2010-2011 we assume decreases of 5% annually based on gas forward prices (electric price trends tend to follow gas trends closely), and constant avoided costs in real terms thereafter. While these marginal avoided costs are higher than those for baseload capacity, efficiency savings will tend to offset the higher cost units operating at any given time.

37. Western Governors' Association, *Op. Cit.,* p. vii.

38. Massachusetts Department of Telecommunications and Energy, *Petition of the Massachusetts Division of Energy Resources For An Investigation into Establishing an Electric Efficiency Performance Standard as a Component of the Supply of Basic Service Electricity*, December 21, 2006, p.4.

39. CT DPUC Docket 06-10-02, see *Conservation and Load Management Portfolio Plan*, Submitted by Connecticut Power & Light and United Illuminating, December 22, 2006.

40. Western Governors' Association, *Op. Cit.,* p. vii.

41. *Ibid*., pp. 55-56

42. PUCT rule 25.181, "Energy Efficiency Goal," Section 25.181(e)

43. *Ibid*.

44. *Ibid*. Section 25.181(i).

45. Eldridge, et al, *Op. Cit.*

46. Western Governors' Association, *Op. Cit.,* p. vii.

47. For an estimate of efficiency savings and costs associated with adoption of appliance efficiency standards in Texas, see Eldridge, M, et al. *Op. Cit.*

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