Role of Energy Efficiency and Onsite Renewables in Meeting Energy and Environmental Needs in the Dallas/Fort Worth and Houston/Galveston Metro Areas

R. Neal Elliott and Maggie Eldridge
American Council for an Energy-Efficient Economy

September 2007

Report Number E078

1001 Connecticut Avenue, N.W., Suite 801, Washington, D.C. 20036
(202) 429-8873 phone, (202) 429-2248 fax, http://aceee.org

CONTENTS

Acknowledgments ii
About the American Council for an Energy-Efficient Economy (ACEEE) ii
Executive Summary iii
Policy Impacts iii
Summary and Conclusions vi
Introduction 1
Summary of ACEEE State-Wide Analysis 1
Challenges Facing Metropolitan Areas 2
Regional Policy Impacts 3
Methodology and Approach 3
Results for Dallas/Fort Worth Metro Area 5
Results for Houston/Galveston Metro Area 10
Impacts of Recent Texas Legislation 13
Policies and Opportunities for Local Implementation 14
Expanded Utility-Sector Energy Efficiency Improvement Program (EEIP) 14
New State-Level Appliance and Equipment Standards 14
More Stringent Building Energy Codes 14
Advanced Energy-Efficient Building Program 15
Energy-Efficient State and Municipal Buildings Program 15
Short-Term Public Education and Rate Incentives 16
Combined Heat and Power (CHP) Capacity Target 16
Increased Demand Response Programs 16
Onsite Renewable Energy Incentives 17
Summary and Conclusions 17
References 19
Technical Appendix 23
Metro Area Forecasts 23
Retail Electricity Price Assumptions 24
Methodology for Apportioning Individual Policies 26
Methodology for Apportioning Macroeconomic Results 29

ACKNOWLEDGMENTS

The authors express their appreciation to the Energy Foundation and Environmental Defense whose combined support made this report possible. We also express our appreciation to Ramon Alvarez of Environmental Defense and David Wooley of the Energy Foundation for their guidance in the planning and preparation of this study.

The authors wish to thank Jay Zarnikau of Frontier Associates for his invaluable insight and advice, as well as Tom Fitzpatrick of Public Citizen, Thomas Glenn of Environmental Defense, Paul Wattles of the Electric Reliability Council of Texas (ERCOT), Mike Stockard of Oncor Electric Delivery, Parviz Adib of the Public Utility Commission of Texas (PUCT), and Paul Smolen of Fox, Smolen & Associates for contributing data and/or reviewing the report.

We also acknowledge the invaluable contributions to this report that we received from our ACEEE colleagues John "Skip" Laitner, Vanessa McKinney, and Renee Nida.

ABOUT THE AMERICAN COUNCIL FOR AN ENERGY-EFFICIENT ECONOMY (ACEEE)

ACEEE is a nonprofit organization dedicated to advancing energy efficiency as a means of promoting both economic prosperity and environmental protection. For more information, see http://www.aceee.org. ACEEE fulfills its mission by:

- Conducting in-depth technical and policy assessments
- Advising policymakers and program managers
- Working collaboratively with businesses, public interest groups, and other organizations
- Organizing conferences and workshops
- Publishing books, conference proceedings, and reports
- Educating consumers and businesses

Projects are carried out by staff and selected energy efficiency experts from universities, national laboratories, and the private sector. Collaboration is key to ACEEE's success. We collaborate on projects and initiatives with dozens of organizations including federal and state agencies, utilities, research institutions, businesses, and public interest groups.

Support for our work comes from a broad range of foundations, governmental organizations, research institutes, utilities, and corporations.

EXECUTIVE SUMMARY

The state of Texas is rapidly growing, with population rising at an annual rate of 1.8% and the economy expanding at an annual rate of 3.8% from 2000 to 2006. About half of the state's population and a similar share of electricity consumption and peak demand are concentrated in the state's two largest metropolitan regions, the greater Houston and Dallas/Fort Worth (DFW) areas. These regions are also among the fastest-growing in the state. Unfortunately, these regions also face significant environmental challenges, in part because of the concentration of economic activity and population. If the growth in these regions continues, new resources will be needed to meet the surging demand for electricity without worsening their environmental challenges.

A recent American Council for an Energy-Efficient Economy (ACEEE) report showed that energy efficiency, onsite renewable energy, and expanded demand response can meet all of Texas' new needs for electricity over the next 15 years. The statewide report proposed a suite of policy recommendations to realize this potential. In this follow-up analysis, we explore how these policies can contribute to meeting the energy needs of the DFW and Houston metro regions.

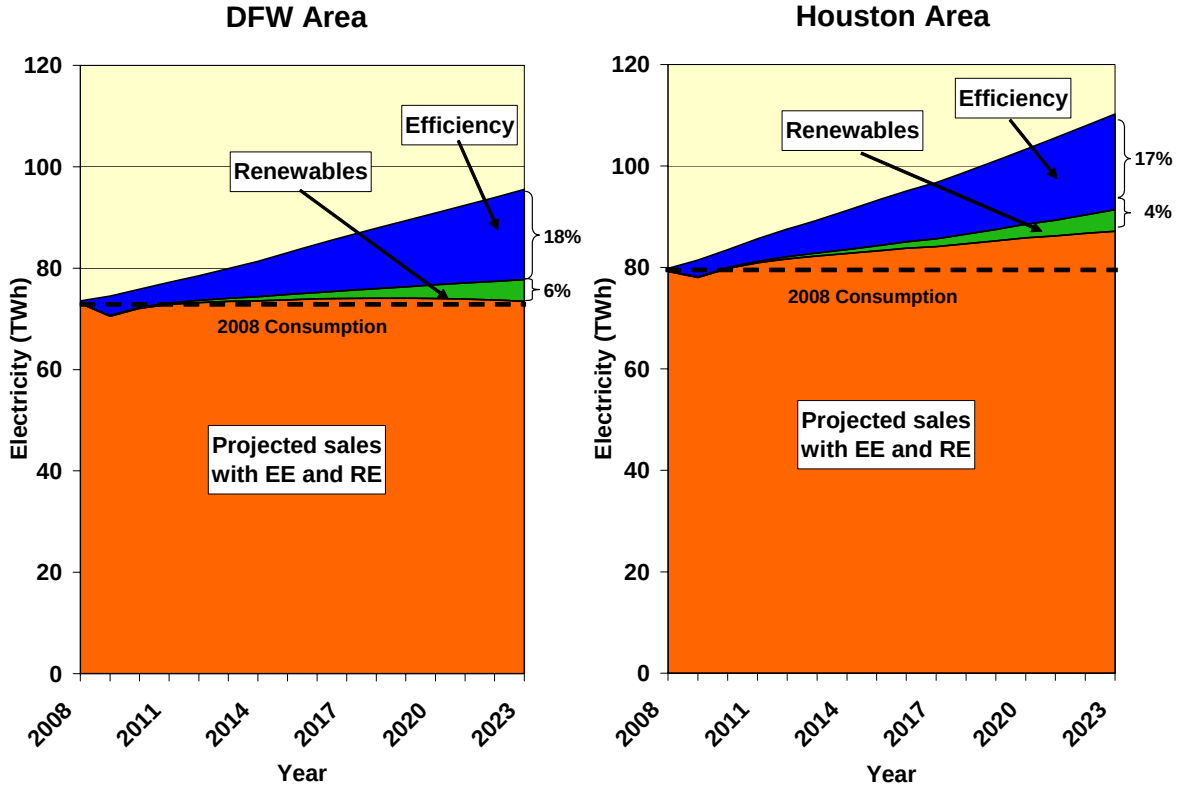
Policy Impacts

This analysis estimates local energy savings, emissions reductions, and economic impacts from both local and statewide investment in energy efficiency and renewable energy. We assess the impacts of the nine policies below, which were outlined in the statewide energy policy and economic potential analysis, by apportioning the results from the statewide analysis to the greater Houston/Galveston and Dallas/Fort Worth metro areas using regional electricity use and demographic data. The nine policies are:

1. Expanded Utility-Based Energy Efficiency Improvement Program
2. New State-Level Appliance and Equipment Standards
3. More Stringent Building Energy Codes
4. Advanced Energy-Efficient Building Program
5. Energy-Efficient State and Municipal Buildings Program
6. Short-Term Public Education and Rate Incentives
7. Increased Demand Response Programs
8. Combined Heat and Power (CHP) Capacity Target
9. Onsite Renewable Energy Incentives

The suite of policies analyzed for this study has the ability to meet 101% of the total electricity load growth in the DFW Metro Area and 76% in the greater Houston metro area over the next 15 years, reducing forecasted electricity use by over 24% and 21% by 2023 in DFW and Houston, respectively (see Figure ES-1).

Figure ES-1. Effect of Policies on Electricity Consumption in the Metro Regions



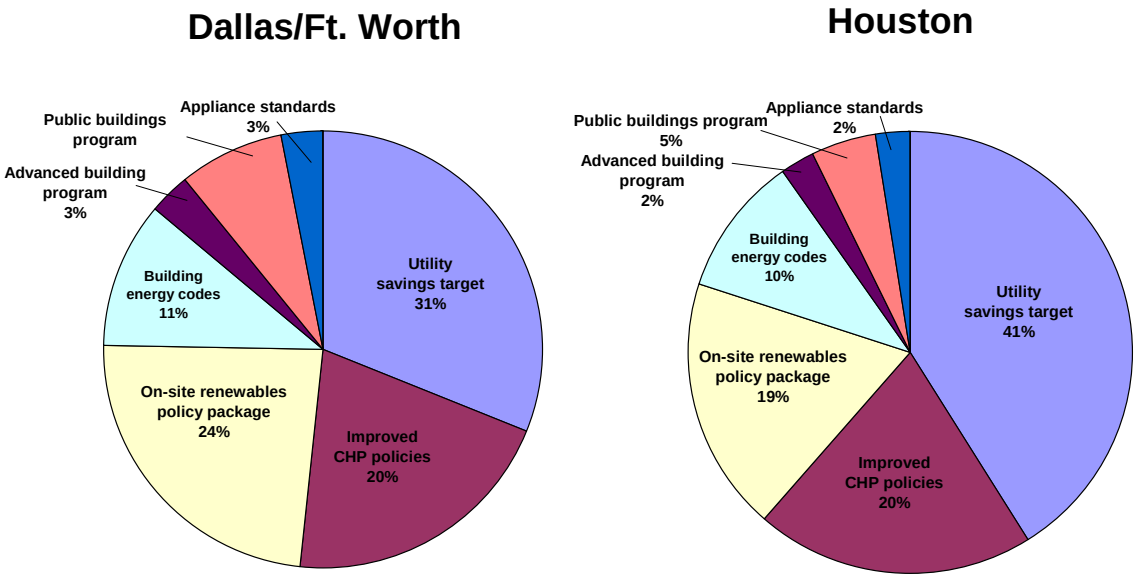
The energy efficiency and onsite renewable policies reduce peak demand by 23% for DFW and 20% for Houston by 2023 compared to forecasts. Peak demand can be further reduced through the deployment of expanded demand response programs, which provide an additional 14% demand reduction in DFW and 11% in Houston. Combined, these policies would reduce peak demand in DFW by 38% and in Houston by 31% in 2023.

As can be seen in Figure ES-2, the major electricity savings come from five major bundles of policies:

1. Utility savings targets—this assumes 50% of load growth and applies to all transmission and distribution utilities statewide
2. Expanded CHP—policies that encourage expanded CHP in industrial, commercial, and institutional markets
3. Onsite renewable energy
4. Efficient buildings—energy codes, advanced buildings, and public buildings
5. Appliance savings

While all of these policies or bundles can be implemented at the state level (indeed, some were partially established by the 80th Texas Legislature), two-thirds of the energy savings (all but the utility savings targets, which are the purview of state regulators) can be enabled at the local level, and in some cases can be even more effectively driven by local governments.

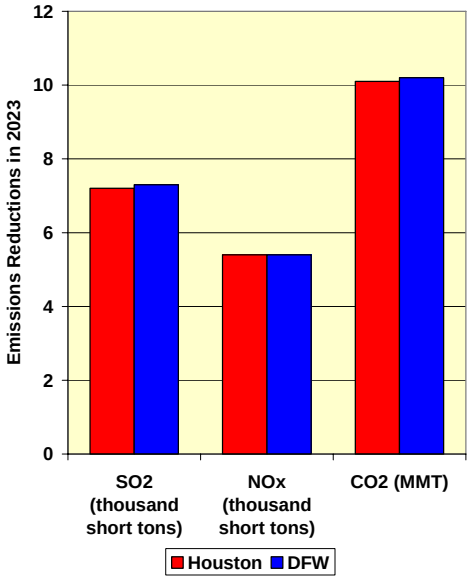
Figure ES-2. Distribution of Electricity Savings in the Metro Regions



The policies analyzed in this report would significantly reduce customer expenditures for electricity. Over the next 15 years, consumers and businesses in the Houston metro area would save almost a net $10 billion, while customers in the DFW Metro Area would also save almost a net $10 billion. The investments required to realize these savings would stimulate the local economies and create new jobs. Our analysis suggests that full implementation of these policies over the 15-year study period would result in the creation of approximately 11,100 net new jobs in the Houston area and 11,700 net new jobs in the DFW area by 2023.

Because a large portion of pollutant emissions in the Houston and DFW metro areas come from mobile sources, energy efficiency and onsite renewable energy resources by themselves will not solve the region's pollution challenges. These clean energy resources can, however, help meet the growing demand for electricity in the region without worsening its environmental problems. This suite of policies is a cost-effective means to avoid emissions, and we estimate that they could result in avoided emissions as indicated in Figure ES-3. These emissions reductions are based on statewide emissions rates in 2005, and thus may underestimate the savings that would result in the region because we don't capture the higher emissions rates from peaking units in the region, or may overestimate them due to emissions reductions resulting due to current and future regulations.

Figure ES-3. Emissions Reductions from Policies



Summary and Conclusions

Expanded energy efficiency, demand response, and onsite renewable energy resources represent the best opportunity for the greater Houston/Galveston and Dallas/Fort Worth metro areas to meet projected growth in electricity demand while helping improve the regions' air quality. Greater reliance on these clean energy resources would support the robust economic health of these two regions, which account for half the population and economic output of the state, thus sustaining Texas' long-term economic prosperity.

While the suite of policies proposed in this report can be enacted at the state level, and local governments should encourage the Legislature and state leadership to move aggressively on these provisions, up to two-thirds of the savings suggested in this analysis could be realized through local government action. In particular, policies to encourage expanded use of onsite renewable energy and CHP and to improve efficiency in buildings represent key opportunities for local action. Aggressive local policies could in fact achieve even greater savings than is suggested here.

ACEEE's analysis leads us to conclude that expanded investment in energy efficiency, demand response, and onsite renewable energy resources should be the foundation of policies to sustain the economic engines of the Dallas/Fort Worth and Houston metro areas.

INTRODUCTION

The state of Texas is rapidly growing, with population rising at an annual rate of 1.8% and the economy expanding at an annual rate of 3.8% from 2000 to 2006. About half of the state's population and a similar share of electricity consumption and peak demand are concentrated in the state's two largest metropolitan regions, the greater Houston and Dallas/Fort Worth areas. These regions are also among the fastest-growing in the state. Unfortunately, these regions also face significant environmental challenges, in part because of the concentration of economic activity and population. If the growth in these regions continues, new resources will be needed to meet the surging demand for electricity without worsening their environmental challenges.

A recent American Council for an Energy-Efficient Economy report (Elliott et al. 2007) showed that energy efficiency, onsite renewable energy and expanded demand response can meet much of Texas' needs for electricity over the next 15 years. The statewide report proposed a suite of policy recommendations that would help to realize this potential. In this follow-up report, we explore how these policies can contribute to meeting the energy needs of the DFW and Houston metro regions of the state. We will identify steps that local governments can take to complement the statewide policy recommendation and how these policies can contribute to the economic and environmental health of these metro areas.

Summary of ACEEE Statewide Analysis

Over the next 15 years, it is projected that Texas' population growth will continue at an annual rate of 1.7% through 2023, with the state's economy projected to grow at an annual rate of 3.2%. Accompanying this rapid population and economic growth is rapid growth in electricity needs and peak demand. Peak demand growth is the most pressing short-term policy concern in Texas. The Electric Reliability Council of Texas reported that peak demand increased by about 2.5% per year between 1990 and 2006. The current forecast is for peak demand to increase by 2.3% annually from 2007 through 2012. ERCOT predicted that the state might be without sufficient generation capacity for peak demands beginning in 2009. As a result of Texas' rapidly growing peak electric demand and electricity consumption, ERCOT and electric generating companies have called for the construction of new fossil-fueled and nuclear power plants to meet growing needs.

ACEEE's study (Elliott et al. 2007) suggested that, beyond just conventional supply resources, expanded demand-side energy efficiency (including CHP and recycled energy) and onsite renewable resources should be considered as the state develops its near- and long-term energy plans. Energy efficiency, demand response, and onsite renewable energy generation can meet the growing demand for electricity in Texas. Expanded demand response with efficiency and renewable energy resources can meet 107% of growth in summer peak demand in Texas by 2013. By expanding the utilization of these "clean tech" resources, Texas can prevent the forecasted reserve margin crisis and reduce overall summer peak demand, resulting in cost saving for consumers. Additionally, demand response, efficiency, and renewable energy resources are a lower cost alternative to construction of conventional generation resources while enhancing energy security and economic growth within Texas.

Some of these policy proposals were implemented by the last legislative session in various pieces of legislation, including House Bill 3693 (Texas Legislature 2007). A more detailed discussion of this topic is included later in this report.

Challenges Facing Metropolitan Areas

The Texas economy has shown great strength. Job growth and real GDP for the years 2005–2006 have topped the national average, with predictions for this trend to continue (Bryson 2006). The two major metropolitan areas of Dallas/Fort Worth and Houston/Galveston contribute significantly to Texas' overall economic health. The Dallas/Fort Worth metro area has a population of 6 million while the greater Houston metro area has a population of 5.5 million (U.S. Census Bureau 2006).[1] Combined, these two metro areas comprise about 50% of the state's population, and a comparable fraction of the state's energy needs.

However, the economic contribution of these metro areas may be limited in the future by growing energy needs and limitations placed on energy production by existing environmental quality conditions. This triple challenge of the economy, environment, and growing energy needs requires new policy solutions if these economic engines are to continue to expand. For continued economic viability in Texas, energy efficiency provides least-cost resources to meet future growth in energy needs while at the same time reducing the impacts of volatile energy prices (Elliot 2007). Accordingly, energy efficiency improves local air quality by reducing overall energy needs and the use of fossil fuels for electricity generation with their associated emissions.

The Dallas/Fort Worth metropolitan statistical area contributes $265 billion to the GDP of the Texas economy (City of Dallas 2007). Electricity use in this region is more concentrated in the commercial sector than in the state as a whole (see Figure 1). As a center for technology industries, the industrial electricity use is less significant than the state as a whole. Designated as a nonattainment area for ozone, the DFW metropolitan area's air quality threatens its future economic growth and electric reliability (TCEQ 2007a).

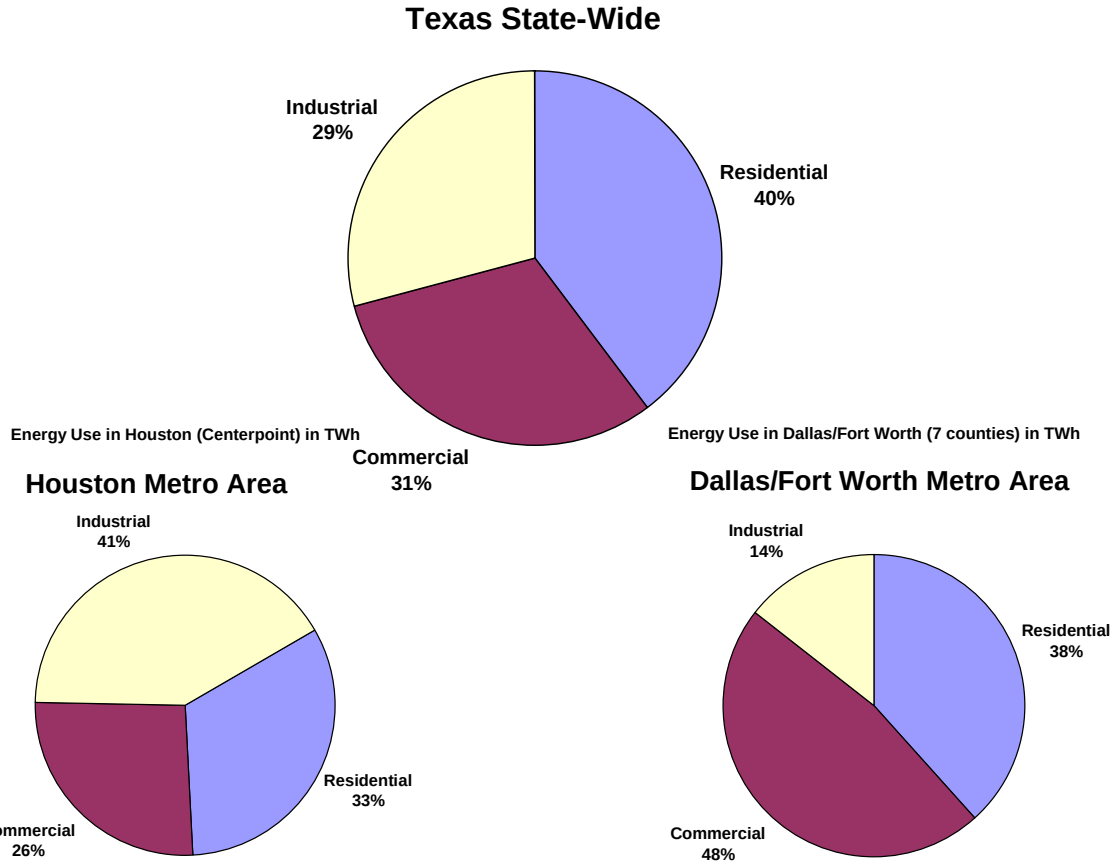
The Houston/Galveston/Brazoria metropolitan area (HGB)[2] is a center for energy-intensive manufacturing, particularly petroleum and chemicals, which accounts for the largest share of electricity consumption (see Figure 1), while the commercial sector consumes a lower fraction of total electricity consumption than in the state as a whole. Energy efficiency has been incorporated into the State Implementation Plan to address the specific needs of the HGB metropolitan area's non-attainment zone (TCEQ 2007b). The HGB metropolitan area

[1] The U.S. Census Bureau classifies the Dallas and Houston Metropolitan Statistical Areas (MSA) as Dallas-Fort Worth-Arlington, a 12-county region, and Houston-Sugar Land-Baytown, a 10-county region (U.S. Census Bureau 2006). Population data is reported here for these U.S. Census Bureau MSAs. For purposes of this energy efficiency, renewable energy, and demand response policy analysis, however, we designate a 7-county region for Dallas/Fort Worth, and for the Houston metro area we use data from Centerpoint Energy, the transmission and distribution utility (TDU) that serves the roughly 8-county Houston/Galveston area. For the economic analysis, we estimate employment impacts on the U.S. Census Bureau's slightly larger Dallas and Houston MSAs for data purposes.

[2] Houston/Galveston/Brazoria is the greater Houston designated nonattainment area classified by the U.S. Environmental Protection Agency.

is designated as a nonattainment area for ozone. By employing energy efficiency methods, the HGB area will prevent detrimental affects to the economy and improve air quality throughout the metropolitan area.

Figure 1. Distribution of Electricity Consumption by End-Use Sector for the State of Texas and Two Major Metro Areas



REGIONAL POLICY IMPACTS

To estimate the potential impacts of expanded energy efficiency, demand response, and onsite renewable energy resources, we used the results of our previous statewide analysis (Elliott et al. 2007) to estimate the impact on the two major metropolitan areas. We also explored the interaction between statewide policies and policies that could be enacted by local governments.

Methodology and Approach

To estimate the impacts of energy efficiency, demand response, and onsite renewable policies on the energy use, environment, and economy of the Houston and Dallas/Ft. Worth metro areas, we drew upon the results from our previous statewide analysis (Elliott et al. 2007) apportioning the results to the regions. To do this, we used the following methodology:

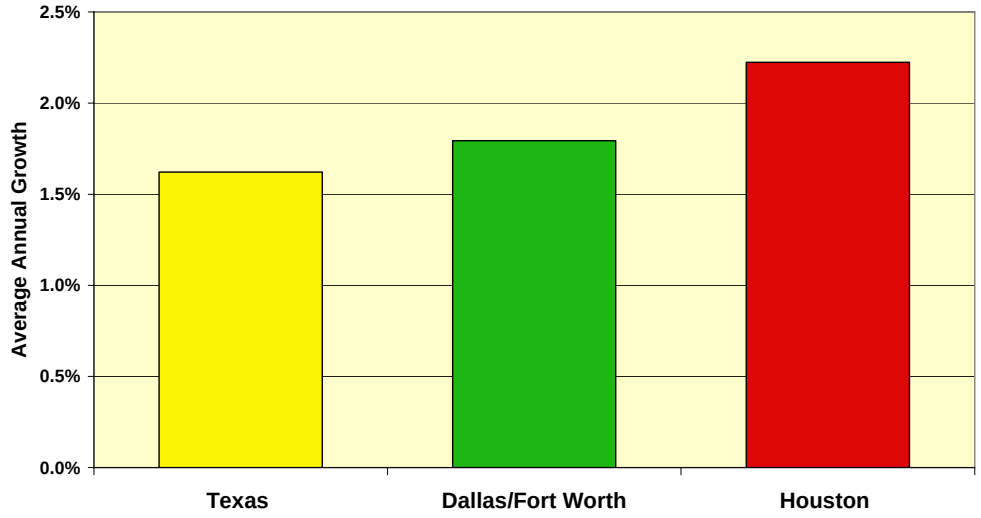
- Characterized demographics of current and forecasted electricity consumption in each metro region;
- Apportioned statewide policy electric savings based on the demographics of electricity consumption characterized above;
- Apportioned demand reductions based on electricity consumption demographics; and
- Apportioned impacts of statewide policies on emissions and economic indicators based on electricity savings.

Energy Demand Reference Case

The distribution of electricity consumption and demand in the two metro areas is significantly different from each other, and different from the state as a whole (see Figure 1). We developed electricity sales forecasts, disaggregated by sector, for the two metro areas using various data sources as discussed in the appendix. For the greater Houston metro region, we used the available electricity sales data for Centerpoint Energy (PUCT 2007a), the transmission and distribution utility that serves this area, as a proxy for total sales in the region, with sector sales estimates derived by apportioning 2000 sectoral data to current total electric sales (PUCT 2000). Oncor (formerly known as TXU Delivery), the TDU that serves the Dallas/Fort Worth metro area, provided electricity sales data specific to the metro region (Stockard 2007).

We estimate that electricity consumption and demand will grow more rapidly in these two metro areas than in the state as a whole. Figure 2 shows the statewide forecast along with our estimates for electricity consumption growth in the two regions.

Figure 2. Relative Electricity Consumption Growth Rates for Texas and Two Major Metro Areas (2008–2023, projected)



Policy Scenario

This analysis estimates local energy savings, emissions reductions, and economic impacts from both local and statewide investment in energy efficiency and renewable energy. We assess the impacts of the nine policies below, which were outlined in the statewide energy policy and economic potential analysis, by apportioning the results from the statewide analysis to the Houston and Dallas/Fort Worth metro areas using regional electricity use and demographic data. The nine policies are:

1. Expanded Utility-Sector Energy Efficiency Improvement Program
2. New State-Level Appliance and Equipment Standards
3. More Stringent Building Energy Codes
4. Advanced Energy-Efficient Building Program
5. Energy-Efficient State and Municipal Buildings Program
6. Short-Term Public Education and Rate Incentives
7. Increased Demand Response Programs
8. Combined Heat and Power Capacity Target
9. Onsite Renewable Energy Incentives

For a more detailed discussion of the policies, see the statewide report (Elliott et al 2007). The methodology of apportioning the electricity impacts to the regions from each policy is discussed in the appendix.

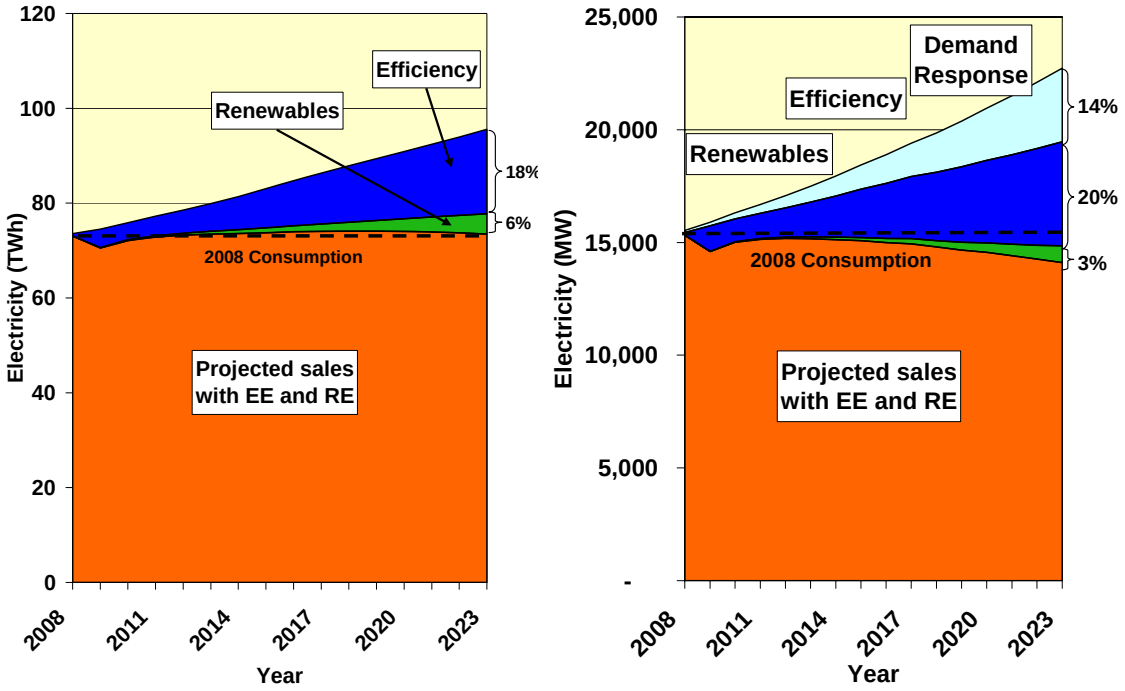
Economic and Environmental Impacts

ACEEE assessed the economic and environmental impacts of the policy scenario outlined above (Laitner, Eldridge, and Elliott 2007). Results from that report, which uses an economic assessment model called DEEPER—or the Dynamic Energy Efficiency Policy Evaluation Routine—suggest that cost-effective investments in the combination of energy efficiency and alternative generation technologies can actually reduce overall electricity costs, boost net employment, and reduce air pollutants within the state. For this analysis, we apportioned net employment gains from the statewide analysis to the metro regions based on personal income data and average electricity prices. For emissions impacts, we used statewide average emission rates to determine emissions reductions from lowered electricity demands. For a detailed discussion of the methodology, see the technical appendix.

Results for Dallas/Fort Worth Metro Area

The suite of policies analyzed for this study has the ability to meet 101% of the load growth in the DFW Metro Area over the next 15 years, reducing electricity use by over 24% in 2023 (see Figure 3). The energy efficiency and onsite renewable policies reduce the region's peak summer demand by 23% by 2023 (see Figure 3). Peak demand can be further reduced through the deployment of expanded demand response programs, which provide an additional 14% demand reduction in DFW. Combined, these policies would reduce peak demand in DFW by 38%, or roughly 6,700 MW by 2023 (see Table 1).

Figure 3. Impact of Policies on Electric Consumption and Peak Demand in DFW Area



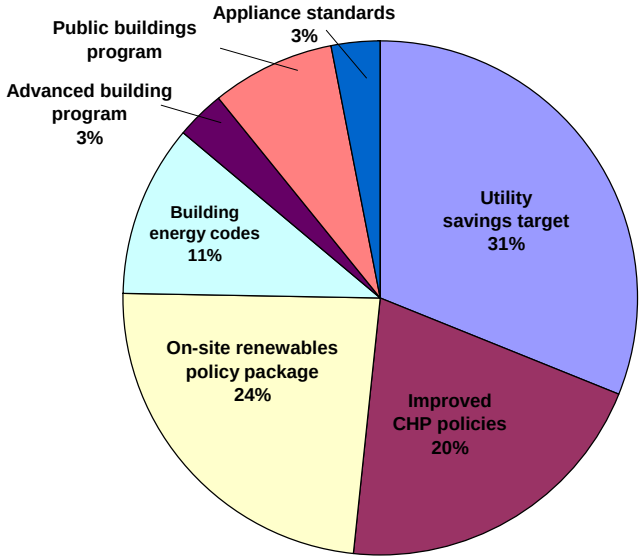
As can be seen in Table 1 and Figure **4**, the greatest electricity savings come from five major bundles of policies:

1. utility savings targets
2. expanded CHP
3. onsite renewable energy
4. efficient buildings—energy codes, advanced buildings, and public buildings
5. appliance savings

Table 1. Annual Electricity Savings by Policy in Dallas/Fort Worth

	Annual Energy Savings			
	2013		2023	
Policies	Demand Savings (MW)	Electricity Savings (million kWh)	Demand Savings (MW)	Electricity Savings (million kWh)
Utility savings target	170	2,247	251	7,282
Improved CHP policies	227	1,790	606	4,772
Onsite renewables policy package	81	803	736	5,528
More stringent building codes	123	568	570	2,524
Advanced building program	23	105	155	689
Public buildings program	132	603	422	1,798
Appliance & equipment standards	352	377	606	737
Short-term public ed. & rate incentives	50	168	0	0
Expanded demand-response programs	700	NA	3,266	NA
Total (GWH)	**1,858**	**6,660**	**6,610**	**23,330**

Figure 4. Electricity Savings by Policy in Dallas/Fort Worth in 2023



While all of these policy areas can be driven from the state level, two-thirds of the energy savings (all but the utility savings targets and the appliance standards) can be facilitated at the local level, and in some cases even more effectively driven by local governments.

As the statewide report (Elliott et al. 2007) indicated, Texas is the leading state for CHP, with much of the existing capacity in the manufacturing sector. Our analysis suggests that a significant share of the remaining potential exists in the commercial and institutional sectors, which are also where we see the potential in the DFW area. The significant fraction of the potential in the DFW area for onsite renewables also lies in the commercial and institutional sector, with much of the remainder in the residential sector dominated by solar hot water heating.

Because of the rapid pace of new construction in the region, energy efficient buildings represent another important opportunity for the region. Because buildings typically have long lifetimes, and retrofitting to incorporate efficiency after construction is costly, efficiency is best incorporated at the time of construction. Both local building energy codes as well as enhanced enforcement represent an important policy to lock in energy efficiency for the future. Local programs that build on a state-advanced buildings effort and federal tax credits —as discussed in the statewide report (Elliott et al. 2007)—have the potential to encourage construction to go beyond code. Similarly, local governments can demonstrate leadership by expanding energy efficiency efforts in public buildings, while also reducing energy expenditures, thus helping local budgets.

Economic Impacts of Policies

The policies analyzed here will significantly reduce customer expenditures for electricity. Over the next five years customers would save over $3 billion on energy expenditures and almost $22 billion over the next 15 years (see Table 3).[3] After taking into account energy efficiency investments, including program costs and customer investments, total net cumulative savings are nearly $10 billion over the next 15 years.

Generally, we find that cost-effective investments in the combination of energy efficiency and alternative generation technologies can actually boost net employment. As discussed in the earlier ACEEE economic analysis (Laitner, Eldridge, and Elliott 2007), much of the job creation from energy efficiency programs is derived by the difference between jobs within the utility supply sectors and jobs that are supported by the re-spending of energy bill savings in other sectors of the economy, such as manufacturing. Whereas Texas' electric utility industry provides, for example, only 2.4 jobs per million dollars of revenues that it receives, one million dollars spent in manufacturing supports 6.7 jobs, both directly and indirectly (Laitner, Eldridge, and Elliott 2007). We estimate that by 2023 (the last year of this analysis), as a result of greater energy productivity, the DFW metro area will show a net employment increase of about 11,700 jobs (see Table 3). This is roughly equivalent to the employment that would be directly and indirectly supported by the construction and operation of an additional 100 average manufacturing plants within Texas.

[3] Savings are based on estimates of regional energy prices as discussed in the appendix. Net savings, which take into account consumer investments in efficiency measures and program and administrative costs, are a rough estimate. The estimates do not take into account any price reductions that would result from reduced electric demand and avoided supply-side investments.

Table 2. Customer Savings in Electricity Expenditures in the DFW Area (cumulative from 2008)

Policies	(million 2005$)	
	2013	2023
Energy Efficiency	2,776	17,947
Renewables	270	3,840
Total	3,046	21,787
Net Savings	**363**	**9,829**

Table 3. Net Economic Impacts in DFW Area for Benchmark Years

Category of Impact	2008	2013	2018	2023
Jobs (Actual)	1,697	3,184	6,963	11,657

Environmental Impacts of Policies

Because the majority of ozone pollution in DFW comes from mobile sources and by regional transport from upwind areas inside and outside of Texas, expanding energy efficiency and onsite renewable energy resources will not alone solve the pollution challenges facing the region. These resources can, however, help to meet the growing demand for electricity in the region without further exacerbating existing air pollution problems. We estimate that the suite of policies could prevent emissions in the region as indicated in Table 4. These emissions reductions are based on statewide emissions rates and thus may underestimate the saving that would result in the region, because we don't capture the higher emissions rates from peaking units in the region, or overestimate them due to emissions reductions due to current and future regulations.

Table 4. Estimate of Avoided Air Emissions Resulting from Expanded Efficiency and Renewable Measures in the DFW Area

Category of Pollutant	2008	2013	2018	2023
SO_2 (thousand short tons)	0.4	3.0	4.9	7.3
NOx (thousand short tons)	0.2	1.9	3.6	5.4
CO_2 (million metric tons)	0.3	3.3	6.6	10.2

Note: Emissions are based on state average rather than marginal emission rates.

Discussion and Local Policy Recommendations

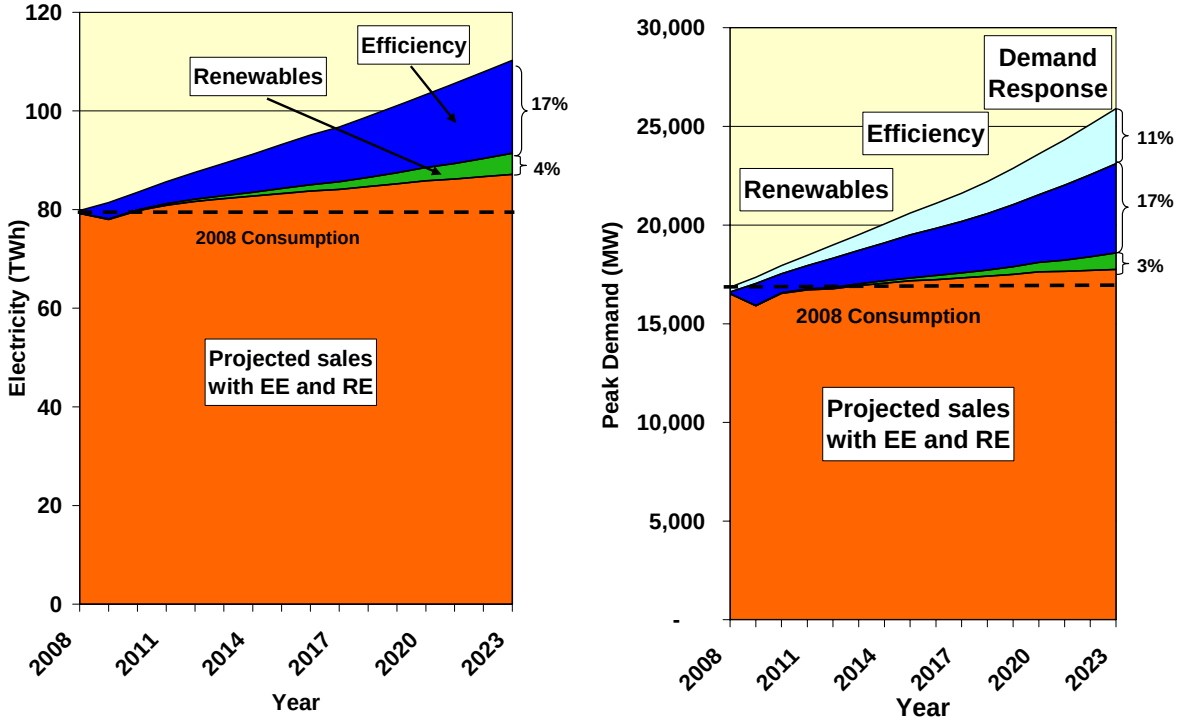
The suite of statewide policies analyzed in this report can represent an important contribution to meeting future electricity needs in the DFW area without exacerbating the current environmental problems that exist in the region. As a result, local governments in the region should advocate for strong implementation of these state policies. In addition, local governments can move beyond just advocating these state policies by promoting complementary policies that can facilitate achieving these impacts, which could expand the savings beyond what is estimated here. In particular, local leadership on CHP, onsite

renewables, and building policy recommendations represent significant opportunities. Frameworks already exist at the state level for these policy areas so all that is required is a commitment at the local level.

Results for Houston/Galveston Metro Area

The greater Houston area faces perhaps the greatest energy challenges of any of the other regions in Texas because electricity consumption is projected to grow at an annual average of 2.2% over the next 15 years compared with 1.6% per year statewide. The suite of policies analyzed for this study has the ability to meet 76% of the load growth in the greater Houston metro area over the next 15 years, reducing electricity use by 21% by 2023 (see Figure 5). The energy efficiency and onsite renewable policies also reduce the region's peak summer demand by 20% by reducing overall electricity consumption (see Figure 5). Peak demand can be further reduced through the deployment of expanded demand response programs, which would provide an additional 11% demand reduction in DFW. Combined, these policies would reduce peak demand in the Houston area by 33%, or roughly 5,600 MW by 2023 (see Table 5).

Figure 5. Impact of Policies on Electricity Consumption and Peak Demand in the Houston Metro Area



As can be seen in Table 5 and Figure 6, the big electricity savings come from major five bundles of policies:

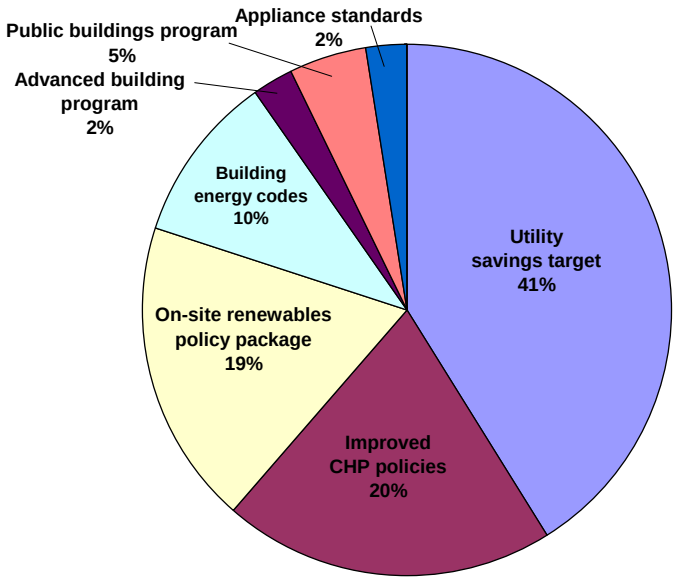
1. utility savings targets
2. expanded CHP

3. onsite renewable energy
4. efficient buildings—energy codes, advanced buildings, and public buildings
5. appliance savings

Table 5. Annual Energy Savings by Policy in the Houston Area

Policies	Annual Energy Savings			
	2013		Policies	
	Demand Savings (MW)	Electricity Savings (million kWh)	Demand Savings (MW)	Electricity Savings (million kWh)
Utility savings target	210	3,278	324	9,515
Improved CHP policies	223	1,758	595	4,689
Onsite renewables policy package	91	612	838	4,304
More stringent building codes	141	650	539	2,390
Advanced building program	20	93	130	577
Public buildings program	81	370	265	1,126
Appliance & equipment standards	295	287	156	574
Short-term public ed. & rate incentives	54	128	0	0
Expanded demand-response programs	801	NA	2,797	NA
Total	**1,916**	**7,177**	**5,643**	**23,174**

Figure 6. Electricity Savings by Policy in 2023 in Houston Area



Economic Impacts of Policies

The policies analyzed in this report would significantly reduce customer expenditures for electricity. Over the next five years, the policies would result in nearly $3 billion in

electricity expenditure savings and nearly $21 billion over the next 15 years.[4] After taking into account energy efficiency investments, including program costs and customer investments, total net savings are nearly $10 billion over the next 15 years (see Table 6). Net employment would be boosted, for reasons aforementioned in the DFW results, by about 11,100 net new jobs by 2023 (see Table 7). This is the equivalent of jobs in an additional 100 average manufacturing plants.

Table 6. Customer Savings in Electricity Expenditures in the Houston Area (cumulative from 2008)

Policies	(million 2005$)	
	2013	2023
Energy Efficiency	2,795	18,145
Renewables	197	2,836
Total	2,991	20,981
Net Total Savings	292	9,979

Table 7. Net Economic Impacts in the Houston Area for Benchmark Years

Category of Impact	2008	2013	2018	2023
Jobs (Actual)	1,621	3,041	6,651	11,135

Environmental Impacts of Policies

Because the majority of pollutant emissions in the Houston metro area come from mobile and area sources, energy efficiency and onsite renewable energy resources by themselves will not solve the pollution challenges facing the region. These clean resources can, however, help to meet the growing demand for electricity in the region without further exacerbating the environmental problems. We estimate that the suite of policies would prevent emissions in the region as indicated in Table 8. This estimate is based on statewide emissions rates and thus may underestimate the saving that would result in the region, because we don't capture the higher emissions rates from peaking units in the region, or overestimate them due to emissions reductions resulting from current and future regulations.

Table 8. Estimate of Avoided Air Pollutants in the Houston Area

Category of Pollutant	2008	2013	2018	2023
SO_2 (thousand short tons)	0.4	3.3	4.9	7.2
NOx (thousand short tons)	0.3	2.1	3.5	5.4
CO_2 (million metric tons)	0.3	3.5	6.5	10.1

Note: Emissions are based on state average rather than marginal emission rates.

[4] Savings are based on estimates of regional energy prices as discussed in the appendix. Net savings, which take into account consumer investments in efficiency measures and program and administrative costs, are a rough estimate. The estimates do not take into account any price reductions that would result from reduced electric demand and avoided supply-side investments.

Discussion and Policy Recommendations

The suite of statewide policies analyzed in this report can represent an important contribution to meeting future electricity needs in the Houston Metro area without exacerbating the current environmental problems that exist in the region. While all of these policy areas can be driven from the state level, up to two-thirds of the energy savings (all but the utility savings and demand response) can be facilitated at the local level, and in some cases even more effectively driven by local government. Local governments in the region should both advocate for strong implementation of these state policies as well as promote complementary policies that can facilitate achieving these impacts, expanding the savings beyond what is estimated here. In particular, local leadership on CHP, onsite renewables, and buildings represent significant opportunities. Frameworks already exist at the state level for these policy areas, so all that is required is a commitment at the local level. In particular, many of the large industrial firms in the region may be important allies as they can provide both important energy efficiency opportunities and support for local policies that help ensure adequate electricity supplies, contain future electricity cost increases, and reduce environmental pressures.

IMPACTS OF RECENT TEXAS LEGISLATION

In the 80th Texas Legislature, several bills were passed that established some elements of the state policies recommended in our statewide report (Elliott et al. 2007). Most significant of these was House Bill 3693 (Texas Legislature 2007). This act in part implemented two of our recommended policies, and somewhat addressed building codes.

- The act increased the EEIP target from 10% to 20% of load growth, and directed the PUCT to study whether the target could be raised to 50%, which was what we had recommended. The provision, however, reduced the coverage from total load to just residential and commercial loads, excluding industrial load. While the details of implementation are a subject of PUCT proceedings, taken together these represent a modest increase in the savings levels, though only a fraction of our recommendation.
- The act includes several provisions that expand energy efficiency in public facilities, including energy-efficient product purchasing requirements and setting of targets for energy savings in government and public school facilities. The additions represent a significant expansion of the state's efforts in this area, though no additional funding was provided to assist in the implementation. Current state policy assumes financing to be available through energy savings performance contracts. Local innovation may be needed in budget policy or utility partnerships to spur public sector success in leading efficiency improvements by example.
- The act directs the Texas State Energy Conservation Office (SECO) along with the Texas A&M University's Energy Systems Laboratory (ESL) to regularly evaluate (every three years) new versions of the IECC building energy codes and to adopt them if assessed to save more energy than the current version (BCAP 2007). The advisory committee will release a draft of possible code updates to go out for public review in October 2007, with a code update possible in 2008.

POLICIES AND OPPORTUNITIES FOR LOCAL IMPLEMENTATION

As noted at the end of the previous sections, most of the policies can be complemented and/or implemented at the local level. In this section, we describe each policy recommendation and explore local implementation approaches for each measure. With the next opportunity for legislation not occurring until 2009, implementation at the local level represents an important opportunity for Texas metro regions to take immediate actions to improve energy efficiency.

Expanded Utility-Sector Energy Efficiency Improvement Program (EEIP)

In 1999, at the time of deregulation of its electric industry, the Texas legislature mandated the state's investor-owned utilities (IOUs) to meet 10% of their annual growth in electricity demand with energy efficiency. In recent years, load growth in Texas has averaged about 2% per year, and thus the current requirement means savings of about 0.2% of demand annually. By comparison, several leading states have achieved annual savings on the order of 1–2%. In 2006, the nine Texas IOUs exceeded their statewide legislative energy efficiency goals for the fourth straight year, specifically exceeding the peak demand goal by 27% (Frontier Associates 2007). The EEIP along with demand response are the two policy recommendations that must be addressed at the state level. IOUs in the metro regions will significantly contribute to overall state efficiency savings; however, local governments do not have authority to preempt state goals.

New State-Level Appliance and Equipment Standards

State-level appliance and equipment standards establish minimum efficiency requirements for specific products, eliminating the most inefficient models from the market. Efficiency standards are recommended for 10 products in the Texas statewide analysis, of which one or more product standards have already been established by eight other states. Efficiency standards could also be implemented at the local level by ordinance. For example, New York City implemented standards on plumbing fixtures in the 1980s (Osann 2007). Municipalities in Texas could undertake similar efficiency requirements for some or all of these identified products. One possibility is for these to be implemented through amended building codes, which jurisdictions in Texas have the authority to update. Another possibility is for local governments to adopt appliance efficiency standards as part of their clean air strategies as a means to avoid pollutant emissions.

More Stringent Building Energy Codes

In HB 2129, the 79th Texas Legislature (Texas Legislature 2005) required Texas A&M University's Energy Systems Laboratory to identify alternative methods for updating residential and commercial building codes that could reduce energy use by 15%. Because of the rapid pace of new building construction in the Dallas/Ft. Worth and Houston metro areas, which are growing faster than the rest of the state, building code improvements would result in significant energy savings in these regions. Because implementation of building energy codes and code enforcement ultimately occur at the local level, and because jurisdictions in Texas have the authority to adopt a more stringent code than the statewide code, action by

local government represents an important contributor to lock in energy efficiency for the future.

Advanced Energy-Efficient Building Program

The statewide analysis identified an economic potential to reduce energy use in new Texas homes and commercial buildings by around 50%, as new technologies make these savings realistic in the next few years. If updated state building codes improve efficiency by 15%, this leaves an additional 35% energy savings still to be captured. One way to capture some of these savings is to offer an advanced building program that combines training and technical assistance for architects, engineers, and builders on ways to achieve the savings at modest cost, with financial incentives to help defray the extra costs. Local governments are uniquely positioned to encourage advanced buildings through their zoning power and ability to influence builders. Local governments are also uniquely positioned to work with the local lending community to encourage favorable loan terms for energy-efficient properties. With guidelines available for what constitutes "efficient" from such programs such as ENERGY STAR®,[5] LEED,[6] and the New Buildings Institute,[7] it has become easier to identify best practices. In addition, local governments can offer favorable permitting and fee treatment for qualifying advanced energy-efficient buildings, further encouraging builders to implement these designs.

Energy-Efficient State and Municipal Buildings Program

A state and municipal buildings program is a significant way for state and local governments to lead by example by adopting energy efficiency measures while saving money on energy bills. Texas is operating a major program, Texas *LoanSTAR*, to assist state and municipal facilities to undertake energy-saving investments. The heart of the *LoanSTAR* program is a $95 million revolving loan fund that is used to finance efficiency improvements. Because this loan fund has been fully utilized in recent years and a waiting list has developed, our statewide report recommends that funds be expanded so that half of all eligible facilities can receive assistance over the next 15 years. As noted in the previous section, legislation enacted in 2007 expands these state programs and encourages government entities to set energy savings targets. Local governments should consider going beyond these state efforts to assess how far they can go in implementing energy efficiency in local public facilities. Energy efficiency is prudent management, because energy has become one of the fastest growing line-items in local governments' budgets. Implementing energy efficiency does not have to mean spending money. Local governments can seek energy savings performance contracts (ESPC) from energy efficiency service providers in the state. The federal government and many state and municipalities have successfully used these instruments to reduce energy expenditures without spending tax dollars.

By becoming energy efficiency leaders, local governments can both show fiduciary responsibility with taxpayers' dollars, while at the same time setting an example for

[5] See http://www.energystar.gov/index.cfm?c=new_homes.hm_index
[6] See http://www.usgbc.org.
[7] See http://www.newbuildings.org

individual consumers and business to step up to the plate in adopting energy efficiency practices. Guidelines and examples of success are available from ICLEI,[8] an organization of more than 500 cities, towns, counties, and villages that supports sustainable policies in local governments, as well as from the State Energy Conservation Office.[9]

Short-Term Public Education and Rate Incentives

Public education and incentives are a means to increase public awareness and ease financial barriers for consumers, which can jumpstart demand savings in the short term and allow time for long-term policies to mature. Public education campaigns in California and elsewhere have been shown to produce lasting demand reductions. Similarly, local leaders can mobilize their citizens to implement energy efficiency through educational efforts in conjunction with schools and local media, and incentives like a sales tax holiday on energy-efficient products such as compact fluorescent lamps and ENERGY STAR appliances.

Combined Heat and Power Capacity Target

Texas has been a leader in implementing utility and environmental regulatory policies that create a favorable environment for CHP (Brown and Elliott 2003). The state's leadership has been rewarded with continued growth in the installed CHP capacity and the fraction of electricity generated by CHP, as was discussed in our earlier report (Elliott et al. 2007). More importantly for the DFW and Houston areas, CHP facilities can be particularly important players in peak demand management efforts because most CHP responds to market price signals, and when located in urban load centers, will improve capacity and energy delivery by reducing line losses and supporting voltage in those load centers.

At the state level, the regulatory roadmap is in place for expanded CHP (Brooks, Elswick and Elliott 2006). What is needed is a commitment by the state to promote new installations that allow the state to benefit from the capabilities of CHP systems. Therefore, we proposed that the state establish a target of 250 MW per year of new CHP capacity for the next 15 years. While this target has not implemented at the state level, local governments should take steps to encourage the location of CHP in their communities, such as providing favorable treatment of siting permit requests. They may also want to consider favorable tax treatments of CHP facilities, such as has been done with emissions control investments. It is also important to note that a significant portion of the new CHP potential exists in public institutions such as education, healthcare, and government facilities, so local governments have both control and can directly reap the benefits of expanded CHP.

Increased Demand Response Programs

Statewide increased demand response programs have value to moderate high energy prices or fuel shortages, and particularly as an operational reliability tool to remedy the imbalance between electricity demand and supply in peak hours or shoulder periods, or during extreme weather events, generation outages, transmission and generation contingencies, and

[8] http://www.iclei.org/
[9] http://www.seco.cpa.state.tx.us/TEP_Production/index.html

erroneous load forecasts. Demand response can also contribute toward addressing temporary air quality problems or fuel delivery interruptions. The statewide analysis (Elliott 2007) made several recommendations to increase demand response programs, including smart, programmable thermostats for all new residential and commercial buildings plus raising the MW requirement for Load Acting as a Resource (LaaR). The analysis also assumed that all Texas retail electric providers and utilities (including munis and coops) meet a Demand Response Portfolio Requirement, achieving no less than 3% of peak load from demand response resources by 2011, ramping up to 10% by 2023. This again represents a measure that local governments have limited ability to influence since it is administered at the state level by PUCT and ERCOT.

Onsite Renewable Energy Incentives

The broad range of renewable energy resources in Texas, including wind, PV, solar hot water heating, and biomass, calls for a suite of policies to accelerate their market acceptance and utilization. Three types of policy options were outlined in the statewide analysis:

1. *Supply-Side Incentives:* to make the renewable energy production more cost competitive (e.g., tax credits, a "buy down" incentive such as standard offer payments and rebates, low-interest financing).
2. *Demand-Side Policies:* examples include mandates (e.g., Renewable Portfolio Standards that may include set-asides) and "must buy" policies (e.g., standard offer contracts, feed-in laws) and building codes.
3. *Enabling Policies:* to prepare the market to succeed (e.g., installer training and certification, interconnection requirements, competitive wholesale markets, retail real-time pricing, net metering, zoning and insurance guidelines).

The set of statewide recommended policies to stimulate onsite renewable generation in Texas draws on all three types of policy approaches and is described in detail in the statewide report (Elliott et al. 2007). These recommendations build upon programs already in use in Texas for which onsite renewables qualify, and provide added stimulus. As with CHP, local government can encourage implementation by their treatment of permitting requests and property taxes.

SUMMARY AND CONCLUSIONS

Expanded energy efficiency, demand response, and onsite renewable energy resources represent the best opportunities for the greater Houston and Dallas/Fort Worth metro areas to meet surging electricity demand without further compromising the region's environmental quality. Greater reliance on these clean energy resources would help to support the robust economic health of these two regions, which account for half of the population and economic output of the state, thus sustaining Texas' long-term economic prosperity.

While the suite of policies proposed in this report can be enacted at the state level, and local governments should encourage Austin to move aggressively on these provisions, up to two-thirds of the savings suggested in this analysis could be realized with local action. In particular, policies to encourage expanded use of CHP and onsite renewable energy, and

improving the energy efficiency of buildings represent key opportunities for local action. Aggressive local policies could in fact achieve even greater savings than is suggested in this analysis.

These policies can not only meet most of the projected growth in electricity needs over the next 15 years, but can result in net consumer electricity expenditure savings of $20 billion over that period. The investments required to realize these savings along with the consumer bill savings would be recycled into the local economy, creating new jobs. Our analysis suggests that full implementation of the policies would result in the creation of nearly 23,000 net new jobs in 2023 in these regions.

Expanded energy efficiency, demand response, and onsite renewable energy resources should be the foundation of policies to sustain the economic engines that are the Dallas/Fort Worth and Houston metro areas.

REFERENCES

[BCAP] Building Codes Assistance Project. 2007. *Texas Overview*. http://bcap-energy.org/state_status.php?state_ab=TX. Accessed September 20. Washington, D.C.: Building Codes Assistance Project.

[BEA] Bureau of Economic Analysis. 2007. *Regional Economic Accounts.* With data for 2005. http://www.bea.gov/regional/index.htm. Washington, D.C.: U.S. Department of Commerce.

Brooks, S., B. Elswick, and R.N. Elliott. 2006. *Combined Heat and Power: Connecting the Gap between Markets and Utility Interconnection and Tariff Practices (Part I).* http://aceee.org/pubs/ie062.htm. Washington, D.C.: American Council for an Energy-Efficient Economy.

Brown, E. and R.N. Elliott. 2003. *State Opportunities for Action: Update of States' Combined Heat and Power Activities*. http://aceee.org/pubs/ie032.htm. Washington, D.C.: American Council for an Energy-Efficient Economy.

Bryson, Jay H. 2006. *Wachovia Economic Commentary: Texas Economic Trends and Outlook.* http://www.wachovia.com/ws/econ/view/0,,3045,00.pdf. Retrieved August 21. Charlotte, N.C.: Wachovia Corporation.

City of Dallas. 2007. *Dallas Economic Review*. Retrieved August 21. http://www.dallas-edd.org/images/dallas_data/strategic/economic_review/winter_2006_2007.pdf. Dallas, Tex.: City of Dallas, Department of Economic Review

[EIA] Energy Information Administration. 2007. *Electric Power Monthly, March 2007.* http://tonto.eia.doe.gov/ftproot/electricity/epm/02260703.pdf. Washington, D.C.: U.S. Department of Energy.

Elliot, Neal R. 2007. *America's Energy Straitjacket.* Presentation at ACEEE Summer Study on Energy Efficiency in Industry 2007. http://aceee.org/conf/07ss/Presentations/RNEIndSS07_StraitJacket.pdf. Washington, D.C.: American Council for an Energy-Efficient Economy.

Elliott, R.N., M. Eldridge, A.M. Shipley, J.S. Laitner, S. Nadel, A. Silverstein, B. Hedman, and M. Sloan. 2007. *Potential for Energy Efficiency, Demand Response and Onsite Renewable Energy to Meet Texas' Growing Electricity Demands.* ACEEE report E073. Washington, D.C.: American Council for an Energy-Efficient Economy.

[ERCOT] Electric Reliability Council of Texas. 2007. "Coast-NorthCentral Zone MWh Forecasts 2007–2017." August spreadsheet from Paul Wattles. Austin, Tex.: Electric Reliability Council of Texas.

Fitzpatrick, Tom. 2007. "Texas: Innovative Energy Efficiency Programs & Legislation in the Western States." July 17 Presentation. Denver, Colo.: Western Governors Association Energy Efficient Buildings Workshop.

Frontier Associates. 2007. *Energy Efficiency Accomplishments of Texas Investor Owned Utilities, Calendar Year 2006.* http://www.texasefficiency.com/EUMMOT_REPORT_2006_FINAL_07_02_07_v.5.doc. Austin, Tex.: Frontier Associates.

Laitner, J.S., M. Eldridge, and R.N. Elliott. 2007. *The Economic Benefits of an Energy Efficiency and Onsite Renewable Energy Strategy to Meet Growing Electricity Needs in Texas*. Washington, D.C.: The American Council for an Energy-Efficient Economy.

Lami, L. and D. Bullock (Houston Advanced Research Center). 2007. Personal communication with N. Elliott and M. Eldridge. August 15.

Osann, Ed (Potomac Resources). 2007. Personal communication with Neal Elliott. September.

[PUCT] Public Utility Commission of Texas. 2000. *2000 Annual Update of Generating Electric Utility Data.* Austin, Tex.: Public Utility Commission of Texas.

——— 2007a. *Summary of Performance Measure Data.* http://www.puc.state.tx.us/electric/reports/RptCard/index.cfm. Accessed August. Austin, Tex.: Public Utility Commission of Texas.

———. 2007b. *Average Annual Rate Comparison Archive.* http://www.puc.state.tx.us/electric/rates/RESrate/RESratearc.cfm. Accessed August. Austin, Tex.: Public Utility Commission of Texas.

Sifuentes, Theresa (State Energy Conservation Office). 2007. Personal e-mail communication. February 15.

Stockard, Mike. 2007. "2006 DFW Annual Consumption by Rate Class TXU." Spreadsheet. Dallas, Tex.: Oncor Electric Delivery.

[TCEQ] Texas Commission on Environmental Quality. 2007a. *Dallas/Fort Worth Nonattainment Zone.* Retrieved August 21. http://www.tceq.state.tx.us/implementation/air/sip/dfw.html. Austin, Tex.: Texas Commission on Environmental Quality.

———. 2007b. *Houston/Galveston/Brazoria Eight-Hour Nonattainment Zone.* Retrieved August 21. http://www.tceq.state.tx.us/implementation/air/sip/hgb.html. Austin, Tex.: Texas Commission on Environmental Quality.

Texas Legislature. 2005. House Bill No. 2129. http://www.capitol.state.tx.us/BillLookup/History.aspx?LegSess=79R&Bill=HB2129 Austin, Tex.: Texas Legislature Online.

———. 2007. House Bill No. 3693, http://www.capitol.state.tx.us/BillLookup/Text.aspx?LegSess=80R&Bill=HB3693. Austin, Tex.: Texas Legislature Online.

U.S. Census Bureau. 2006. *Annual Estimates of the Population of Metropolitan and Micropolitan Statistical Areas: April 1, 2000 to July 1, 2006.* http://www.census.gov/population/www/estimates/metro_general/2006/CBSA-EST2006-01.xls. Washington, D.C.: U.S. Census Bureau.

——— 2007. Housing Units Authorized by Building Permits. http://www.census.gov/const/www/C40/table3.html. Washington, D.C.: U.S. Census Bureau.

TECHNICAL APPENDIX

Detailed current disaggregated electricity data and forecasts are largely unavailable for the metro areas studied in this report. In part, this lack of data results from the shift that has occurred over the past decade as the state has deregulated its electricity sector and the various entities have been absolved of much of their public reporting obligations. As a result, the authors were forced to use various proxies to develop estimates of electricity consumption, demand, and prices for the regions. We thus drew upon a wide variety of data sources and experts to develop our estimates for the metro areas. This challenge was further complicated by the varying geographic definitions of the regions. Because we did not have sufficient data to better disaggregate the regions, we were forced to ignore the differences between the varying regional geographic boundaries. While this is perhaps less than ideal, for broad policy purposes these estimates should serve as a first-order approximation.

Metro Area Forecasts

We first developed electricity sales forecasts, disaggregated by sector, for the two major Texas metro areas using several data sources. The Public Utility Commission of Texas provides monthly aggregate electricity sales data and disaggregated data for the residential and small commercial sectors for each utility (PUCT 2007a). Highly disaggregated utility electric sales data and forecasts for all sectors, however, are no longer maintained by the PUCT.

For the Houston metro region, we used the available PUCT electricity sales data for Centerpoint Energy, the transmission and distribution utility that services this area, as an indicator of total sales in the region. Disaggregated sector sales data were derived by applying the percent of electricity sales by sector in 2000 to current total electric sales (PUCT 2000). TXU Delivery (now Oncor Electric Delivery), the TDU which serves the Dallas/Fort Worth metro area, provided electricity sales data specific to the metro region for a seven-county region (Stockard 2007).

To forecast electricity sales through the year 2023 using current sales data, we applied growth rates from ERCOT forecasts by weather zone (ERCOT 2007). The North Central weather zone growth trend was applied to DFW data and the Coastal zone growth trend was applied to the Houston metro area data. Only aggregate regional electricity sales forecasts were available, so we were limited to use the same growth trend for each sector.

Peak demand forecasts were developed using forecasted ERCOT ratios of peak energy demand to electricity sales and applying those to forecasted regional electricity sales. Regional peak demand forecasts and growth rates are shown in Tables A-1 and A-2.

Metro region electricity sales and peak demand forecasts for benchmark years 2008, 2013, and 2023 are also shown in Tables A-1 and A-2, as are the average growth rates during the 15-year study period. In 2008, the Dallas/Fort Worth metro area will consume about 74,000 million kWh, or 20.5% of the state's electricity sales. Forecasted electricity sales in the Houston metro area for the same year are approximately 80,000 million kWh, or 22% of the state's electricity sales. Average growth rates for each region exceed that of total ERCOT

electricity sales, with electricity consumption for DFW and Houston growing at an average rate of 1.8% and 2.2%, respectively, compared to 1.6% for total ERCOT sales. In 2023, because the metro areas are growing faster than the state, the regional share of total state electricity sales rises to 21.5% for DFW and 24% for Houston.

Table A-1. Dallas/Fort Worth Reference Case Electricity Consumption and Demand Forecast

	2008	2013	2023	Average Growth Rate
Peak Summer Demand—All Sectors (MW)	15,530	17,492	22,731	2.36%
Residential	7,277	8,136	10,508	
Commercial	8,075	9,028	11,660	
Industrial	1,358	1,519	1,961	
Electricity Consumption—All Sectors (million kWh)	73,570	80,119	96,767	1.8%
Residential	28,821	31,662	38,037	
Commercial	35,119	39,578	50,067	
Industrial	10,158	10,520	12,107	

Table A-2. Houston Metro Area Reference Case Electricity Consumption and Demand Forecast

	2008	2013	2023	Average Growth Rate
Peak Summer Demand—All Sectors (MW)	16,848	19,517	25,903	2.79%
Residential	6,694	7,698	10,154	
Commercial	4,816	5,537	11,660	
Industrial	4,265	4,904	1,961	
Electricity Consumption—All Sectors (million kWh)	79,811	89,394	110,272	2.2%
Residential	25,944	29,314	35,967	
Commercial	20,943	24,276	31,364	
Industrial	31,895	33,973	39,933	

Retail Electricity Price Assumptions

There are two components of electricity rates in Texas—the energy rate plus the transmission and distribution rate. The energy rates vary by weather zones and the transmission and distribution rates vary by the utilities' service territories. The wholesale energy rates can be affected by the congestion or inadequate capacity of the transmission lines. If a specific line is too congested to allow for the transmission from a lower cost generator, a higher cost generator may come online and increase the price to the retail electric provider, which is then

passed on to the retail customers. These congestion costs are uplifted by weather zone and, as a result, the prices may increase for all customers. Obtaining accurate energy rate data, however, is difficult because the PUCT has not collected pricing data for all customer classes since restructuring.

Residential Prices

Current Dallas/Ft. Worth and Houston residential electricity prices were obtained by utilizing residential data available from PUCT (PUCT 2007b). For Dallas/Ft. Worth, we used retail electricity price data for customers within the Oncor (formally TXU Electric Delivery) service area. For Houston, we used data for customers within the CenterPoint Energy service area. We used retail prices for customers using 1000 kWh per month, which Frontier Associates indicated is an appropriate indicator of electricity consumption in these metro areas. Because there are many retail electric providers (REPs) offering different prices within each TDU service area, we calculated a weighted average of residential prices (cents per kWh) assuming that 40% of customers contracted for competitive pricing and 60% of customers purchased from the affiliated provider (TXU Energy for Dallas/Ft. Worth and Reliant Energy for Houston). We used this monthly REP-weighted average of residential prices combined with monthly average residential kWh usage data (PUCT 2007b) to obtain a "2006 Weighted Average of Residential Rate" for DFW and Houston.

Commercial and Industrial Prices

Commercial and industrial price data are not available for any geographic subregion of ERCOT from any public source. As a result, we resorted to using the average retail electricity price data for Texas from the Energy Information Administration (EIA 2007) and weighting it by the ratio of residential rates to statewide residential rates to obtain Dallas/Ft. Worth and Houston 2006 commercial and industrial electricity prices. A ratio of "Texas Commercial Rates in 2006" to "Texas Residential Rates in 2006" was computed and multiplied by the "2006 Weighted Average of Residential Rates" for DFW and Houston to obtain an estimate of "2006 Weighted Average of Commercial Rates" for DFW and Houston. Similarly, a ratio of "Texas Industrial Rates in 2006" to "Texas Residential Rates in 2006" was computed and multiplied by the "2006 Weighted Average of Residential Rates" for DFW and Houston to obtain estimates of "2007 Weighted Average of Industrial Rates" for DFW and Houston. The commercial pricing data was cross-checked with a proprietary database maintained by a private consultant and was found to be reasonable in the Oncor service territory but about one cent too high in the CenterPoint service territory. The CenterPoint commercial price was adjusted based on this data, and the industrial price was also adjusted downward the same fraction based on expert judgment.

All Sectors Average

We calculated an average price for "All Sectors" for each region using a weighted average of electricity consumption and prices in each sector. Data reported by the EIA is used for an "All Sectors" average for the state of Texas. In our analysis, we use the "All Sectors" regional average prices to calculate the cost of saved energy.

In Table A-3 a comparison of 2006 statewide average electricity prices and the calculated electricity prices for the metro areas is shown. 2006 residential electricity prices for Dallas/Ft. Worth and Houston are 15% and 25%, respectively, higher than current statewide average prices. The same ratio for Dallas/Ft. Worth applies to the commercial and industrial sectors. The "All Sectors" average for Dallas/Ft. Worth and Houston, weighted by consumption in each sector, is approximately 18% and 14% higher, respectively, than the statewide average.

Table A-33. Statewide and Regional Retail Electricity Prices in Texas (¢/kWh)

	Texas	Dallas/ Ft. Worth	Houston
Residential	12.7	14.6	15.8
Commercial	9.73	11.2	11.1
Industrial	7.77	8.95	8.81
All Sectors	10.3	12.2	11.7

Methodology for Apportioning Individual Policies

Expanded Utility-Sector Energy Efficiency Improvement Program

In 1999, at the time of deregulation of its electric industry, the Texas legislature mandated the state's investor-owned utilities to meet 10% of their annual growth in electricity demand with energy efficiency. In recent years, load growth in Texas has averaged about 2% per year, and thus the current requirement means savings of about 0.2% of demand annually. By way of comparison, several leading states have achieved annual savings on the order of 1–2%. The Texas IOUs have met the energy efficiency goals for four straight years and have even exceeded the goals. In 2006, the utilities exceeded the peak demand goal by 27%. In 2007, the Texas legislature passed HB 3693, which expands energy efficiency goals for residential and commercial customers to 15% of forecast demand growth by 2008 and 20% by 2009 (Fitzpatrick 2007).

Based on state experience elsewhere, we believe it is reasonable to increase the Texas target to 50% of load growth for all sectors, which is the assumption used in our statewide analysis. We assumed the same efficiency targets for utilities in the metro areas. Energy demand in the Houston and DFW metro areas is growing faster than the rest of the state, making these areas a key resource for meeting the energy efficiency targets.

New State-Level Appliance and Equipment Standards

State-level appliance and equipment standards establish minimum efficiency requirements for specific products, eliminating the most inefficient models from the market. Efficiency standards are recommended for 10 products in the Texas statewide analysis, of which one or more product standards have already been established by eight other states (AZ, CA, MA, NY, OR, RI, VT, and WA). Estimated savings in the Houston and DFW metro areas were apportioned based on residential and commercial electricity sales in these regions relative to

statewide residential and commercial sales, which is an appropriate indicator of appliance and equipment sales.

More Stringent Building Energy Codes

Updated residential and commercial building codes could reduce energy use by 15% according to the Texas A&M Energy Systems Laboratory. Our statewide estimates for building codes assumed 15% savings relative to current code beginning in 2009, and 30% savings relative to current code beginning in 2020. The Dallas/Ft. Worth and Houston metro areas are growing faster than the rest of the state and as a result, building code improvements will result in significant savings in these regions. According to the U.S. Census, the Dallas/Ft. Worth metro area represents 26% of the housing permits in the state and the Houston–Sugar Land–Baytown (the U.S. Census Bureau's 10-county Greater Houston classification) represents 33% of the state's housing permits (U.S. Census 2007). We apportioned the statewide energy savings estimates to the metro areas based on the ratio of new residential and commercial electricity sales each year to total new electricity sales in the state of Texas.

Advanced Energy-Efficient Building Program

The statewide analysis identified an economic potential to reduce energy use in new Texas homes and commercial buildings by around 50%, as new technologies make these savings realistic in the next few years. If updated state building codes improve efficiency by 15%, this leaves an additional 35% energy savings still to be captured. One way to capture some of these savings is to offer an advanced building program that combines training and technical assistance for architects, engineers, and builders on ways to achieve the savings at modest cost, with financial incentives to help defray the extra costs, particularly on the first homes and buildings an architect or builder designs. To estimate local savings, we used the same methodology as that of new building codes. We used the statewide estimates and apportioned energy savings for each metro region based on its contribution to the state's annual growth in residential and commercial electricity sales

Energy-Efficient State and Municipal Buildings Program

A state and municipal buildings program is a significant way for state and local governments to lead by example by adopting energy efficiency measures while saving money on energy bills. Texas is operating a major program, Texas *LoanSTAR*, to assist state and municipal facilities to undertake energy-saving investments. Nearly 200 facilities have received funding, with energy savings averaging about 15% (Sifuentes 2007). The heart of the *LoanSTAR* program is a $95 million revolving loan fund that is used to finance efficiency improvements. Because this loan fund has been fully utilized in recent years and a waiting list has developed, our statewide report recommends that funds be expanded so that half of all eligible facilities can receive assistance over the next 15 years. This metro region analysis apportioned statewide energy savings by commercial electricity sales, an appropriate indicator of public building electricity use.

Short-Term Public Education and Rate Incentives

Public education and incentives are a means to increase public awareness and ease financial barriers for consumers, which can jumpstart demand savings in the short term and allow time for long-term policies to mature. Public education campaigns in California and elsewhere have been shown to produce lasting demand reductions. Our statewide analysis assumed that a Texas energy education program will produce 3% energy savings and 5% peak demand savings at half the cost of California's program. Savings in the metro region were apportioned by electricity sales in the residential and commercial sector.

Combined Heat and Power Capacity Target

In our statewide analysis (Elliott et al. 2007), an estimate was made of the achievable potential for CHP. Since that study was released, the Houston Advanced Research Center (HARC) has undertaken an assessment of the potential for CHP in the Houston/Galveston/Brazoria metropolitan area. The results of this preliminary analysis (Lami and Bullock 2007) suggests the technical potential for CHP in the commercial & institutional (C&I) and industrial sectors for the HGB region, and their analysis suggests that HGB represents about 21% of the statewide potential. Comparing the HARC technical potential with the statewide achievable estimates from our previous report suggests that the achievable numbers represents about 25% of the potential for 2020 estimate. We thus estimated HGB CHP impacts to be 21% of the statewide economic potential as reported in the overall analysis. Maintaining a consistent ratio of CHP to C&I and industrial load, we estimated that DFW would be about 21% of the state potential, with the potential much more heavily weighted toward C&I than industrial.

Increased Demand Response Programs

Statewide increased demand response programs have value to moderate high energy prices or fuel shortages, and particularly as an operational reliability tool to remedy the imbalance between electricity demand and supply in peak hours or shoulder periods, or during extreme weather events, generation outages, transmission and generation contingencies, and erroneous load forecasts. Demand response can also contribute toward addressing temporary air quality problems or fuel delivery interruptions. The statewide analysis made several recommendations to increase demand response programs, including smart, programmable thermostats for all new residential and commercial buildings plus raising the MW requirement for Load Acting as a Resource. The analysis also assumed that all Texas retail electric providers and utilities (including munis and coops) meet a Demand Response Portfolio Requirement, achieving no less than 3% of peak load from demand response resources by 2011, 6% by 2017, and 10% by 2023. We apportioned the statewide peak demand savings to the Houston and Dallas/Ft. Worth metro areas using the ratio of summer peak demand in the metro areas to the statewide summer peak demand.

Onsite Renewable Energy Incentives

The broad range of renewable energy resources in Texas calls for a suite of policies to accelerate their market acceptance and utilization. Three types of policy options were outlined in the statewide analysis:

1. *Supply-Side Incentives:* to make the renewable energy production more cost competitive (e.g., tax credits, a "buy down" incentive such as standard offer payments and rebates, low-interest financing).
2. *Demand-Side Policies:* examples include mandates (e.g., Renewable Portfolio Standards that may include set-asides) and "must buy" policies (e.g., standard offer contracts, feed-in laws) and building codes.
3. *Enabling Policies:* to prepare the market to succeed (e.g., installer training and certification, interconnection requirements, competitive wholesale markets, retail real-time pricing, net metering, zoning and insurance guidelines).

The set of statewide recommended policies to stimulate onsite renewable generation in Texas draws on all three types of policy approaches and is described in detail in the statewide report. These recommendations build upon programs already in use in Texas for which onsite renewables qualify, and provide added stimulus. For the metro areas, we apportioned statewide electricity savings from renewables based on the ratio of total electric sales in each region to statewide electric sales.

Methodology for Apportioning Macroeconomic Results

To estimate net employment impacts on the metro regions, we apportioned results from the statewide analysis, which used an economic assessment model called DEEPER—or the Dynamic Energy Efficiency Policy Evaluation Routine (Laitner 2007)—to estimate employment impacts. These estimates were based on a top-down apportionment of results from the statewide analysis and should be used only as a rough approximation of job impacts.

To apportion employment impacts by region, we first assume the regional share of personal income as a starting point for apportionment of job impacts (Houston and DFW represent 28% and 29%, respectively, of statewide personal income [BEA 2007]). [10] Then, because higher electricity prices are likely to generate somewhat higher levels of efficiency savings and jobs, and prices are higher in the metro regions, we adjusted these regional shares to reflect varying regional electricity prices using a price indicator. The regional price indexes (regional price divided by state average; see Table A-3 above for prices) are 1.1236 for Houston and 1.184 for Dallas. Assuming a price-based elasticity of 0.33 to adjust for the responsiveness to electricity prices, the new index (price index raised to the elasticity) are 1.043 for Houston and 1.057 for Dallas. We then multiplied the new indices by the regional shares of personal income, with results constrained to 100%, which generated regional shares of job impacts for Houston and DFW of roughly 29% and 30%, respectively. These regional

[10] For the employment impacts assessment, we used U.S. Census Bureau's MSA regions for Houston and Dallas, which are the same regions the Bureau of Economic Analysis uses to report personal income data.

shares are then multiplied by the statewide net employment impacts for the benchmark years to produce regional employment impacts.